Newry Southern Relief Road

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Stage 2 Scheme Assessment Report

Department for Infrastructure (DfI) Roads

FINAL

Project number: 60472927

September 2018

Department for
Infrastructure
An Roinn
Bonneagair
www.infrastructure-ni.gov.uk

Quality information

Prepared by	Checked by	Verified by	Approved by
Sharon Campbell	George Kissick	Michael MacLean	Michael MacLean
Principal Engineer	Associate	Technical Director	Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
FINAL	28/09/2018	FINAL FOR PUBLICATION	MM	Michael MacLean	PM

Distribution List

# Hard Copies	PDF Required	Association / Company Name
2	1	Liam McEvoy (DfI) Aloysius Loughran (DfI) Neville Dynes (DfI)
1		Raymond Glass (DfI Roads HQ)

Prepared for:

Department for Infrastructure (DfI) Roads
Marlborough House
Central Way
Craigavon
BT62 1AD

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Department for Infrastructure | An Roinn Bonneagair

© 2018 AECOM Infrastructure & Environment UK Limited. All Rights Reserved.

This document has been prepared by AECOM Infrastructure & Environment UK Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AE COM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Personal information has been removed in line with General Data Protection Regulations.

About The Department for Infrastructure Roads

The Department for Infrastructure Roads (DfI Roads) (formerly TransportNI and Roads Service) plays a significant role in facilitating the safe and convenient movement of people and goods throughout the province and the safety of road users, through the delivery of road maintenance services and the management and development of the transport network. It also informs the Department's policy development process to ensure that measures to encourage safe and sustainable travel are practical and can be delivered.

DfI Roads is responsible for the maintenance of over 25,000km of public roads together with about 9,700km of footways, 5,800 bridges, 271,000 street lights and 51 Park & Ride/Park & Share (P&R/P&S) public car parks. It also has responsibility for the development of the transport network and a range of transport projects designed to improve network safety, sustainability and efficiency.

The key objectives of DfI Roads are to:

- manage, maintain and improve the transport network to keep it safe, efficient, reliable and sustainable;
- promote increased customer satisfaction with the services delivered by DfI Roads;
- work constructively with DfI Roads' key stakeholders to support the delivery of high quality services;
- develop DfI Roads’ capacity and capability to meet objectives;
- ensure effective management of DfI Roads’ budget, assets and corporate governance arrangements; and
- improve DfI Roads’ resilience in responding to emergencies.

For the purposes of this report, references to DfI Roads shall be read as references to its former TransportNI or Roads Service brand.

Further information about DfI Roads is available on the website, please visit http://www.infrastructure-ni.gov.uk.

0. Executive Summary

The city of Newry, located mainly within southern County Down, has for many years suffered from traffic congestion. Some of the congestion has been relieved by the recent upgrading of the A1/N1 Strategic Corridor between Belfast and Dublin to a high standard dual carriageway.

The town of Warrenpoint to the south-east of Newry has benefited from the increased usage of the recently enhanced port facility. The port is a regional gateway and has risen to rank second in Northern Ireland behind Belfast for volume of freight handled. The majority of the port's vehicular traffic requires access to the A1/N1 corridor and currently has to pass through Newry City centre for onward journeys.

The need for a strategic link between the A2 Warrenpoint Road and the A1/N1 Belfast-Dublin Corridor was recognised in the Banbridge, Newry and Mourne Area Plan 2015.

In April 2015, AECOM was commissioned by the Department for Infrastructure to provide consultancy services in connection with promoting a Newry Southern Relief Road project through the preliminary assessment processes in accordance with the procedures established by the Design Manual for Roads and Bridges.

Improvements to the strategic road network have been established in Northern Ireland policy through the publication of the Regional Development Strategy (RDS) and the Regional Transportation Strategy (RTS). These strategies are implemented in local policy through the Regional Strategic Transport Network Transport Plan 2015 (RSTNTP) and the Investment Strategy for Northern Ireland (ISNI). As set out in the Transport Analysis Guidance, the following are the overarching objectives for transport:

- **Economy** - to support sustainable economic activity and get good value for money;
- **Environment** - to protect the built and natural environment;
- **Social** - to improve safety, accessibility and integration; and
- **Public Accounts** - to consider the cost to the broad transport budget.

During the early part of the development process, scheme objectives were identified that have been used in the preparation and assessment of corridor and route options. These specific objectives are to:

- Reduce journey times for strategic traffic between the Eastern Seaboard (A1 Belfast / Dublin) KTC and the A2 Warrenpoint Road;
- Improve journey time reliability for strategic traffic;
- Reduce conflict between strategic and local traffic movements;
- Contribute positively to transport economic efficiency;
- Contribute positively to road safety;
- Minimise impact on the environment;
- Achieve value for money; and
- Maintain navigation of the Newry Ship Canal.

Following the decision of the DMRB Stage 1 process, that Corridors 4 and 5 should be subject to a Stage 2 Assessment, the project team has developed five route options for further assessment. The engineering designs of the options have been developed in more detail through consultation with various statutory and non-statutory bodies, and with a formal Community Consultation Event held in November 2017 that enabled members of the public and the various consultee bodies to view and comment upon the route options.

Red Route proposes a new at-grade roundabout on the A2 Warrenpoint Road, crossing the Newry River and Ship Canal north of Victoria Lock. A new at-grade roundabout adjacent to Fathom Line would provide a connection between Fathom Line and the relief road. The route option would then pass up the slope of Fathom Mountain in a north-westerly direction, crossing Flagstaff Road and the Belfast-Dublin railway line before connecting into a re-configured roundabout at the A1 Ellisholding Junction.

Yellow Route proposes a new at-grade roundabout on the A2 Warrenpoint Road, crossing the Newry River at Rough Island where a further new at-grade roundabout would provide a connection to Fathom Line. Fathom Line itself would be locally upgraded where necessary before a new roundabout, north of the Red Route crossing, would provide a connection to the relief road. The alignment would then follow the same horizontal geometry as the Red Route.

Blue Route Options

Due to the challenges of steep topography and environmental designations associated with the Blue Route (Corridor 5 at DMRB Stage 1), three alignment variations of this route were developed during the DMRB Stage 2 process to optimise the earthwork balance and minimise impact on Benson's Glen. Initial assessment of these variants identified significant variation in; the alignments required both horizontally and vertically; the consequential earthworks balance; and the associated cost estimates.

It was therefore decided to present the assessment of these variants as route options in the DMRB Stage 2 assessment process to provide visibility of the sensitivity in achieving:

- a reasonable vertical gradient for the alignment;
- an acceptable earthworks balance; and
- a limited impact on environmentally sensitive areas and existing residential properties.

Blue Route Option 1 achieves a better earthworks balance and adopts a gradient of 6%. However, it impacts on Sites of Local Nature Conservation Importance (SLNCIs) and areas of Long-Established Woodland, including Benson's Glen.

Blue Route Option 2 adopts a gradient of 6% and minimises the impact on the SLNCIs and areas of Long-Established Woodland. However, the topography of the revised horizontal alignment requires a significant volume of imported fill material to achieve the desired vertical profile. This has the consequential impact of a higher scheme cost estimate.

Blue Route Option 3 is on the same horizontal alignment as Blue Route Option 2 and similarly minimises the impact on SLNCIs and areas of Long-Established Woodland. The vertical alignment has been amended in an attempt to optimise the earthworks and reduce the amount of imported fill associated with Option 2. However, to achieve this better balance, the vertical gradient has been increased to 8% over 375m, following a 950m length of 5.5%.

Due to the limited buffer width of the Red and Yellow route options, and the extensive designations and steep topography associated with them, there would be no significant difference in the assessment of alignment variants of these options. Therefore, it was not deemed necessary to investigate further variants for the Red or Yellow routes.

Blue Route Option 1 proposes a new at-grade roundabout on the A2 Warrenpoint Road in the vicinity of Greenbank Industrial Estate. It would cross Gerry Brown Park before crossing the Newry River, Ship Canal and Fathom Line. A new at-grade roundabout would offer a connection to Fathom Line. The route would then travel in a south-easterly direction before turning west, crossing Flagstaff Road and the Belfast-Dublin railway line. Another new at-grade roundabout would provide connection to the old Dublin Road before the route would connect to an upgraded A1 Ellisholding Junction in the same arrangement as the Red and Yellow routes.

Blue Route Option 2 proposes the same crossing as Blue Route Option 1. However, following the proposed roundabout adjacent to Fathom Line, the route would be aligned slightly further east compared to Blue Route Option 1, reducing the impact upon the long-established woodland and SLNCI. The route would then turn west before crossing Flagstaff Road and the Belfast-Dublin railway line. Similar to Blue Route Option 1, a new at-grade roundabout is proposed on the old Dublin Road. Blue Route Option 2 would provide this junction approximately 60m further south compared to Blue Route Option 1. Again, the route would connect to an upgraded Ellisholding Junction in the same way as the previous routes.

Blue Route Option 3 proposes the same horizontal geometry as Blue Route Option 2. Differences occur within the vertical geometry, most notably an 8% gradient. This significantly reduces the extent of earthworks associated with the route. This maximum gradient of 8% occurs over a short length of approximately 375m.

The comparative economic assessment found that all of the route options performed positively, with all options presenting an overall economic benefit if selected as the Preferred Option for the scheme.

To distinguish the options, the scheme objectives have been reviewed with the findings from the engineering, environmental, traffic and economic assessments. Opinions on the scheme options expressed in response to the community consultation have also been taken into account. The review has found that the options perform at a broadly similar level, with each option having respective advantages and disadvantages.

Taking into consideration its overall performance across the scheme objectives, and the views raised in response to the Community Consultation Event, it is recommended that Blue Route Option 3 be selected as the Preferred Route by the Department for Infrastructure.

It is also recommended that this option be further developed, in line with engineering standards set out in the DMRB, to a level sufficient for completion of a Stage 3 Scheme Assessment in accordance with TD37/93. In developing the above recommended route option, the following issues should be given further consideration:

- The vertical geometry, in consultation with FTA, Warrenpoint Harbour and the British Ports Association, to provide the optimum balance between geometry and associated earthworks;
- the links and junctions identified to be over-capacity in the 2037 Design year by the traffic and economic assessment;
- the proposed drainage system and outfall arrangements, in consultation with NI Water;
- the structural form and function of the associated river/canal bridge crossing, through consultation with technical specialists and relevant stakeholders, which should include investigating the possibility of providing an opening bridge structure across the Newry Ship Canal;
- the proposed diversion of existing utilities, through consultation with utility providers;
- the temporary traffic management measures required to build the scheme whilst mitigating disruption to road users;
- the development of environmental mitigation in consultation with relevant stakeholders; and
- optimising earthwork quantities through development of the route geometry and further ground investigation.

Table of Contents

Figures

Tables

List of Acronyms

Abbreviation	Explanation
AADT	Annual Average Daily Traffic Flow
AAHT	Annual Average Hourly Traffic Flow
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AST	Assessment Summary Table
ATC	Automatic Traffic Counter
BCR	Benefit to Cost Ratio
BMA	Belfast Metropolitan Area
BMV	Best and most Versatile
BNMP	Banbridge, Newry and Mourne Area Plan
BT	British Telecom
COBA	Cost Benefit Analysis
CTIL	Cornerstone Telecommunications Infrastructure Ltd
DAERA	Department of Agriculture, Environment and Rural Affairs
DfC	Department for Communities
DfE	Department for the Economy
DfI	Department for Infrastructure
DMRB	Design Manual for Roads and Bridges. A comprehensive manual system which accommodates all current standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads.
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
ESC	Environmental Scoping Report
FRA	Flood Risk Assessment
HGV	Heavy Goods Vehicles
ICS	Inscribed Circular Diameter
IDP	Investment Delivery Plan
IP	Inter-Peak
ISNI	Investment Strategy for Northern Ireland
JTC	Junction Turning Count
km	Kilometre
KTC	Key Transport Corridor
L&NWR	London and North Western Railway
LGV	Light Goods Vehicle
LPS	Land and Property Services
m	Metre
MCC	Manual Classified Counts
MMS	Multi – Modal Studies
NATA	New Approach to Appraisal Paper
NI	Northern Ireland
NIE	Northern Ireland Electricity

Abbreviation	Explanation
NIEA	Northern Ireland Environment Agency
NIR	Northern Ireland Railways
NMDDC	Newry, Mourne and Down District Council
NMU	Non-Motorised User
NPV	Net Present Value
NSRR	Newry Southern Relief Road
OD	Origin to Destination Surveys
OGV1	Other Goods Vehicle Class 1
OGV2	Other Goods Vehicle Class 2
P&R	Park and Ride (car park)
P&S	Park and Share (car park)
PPS	Planning Policy Statement
PSNI	Police Service of Northern Ireland
PSSR	Preliminary Sources Study Report
PSV	Public Service Vehicle
PVB	Present Value of Benefits
PVC	Present Value of Costs
RDS	The Regional Development Strategy
ROI	Republic of Ireland
RSI	Road Side Interview
RSPPG	Roads Service Policy and Procedure Guide
RSTN	Regional Strategic Transport Network
RSTN TP	Regional Strategic Transport Network Travel Plan
RTS	Regional Transport Strategy
SRI	Strategic Road Improvements
SSD	Stopping Sight Distance
TRIPS	Transport Improvement Managing System
VPD	Vehicles Per Day
WebTAG	Transport Analysis Guidance Website

1. Introduction

1.1 Introduction

Newry is located in the south of Northern Ireland approximately 55km from Belfast and 108km from Dublin. The scheme's location in a regional context is shown in Figure 1.1.1.

The Department for Infrastructure Roads' general objective for the scheme is to separate strategic traffic travelling to/from Warrenpoint Port from the traffic associated with Newry City and its busy shopping districts. The Newry Southern Relief Road proposal is to provide a direct strategic link between the A1/N1 Belfast to Dublin Road and the A2 to Warrenpoint.

The A1 forms part of the Belfast-Dublin Corridor which is a key arterial route that consists of the M1 and N1 in the Republic of Ireland (RoI), and the A1 and M1 in Northern Ireland (NI). The A1 provides a link from the RoI past Newry, Banbridge, Dromore, Hillsborough and Lisburn to Belfast, via the M1.

The A1 in the vicinity of Newry has seen major upgrades over the past decade to a high standard dual carriageway. In 2015, to the north of Cloghogue Junction the A1 carried approximately 21,250 vehicles per day (vpd) and 19,990vpd to the south of the junction.

The A2 Warrenpoint Road is a key trunk road connecting Warrenpoint Port to Newry and on to the Belfast-Dublin Corridor. The A2 Warrenpoint Road carried approximately 12,500vpd in 2015.

The A1 and the A2 are classified as Rural All Purpose Roads to dual carriageway standard. The existing speed limit for the A1 and the A2 dual carriageways is 70mph. However, it is noted that there are existing speed restrictions on sections of the A1, to the north of Newry, which are below this level. It is also noted that both the A1 and A2 currently have sections of road which still include gap junctions in the central reservation.

The location of Newry and the Warrenpoint Port adjacent to the A1/N1 Belfast-Dublin Corridor escalates the importance of the scheme. Warrenpoint Port is now the second largest port in NI in terms of cargo tonnage; however, it is disadvantaged by its current link to the strategic road network through the city of Newry.

Figure 1.1.1 Regional Strategic Transport Network

1.2 Regional Strategic Transport Network

The Regional Development Strategy for Northern Ireland 2035 (RDS) guides the future development of Northern Ireland. The RDS recognises the key role that the Regional Strategic Transport Network (RSTN) has to play in achieving the social, economic and development goals in Northern Ireland.

The Regional Transportation Strategy for Northern Ireland 2002-2012 (RTS); identifies strategic transport investment priorities, potential funding sources and affordability of planned initiatives. A revised strategy document, 'Ensuring a Sustainable Transport Future - A New Approach to Regional Transportation', was published in 2012. One of its main Strategic Objectives is to "improve connectivity within the region" by completing the work identified in the current Regional Strategic Transport Network Transport Plan (RSTN TP) and Strategic Road Improvement (SRI) Programme.

The RTS supports and complements the RDS 2035 and aims to achieve its vision for transportation, "to have a modern, sustainable, safe transportation system which benefits society, the economy, and the environment and which actively contributes to social inclusion and everyone's quality of life."

The RSTN TP 2015 is based on guidance in the RDS and RTS. The plan presents a range of multi-modal transport initiatives to manage, maintain and develop Northern Ireland's Strategic Transport Network and proposes SRIs to:

- **remove bottlenecks on the key road network where lack of capacity is causing congestion; and**
- **improve the environment by providing town bypasses, relieving the effects of heavy through traffic.**

The RSTN comprises the complete rail network, five Key Transport Corridors (KTCs), four Link Corridors, the Belfast Metropolitan Transport Corridors and the remainder of the trunk road network. The KTCs are the top tier of the Region's long distance routes, connecting cities and main towns to the major regional gateways and the Belfast Metropolitan Area (BMA).

This scheme would link to the Eastern Seaboard Corridor which includes road and rail links between Larne in Co. Antrim and the border at Newry via the BMA and Lisburn, facilitating onward travel to Dublin; improving access to gateways including: George Best Belfast City Airport, the Ports of Larne and Warrenpoint.

1.3 Investment Strategies and Delivery Plan

In 2008, the Strategic Investment Board announced the updated Investment Strategy for Northern Ireland (ISNI) 2008-2018 which outlined the Government's chief objectives for infrastructure investment. The strategy envisaged an investment of £2.5 billion in SRIs up to 2018.

Due to the envisaged additional investment, DfI Roads produced an associated document listing additional projects to define an Expanded SRI programme to further improve the motorway and trunk road network, known as *'Expanding the Strategic Road Improvement Programme 2015'*. Together with the Investment Delivery Plan (IDP) 2008, these documents show how the Investment Strategy for Northern Ireland would be implemented.

The draft Banbridge, Newry and Mourne Area Plan 2015 includes a proposal for a Newry Southern Bypass as a long term strategic road improvement to link from the A1 Dublin Road, a key strategic route, to the A2 Warrenpoint Road, a trunk road leading to Warrenpoint Port.

1.4 Project Brief

The scheme brief from DfI Roads includes the completion of Stage 1 Assessment Report (Preliminary Options Report) (completed June 2017) and Stage 2 Assessment Report (Preferred Options Report), with a possible extension to include Stage 3 contract completion and Post Project Review, subject to the necessary approvals and availability of funding.

The Brief for the project identifies the scheme as providing a link south-east of Newry between the A1 Belfast to Dublin Road and the A2 Newry to Warrenpoint Dual Carriageway.

1.5 European Union (EU) Funding

The Department for Infrastructure has been awarded Up to €1.53million (£1.35million) of EU funding for the Newry Southern Relief Road Study through the Connecting Europe Facility. This funding will help to complete the following key activities of this road project:

1. Draft Preferred Options Report:
2. Finalise the Preferred Options Report and initiate gateway procedures:
3. Preparation of Stage 3 Proposed Options Report:
4. Prepare draft Statutory Orders:
5. Ground investigation:
6. Prepare for Public Inquiry if required.

The above activities contain a number of associated milestones which are fundamental to the continued funding from the EU, concluding with the preparation of documentation for Public Inquiry in December 2020 if required.

1.6 Existing Problems

The need to consider an alternative arrangement at this location was previously identified through the work carried out to establish the Expanded SRI Programme and the 2008 Feasibility Study Report. The assessment process involves identifying the transport related problems within the Study Area. The key problems that the study will seek to alleviate are outlined below:

- Delays during daily peak, inter-peak and weekend shopping periods for strategic and local traffic;
- strategic long distance traffic (i.e. traffic which does not have an origin or destination in Newry City) mixes with local traffic, resulting in traffic congestion in Newry City centre along William Street / Bridge Street during a large part of a typical working day;
- currently, a relatively high volume of city centre traffic is HGVs accessing Warrenpoint Port, which adds to congestion;
- the resulting congestion leads to journey time unreliability for city centre traffic;
- congestion in the city centre is having a negative impact on freight traffic movements to and from Warrenpoint Regional Gateway;
- poor access to the A1/N1 Belfast-Dublin Corridor for Warrenpoint Port and the businesses located at Greenbank Industrial Estate located on the A2 Warrenpoint Road is due to a discontinuous strategic highway network;
- impact on the local population from noise and air pollution, and vehicle and pedestrian conflicts as a consequence of the congested road network; and
- negative impact on economic growth and development due to delays and congestion.

1.7 Project Objectives

1.7.1 High Level Objectives

The following four criteria, as set out in the Transport Analysis Guidance, are the overarching main objectives for transport:

- **Economy** - to support sustainable economic activity and get good value for money;
- **Environment** - to protect the built and natural environment;
- **Social** - to improve safety, accessibility and integration; and
- **Public Accounts** - to consider the cost to the broad transport budget.

1.7.2 Regional Objectives

The following regional objectives fulfil the requirement to nest within the Government's four main objectives:

- To support the spatial development strategy in the RDS;
- to develop and maintain the RSTN for all users;
- to protect the natural and built environment;
- to improve health, safety and security;
- to support sustainable economic growth; and
- to improve access to regional gateways.

1.7.3 Project Specific Objectives

Project specific objectives are detailed below:

- Reduce journey times for strategic traffic between the Eastern Seaboard (A1 Belfast / Dublin) KTC and the A2 Warrenpoint Road;
- improve journey time reliability for strategic traffic;
- reduce conflict between strategic and local traffic movements;
- contribute positively to transport economic efficiency;
- contribute positively to road safety;
- minimise impact on the environment;
- achieve value for money; and
- maintain navigation of the Newry Ship Canal.

1.8 Stage 1 Scheme Assessment Report Conclusion

The Stage 1 Scheme Assessment considered five corridors within the Study Area, all originating on the A2 Warrenpoint Road and terminating at either Ellisholding or Cloghogue Junctions on the A1 to the southwest of Newry. The Engineering, Traffic, Economic, Safety and Environmental impacts of each corridor were assessed before the Stage 1 Assessment concluded that Corridor 5 provided the best opportunity for a sustainable solution. However, given the limited alignment scope within Corridor 5, it was deemed prudent that Corridor 4 should also be included within the Stage 2 Assessment considering the benefits that it could offer. The assessments undertaken at Stage 2, to allow a Preferred Route Alignment to be determined, are discussed as the subject of this report.

1.9 Methodology

The Stage 2 Scheme Assessment Report has been produced in accordance with Design Manual for Roads and Bridges TD37/93 *Scheme Assessment Reporting*, Roads Service Policy & Procedure Guide: RSPPG_E030 and the Government's over-arching objectives for Transport. The purpose of this Stage 2 SAR is to:

- Summarise the development of alignment options considered at Stage 2;
- summarise the assessment of initial preferred options; and
- identify a preferred option to be taken forward to Stage 3.

2. Existing Conditions

2.1 Introduction

This section outlines the existing conditions relating to the surrounding area and the existing roads. Particular attention is paid to the issues which would have a direct impact on the potential relief road and the aspects which are likely to influence the selection of a preferred alignment. A more detailed assessment of the existing conditions is provided in later sections of this report, namely Engineering Assessment, Environmental Assessment and Traffic and Economics Assessment.

2.2 Existing Road Network

Newry has traditionally been a large centre of population and commerce. It has a significant number of regionally important roads which link it to the surrounding smaller regional towns. It is situated to the east of the main A1/N1 route from Belfast to Dublin. There are also a number of local roads which cross the Study Area, interconnecting with both each other and the A1.

Traffic flows on the local roads are smaller and limited to local residents and other road users familiar with the network. Traffic flows along the local connector roads are larger as traffic is gathered from the smaller population centres. These roads are typically of a larger cross section.

Within the Study Area there are six sections of A-class road:

- A1/N1 Belfast-Dublin Corridor;
- A2 Warrenpoint Road;
- A2 Warrenpoint Road/Kilmorey Street north of Greenbank Roundabout;
- A28 William Street/Abbey Way;
- A2 Bridge Street/Dublin Bridge; and
- A2 Dublin Road.

There are two sections of B-class road:

- B79 Fathom Line/R173 in the RoI; and
- B79 Drumalane Road.

The various local, minor and unclassified roads:

- C0219 Flagstaff Road;
- U5284 Fathom Line/Albert Basin;
- U5291 Ferryhill Road;
- U5285 Hillhead Road;
- the old Dublin Road
- U5328 Barracric Road; and
- U5328 Windy Road.

2.2.1 A1/N1 Belfast-Dublin Corridor

The A1/N1 strategic corridor to the west of Newry has been subject to major upgrades over the past decade, including:

- A1 Loughbrickland to Beech Hill – completed in 2006;
- A1 Beech Hill to Cloghogue – completed in 2010; and
- A1 Cloghogue to Dundalk Link Road (NI section to RoI border) – completed in 2007.

The A1 within the Study Area is a high standard dual carriageway with grade-separated junctions, twin lanes and a hard shoulder in each direction. A dual carriageway standard cross-section is maintained northward towards Belfast; however, many stretches were constructed over 25 years ago and may not comply with current Design Standards.

Cloghogue Roundabout junction is fully grade separated and has no restrictions on traffic movements. Traffic wishing to travel from Newry to the A1/N1 Belfast-Dublin Corridor via Cloghogue Roundabout junction currently utilise a merge on-slip arrangement to gain access to the A1 dual carriageway. Vice versa, traffic wishing to travel to Newry from the A1/N1 Belfast-Dublin Corridor use an off-slip diverge arrangement.

Figure 2.2.1 Cloghogue Roundabout junction southern merge/diverge arrangements

Figure 2.2.2 Cloghogue Roundabout Junction northern merge/diverge arrangements

The grade-separated junction at Ellisholding is a 'half diamond' layout, which has limited traffic movements. The junction has an off-slip diverge arrangement in the southbound direction travelling from the A1 from Newry, and a merge on-slip arrangement in the northbound direction travelling towards Newry to the A1. A ‘dumbbell’ roundabout layout provides links to the old A1 Dublin Road, Ellisholding Road and Upper Fathom Road.

Figure 2.2.3 Ellisholding Junction showing 'half diamond' layout *(AECOM Map Portal)*

The nearest northerly junction on the A1 outside of the Study Area is Chancellors Road junction. This serves the northern reaches of Newry; it connects a new access road and Chancellors Road to the strategic road network. Chancellors Road junction is located approximately 2km north of Cloghogue Roundabout junction. The closest junction to the south of the Study Area is located at Dromad in the RoI, which is approximately 4.8km form Ellisholding junction. It is a half ‘dumbbell’ junction with south facing slip roads, no access is provided to the north side of the A1 at this junction.

The following list details the other junctions along the A1 within and close to the Study Area (within the vicinity of Newry); it also includes the approximate spacing between them:

- Sheepbridge junction – north of Newry, connects A28 Belfast Road and existing A1 Dublin Road (outside Study Area) – 3.2km to Carnbane junction;
- Carnbane junction– north of Newry, connects to the A27 Tandragee Road and A28 Armagh Road (outside Study Area) – 1.7km to Camlough Road junction;
- Camlough Road junction – north-west of Newry, connects to the A25 Camlough Road and Craigmore Way (outside Study Area) – 2.0km to Chancellors Road junction;
- Chancellors Road junction – west of Newry, connects to the Chancellors Road and a new access road (outside Study Area) – 2.1km to Cloghogue Roundabout junction;
- Cloghogue Roundabout junction – south-west of Newry City, connects to A2 Dublin Road, Flagstaff Road and the B113 Forkhill Road – 1.6km to Ellisholding junction, and
- Ellisholding junction – south-west of Newry, connects to Ellisholding Road and existing A1 Dublin Road – 3.1km to the RoI border and subsequently the Dromad junction which straddles the border.

The aforementioned junctions, with the exception of Ellisholding junction, were completed as part of the A1 Dualling – Beechill to Cloghogue scheme which officially opened in 29th July 2010 (5 months ahead of schedule). Ellisholding junction was completed as part of the A1/N1 scheme.

2.2.2 A2 Warrenpoint Road

The A2 Warrenpoint Road, completed in the 1970's, is a rural all-purpose dual carriageway with; two lanes in each direction, hard shoulders and a central reserve. The route has a wooded setting to the east (Narrow Water Wood) consisting of hilly terrain and Newry River running parallel to the west. The existing 7.7km road is the main highway link between Newry and Warrenpoint. Direct access to properties that front onto the road is achieved through utilising a wide central reserve and providing right turn gaps (cross-overs) for traffic wishing to access Old Warrenpoint Road, Aghnamoira Road and several other local access points that serve properties adjacent to the A2 dual carriageway, see Figure 2.2.5 in Appendix A.

Figure 2.2.4 A2 Warrenpoint Road (Image showing gap/cross over type junction)

The A2 has two at-grade roundabout junctions; Warrenpoint Road Roundabout to the north of Warrenpoint giving access to the A2 dual carriageway and Mound Road. Greenbank Roundabout to the south of Newry allows access to Old Warrenpoint Road, Greenbank Industrial Estate and local sports facilities.

2.2.3 A2 Warrenpoint Road/Kilmorey Street north of Greenbank Roundabout

Heading north towards Newry city centre, the A2 Warrenpoint Road from the Greenbank Roundabout becomes the A2 Kilmorey Street at its junction with Home Avenue. The A2 Warrenpoint Road/Kilmorey Street contains two lanes which narrow to a traditional single, two-way carriageway from Newry city centre towards A28 William Street/Dublin Road Junction. The road has footways on each side with a shared cycle way on the western side.

Northbound traffic has two alternative routes to access the A2 Dublin Road via A2 Bridge Street; River Street or A2 Kilmorey Street, both of which turn left towards the A2 Dublin Road. Kilmorey Street makes use of a signalised junction while River Street uses a priority junction. River Street diverges from the A2 Kilmorey Street and has a one way traffic system. As River Street approaches the A2 Dublin Road it widens to two lanes with left turning only onto the A2 Bridge Street mainline.

2.2.4 A28 William Street/Abbey Way

A28 William Street has two lanes in each direction carrying traffic northeast to A28 Abbey Way and west to A2 Bridge Street. In addition, A28 William Street has a two-lane right turn layout for traffic travelling from A2 Bridge Street wishing to turn right on to A2 Kilmorey Street. Along with A2 Kilmorey Street and River Street, A28 William Street has other junctions with John Mitchell Place and St. Mary Street in close proximity.

A28 William Street passes over the Newry River and Canal via Dublin Bridge. A signalised junction is provided at A28 William Street/Bridge Street junction with Buttercrane Quay and the Albert Basin at

U5284 Fathom Line. Traffic can access U5284 Fathom Line and travel south adjacent to Newry Canal towards the RoI.

2.2.5 A2 Bridge Street/Dublin Bridge

A2 Bridge Street has a signalised junction, mid-way along its length, with access provided to the Quays Shopping Centre and Buttercrane Shopping Centre on opposite sides of the road. The street is typical in urban nature with residential and commercial property fronting onto this road and footways on each side. Two lanes carry traffic towards A28 William Street and one lane carries traffic towards A2 Dublin Road. Right-turn lanes are provided for traffic wishing to access either shopping centre. A2 Bridge Street continues southwest towards another signalised junction with A2 Dublin Road, B79 Dominic Street and B79 Drumalane Road.

2.2.6 A2 Dublin Road

Heading south along A2 Dublin Road from the B79 junction, two lanes are provided uphill for traffic with one lane being provided in the opposite direction. This urban climbing lane ends approximately one third of the way along A2 Dublin Road but the carriageway width is maintained up to Cloghogue Roundabout junction. Right turn pockets/lanes for various road and residential accesses on each side of the road are provided. Chancellors Road and Flagstaff Road form the main priority junctions with A2 Dublin Road. Other priority junctions are located along A2 Dublin Road providing access for mainly residential properties.

The A2 Dublin Road provides a footway on either side, climbs steeply from its junction with A2 Bridge Street, B79 Dominic Street and B79 Drumalane Road to an at-grade roundabout at Cloghogue Roundabout junction. The road passes under an existing railway bridge which has a headroom restriction of 4.8m to the existing road surface (minimum current design standard headroom clearance should be 5.3m).

2.2.7 U5284 Fathom Line/Albert Basin & B79 Fathom Line

Travelling south from Newry, crossing the A2 Bridge Street/William Street signalised junction leads to the U5284 Fathom Line/Albert Basin. Various residential housing estates are located along this part of the road to the south of the Quays Shopping Centre. U5284 Fathom Line continues southward towards Omeath and Carlingford via a priority junction with B79 Drumalane Road.

The B79 Fathom Line runs parallel to the Newry River/Canal which is to the east of the existing road (approximately 3-5m from the existing road edge), with Fathom Mountain rising to the west. The existing route travelling south from Newry from the junction with the B79 Drumalane Road and B79 Fathom Line is characterised by narrow lane widths and portions of sub-standard horizontal alignment.

The sub-standard alignment occurs mostly over the first 1km of its length from B79 Drumalane Road junction; after which the existing road is of generally good alignment. Access to a limited number of private dwellings is provided along this road with a large quarry (Drumalane Quarry) located close to its junction with B79 Drumalane Road to the west.

2.2.8 B79 Drumalane Road

B79 Drumalane Road continues from B79 Fathom Line in a northerly direction towards A2 Bridge Street/Dublin Road. Hillhead Road forms a priority junction with this road. Again, lanes are narrow with a large volume of residential housing fronting onto the road. B79 Drumalane Road has traffic calming measures implemented along part of its length close to its junction with A2 Bridge Street/Dublin Road. Travelling north along B79 Fathom Line heading toward the A1/N1 Belfast-Dublin Corridor the Drumalane Road provides a bypass to the busy shopping area along Albert Basin/U5284 Fathom Line.

2.2.9 Other Unclassified Roads within the Study Area

Ferryhill Road is a rural road with particularly sub-standard horizontal and vertical alignment contributing to poor visibility. The road is characterised by narrow carriageway widths between 4-6m and the road's surface dressing is in poor condition (rutted and cracked surface). The Ferryhill Road crosses the RoI border on two occasions along its length. The road starts in the RoI at Cornamucklagh, crosses the border into NI and then back across the border into the RoI where it links into the old A1/R132 Dublin Road via a priority junction. The A1/R132 Dublin Road provides access to both Cloghogue Roundabout and Ellisholding Junctions. There are various property accesses along the length of the Ferryhill Road and access to other rural roads and farm tracks, including: Killeen School Road, Clontigora Road, Cottage Road, Upper Fathom Road, Flagstaff Road and Clontigora Hill.

Flagstaff Road is a rural road with particularly sub-standard horizontal and vertical alignment contributing to poor visibility. The road is characterised by very narrow carriageway widths between 3-5m; little more than a vehicle wide for most of its length and includes passing bays. The road surface is in reasonably good condition. The road has steep embankment slopes to the east facing down into the valley and steep rock cuttings to the west into the side of the mountain. Significant stretches of the road have a Vehicle Restraint System in place. The road is linked to the Ferryhill Road at its southern end and the A2 Dublin Road at its northern end with priority junctions. There are various accesses off the road to other rural roads and farm tracks including; Hillhead Road, Barracric Road and Windy Road.

Hillhead Road - is a rural road with particularly sub-standard horizontal and vertical alignment contributing to poor visibility. The road is characterised by narrow lane widths and steep gradients. The Hillhead Road is connected to the B79 Drumalane Road at its northern end and to the Flagstaff Road at its southern end via priority junctions. The road has been re-aligned away from the quarry edge as the surrounding ground is inherently unstable. The Hillhead Road has been stopped up approximately 400m from its junction with Flagstaff Road and stopped up approximately 750m from its junction with B79 Drumalane Road. Other unclassified rural roads that are sub-standard with regards to engineering design criteria include: Barracric Road and Windy Road.

2.3 Other Improvement Schemes

2.3.1 £350,000 Resurfacing scheme for A28 Belfast Road Newry

This was a significant resurfacing scheme, on the main road from Newry to Belfast, providing almost 1km of new asphalt road surface, footways and associated drainage improvement works. The resurfacing works extended from the junction with New Street, to just beyond the junction with Ashgrove Road and involved replacing 200m of footway and kerbs from the Downshire Road roundabout. Works were completed in July 2017.

2.3.2 £300,000 Resurfacing scheme on A25 Newtown Road, Camlough

The resurfacing works extended a distance of approximately 1.2km from its junction with the B30 Newtown Road, Camlough to near its western junction with the B30 Newtown Road. This significant scheme on the main road from Newry to Newtownhamilton provided over 1km of new asphalt road surface and associated drainage improvement works. Works were completed in November 2017.

2.3.3 Narrow Water Bridge

This proposal is to build a bridge spanning the Newry River. The bridge would cross the river at the narrowest point, Narrow Water Castle, which is approximately one mile north-west of Warrenpoint and would connect the A2 Newry to Warrenpoint dual-carriageway to the R173 in county Louth close to Omeath. This project is still in the development stages.

2.3.4 A1 Junctions

This scheme will progress the A1 improvements from Phase 1 to Phase 2 by providing further grade-separated junctions on the A1 dual carriageway between Hillsborough and Banbridge. The provision of a continuous safety barrier and the closing up of all gaps in the central reservation between Hillsborough and Loughbrickland is also proposed.

2.4 Traffic Conditions

Newry city centre experiences high levels of traffic congestion throughout key periods of the day. Traffic conditions within the city are influenced significantly by the large proportion of heavy goods vehicles travelling to/from Belfast and Dublin to the port at Warrenpoint. Several signalised junctions exist on the Abbey Way/William Street/Dublin Road section, which lead to delays and congestion during periods of peak traffic flow, particularly on the approaches to the city centre from; Dublin Road, Kilmorey Street, Abbey Way and along Bridge Street/William Street as shown in Figure 2.4.1.

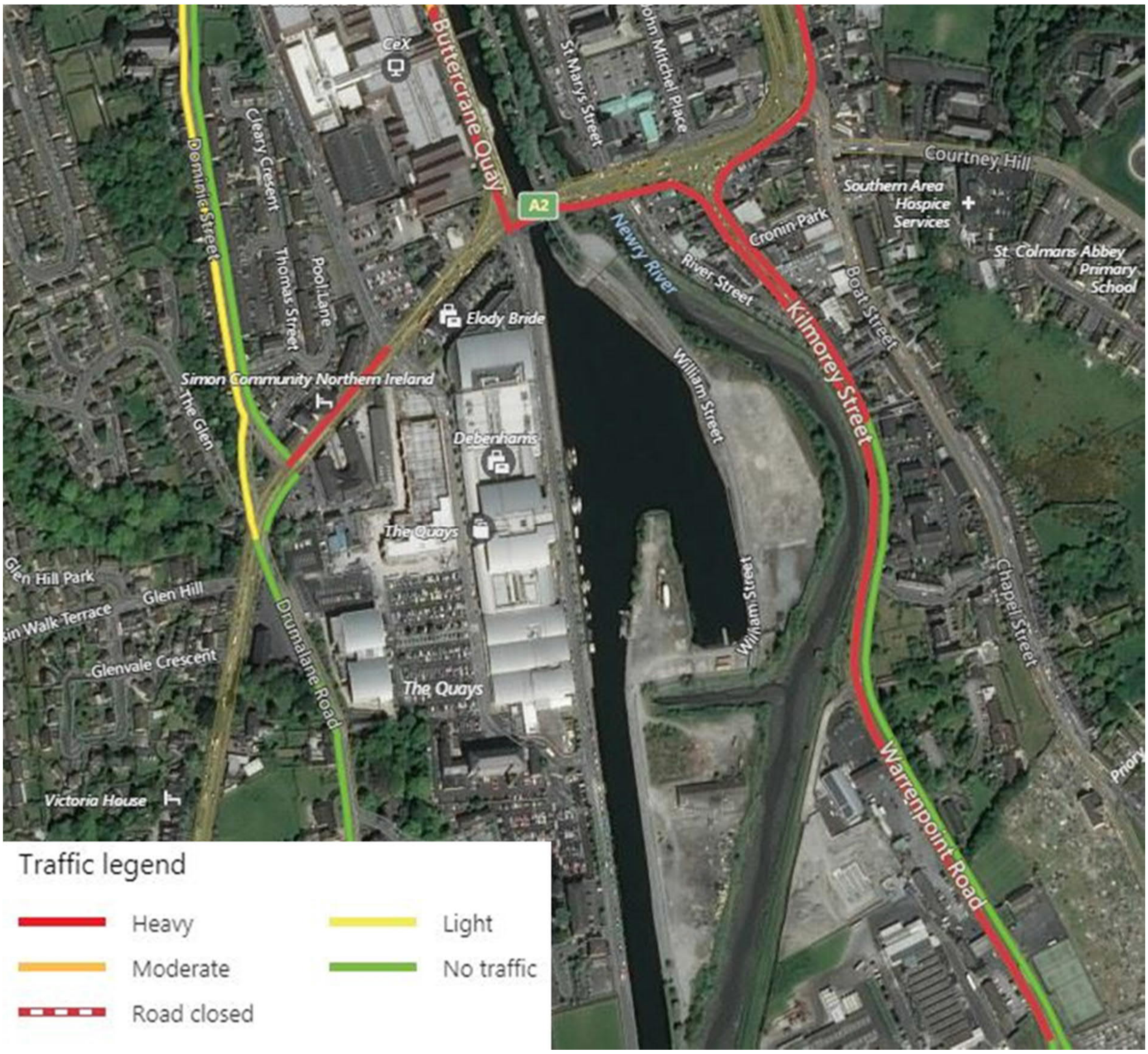


Figure 2.4.1 Traffic Conditions in Newry City Centre - 12:30 - 20/10/2017

A number of surveys were undertaken in connection with this study. These include:

- 20 No. Manual Classified Counts (MCC) at key junctions;
- 6 No. Automatic Traffic Counts at key locations;
- 2 No. journey time routes over 2 days; and
- 10 No. automatic number plate recognition (ANPR) sites.

The 12hour MCCs were completed on the 6th and 13th June 2017 and provide a record of traffic turning movements and traffic composition on the network. Further traffic data is found in Chapter 6.

2.5 Public Transport

There are a number of public transport facilities servicing the Study Area; Newry Bus Centre, located on Canal Quay, provides a range of services detailed in Table 2.5.1 and Newry Railway Station, located north of Camlough Road, which provides a terminus on the Belfast to Dublin line. A park and ride facility is located adjacent to the Railway Station.

2.5.1 Rail Stations and Services

Newry railway station is a terminus for the NI Railways Bangor-Belfast-Newry line and Iarnód Éireann Northern Commuter line from Dublin. The station is also a calling point on the Belfast Central to Dublin Connolly Enterprise service. The station originally opened in 1855 and was operational before closing in 1942. The railway station was reopened in 1984 and was later modernised in 2009 providing a much needed update to the facility. Over 300 car parking spaces are included in an adjacent Park and Ride facility.

Stations to the north of Newry, on the main Dublin to Belfast Enterprise service line, include: Portadown, Lurgan, Moira, and Lisburn. Local services operated by Northern Ireland Railways (NIR) on Mondays to Fridays provide a half-hourly service towards Portadown and two-hourly to Newry in one direction and to Bangor in the other, with extra services at peak times. After 18:00hrs only Enterprise trains serve Newry.

Two disused railway lines, the Dundalk, Newry and Greenore Railway (part of the London & North Western System) pass through the western side of the Study Area and a section of the Portadown-Newry-Warrenpoint Railway which lies under the A2 Warrenpoint Road.

2.5.2 Bus Services and Park and Share Facilities

The public transport operator Translink runs a number of services from Newry connecting to Belfast and other regional centres under the Ulsterbus and Goldline franchise. The following services are currently noted on the Translink website and shown in Table 2.5.1.

Table 2.5.1 Bus Services within the Study Area

Route No.	Route
238 (a/b) – Goldline service	Belfast – Banbridge – Newry
239 – Goldline service	University of Ulster, Coleraine – Newry, Bus Centre
240 – Goldline service	Downpatrick, Bus Station – Newry, Bus Centre
X1/X2 – Goldline service & Aircoach	Belfast – Dublin Airport – Dublin
X4 – Goldline service	Derry/Londonderry – Dublin Airport – Dublin
33/35/38/45/538 – Ulsterbus service	Newry – Banbridge – Belfast (only Route No. 38, 45 & 538 go to Belfast)
39 (f) – Ulsterbus service	Newry – Kilkeel/Warrenpoint (only Route No. 39f goes to Warrenpoint)
40 (b/e/h) – Ulsterbus service	Newry – Armagh
41 (a/b/c)/338E – Ulsterbus service	Newry – Beesbrook – Newry
42 – Ulsterbus service	Newry – Crossmaglen
43 (a/b) – Ulsterbus service	Newry – Forkhill
44 – Ulsterbus service	Newry – Newtownhamilton – Armagh
338 (a/b/c/d/f)/341/463 – Ulsterbus service	Other local tourist and in-city routes, i.e. 341 operates as a link between Newry Bus Centre and Railway Station

Source: Translink website

2.5.3 Park and Share Facilities

At Cloghogue Roundabout there is a Park and Share facility which includes 25 spaces for car owners to use as meeting locations for onward journeys to city centres. These facilities allow car owners who would be travelling alone to leave their vehicle and travel with others reducing the number of car journeys.

2.6 Northern Ireland Transport Statistics 2016-2017

The latest edition of Northern Ireland Transport Statistics, containing statistics for 2016-17 was published on 28th September 2017. This publication was produced by the Analysis, Statistics and Research Branch (ASRB) of the Department for Infrastructure and contains information on vehicle registrations, driver and vehicle testing, the road network, freight, road safety, public transport, air transport, accessible transport and other transport statistics in Northern Ireland. The publication is available on the ASRB website at: https://www.infrastructure-ni.gov.uk/articles/northern-ireland-transport-statistics.

It notes that during 2016, 49.3 million tonnes of freight were lifted within Northern Ireland and transported by road by heavy goods vehicles, an increase of 9% from 2015.

2.7 Topography and Land Use

2.7.1 Topography

The topography within both Corridors is extremely harsh; dominated by the Fathom Mountain and other adjacent mountains to the west of the Corridors which peak at approximately 250m AOD. The area is also defined by the tidal Newry River and navigable Newry Canal (approximately 5m AOD). The Newry River is located at the head of Carlingford Lough with the Newry Canal entrance at Victoria Lock a further 3-4km upstream of Carlingford Lough.

As a result of the topography, watercourses within the Corridors flow in an easterly direction towards the Newry River/Canal. There are areas of floodplains, notably at the Newry River which has a deeper navigable central channel with a large expansive floodplain area (mud flats).

The terrain to the west of the Study Area (Fathom Mountain) is wooded, has steep gradients rising rapidly from the valley floor beyond B79 Fathom Line (from approximately 8m AOD) and the disused London & North Western Railway (L&NWR) which runs parallel to B79 Fathom Line; approximately 5-10m to the landward side of the existing carriageway.

The terrain to the eastern part of the Study Area is wooded, rises more gradually than the western side and is rolling in nature. The ground rises to the east of the A2 Warrenpoint Road (from approximately 8m AOD) to approximately 100m AOD, with the Mourne Mountains as a backdrop in the distance.

Figure 2.7.1 View of Fathom Mountain and other associated mountains from the A2 Warrenpoint Road

2.7.2 Land Use

A mixture of private residential properties, commercial/industrial properties and agricultural outbuildings are located within the two Corridors. Three clusters of residential housing developments are found to the east of A2 Dublin Road, heading towards Newry; to the west of U5284 Albert Basin, and to the east of A2 Warrenpoint Road.

Newry has three Industrial/Enterprise zones; Greenbank Industrial Estate, Carnbane Industrial Estate and Ashtree Enterprise Park; of the three, only Greenbank Industrial Estate lies within the corridors to the east of Newry River/ Canal, south of Newry. There are sections within the Study Area that have Statutory Designations. For example, there are locations containing Long-Established Woodland, Ancient Woodland and Sites of Local Nature Conservation Importance. The Banbridge/Newry and Mourne Area Plan 2015 has designated zones for:

- Housing – 22 zones;
- Economic Development – 8 zones;
- Mixed Use – 1 zone;
- Education – 2 zones;
- Public Services and Utilities - 1 zone;
- City Regeneration – 16 zones;
- Transportation – 2 zones; and
- Environment and Conservation – 33 zones

In addition to these developments there are scattered rural dwellings throughout the study area, along the Flagstaff Road and the Ferryhill Road.

2.7.3 Man Made Constraints

2.7.3.1 Newry Ship Canal and Victoria Lock

Newry Ship Canal is currently used by leisure craft as a means of accessing Newry from the Irish Sea via Carlingford Lough. It was the first ever summit level canal to be built in Ireland and Great Britain and was opened in 1742. It is entered on its seaward approach via Victoria Lock which was automated in May 2007 and was closed for repairs between July 2015 and April 2016.

Within the corridors, the canal is navigable for approximately 5.5km from Victoria Lock in a northerly direction until it reaches Dublin Bridge which is a fixed height bridge. At this location, Albert Basin provides mooring facilities; however, a number of restrictions apply including:

- The maximum size of vessel that can enter Newry Ship Canal is 200 ft. (60 metres) in length x 33 feet (10 metres) in width, to suit the size of the lock chamber at Victoria Lock.
- Maximum Depth of Water (Draft) at the Albert Basin is 11ft (3.3 metres).

2.7.3.2 Disused Dundalk, Newry and Greenore Railway

A disused railway line, part of the London & North Western Railway, passes through the corridors running south from Newry towards Greenore; parallel to the B79 Fathom Line before continuing west to Dundalk as shown in Figure 2.7.2 coloured in red. The railway was built in the 1860's before closing in 1951. The old route can still be seen cutting through the landscape in certain locations, however, it is largely hidden and has become overgrown and dilapidated.

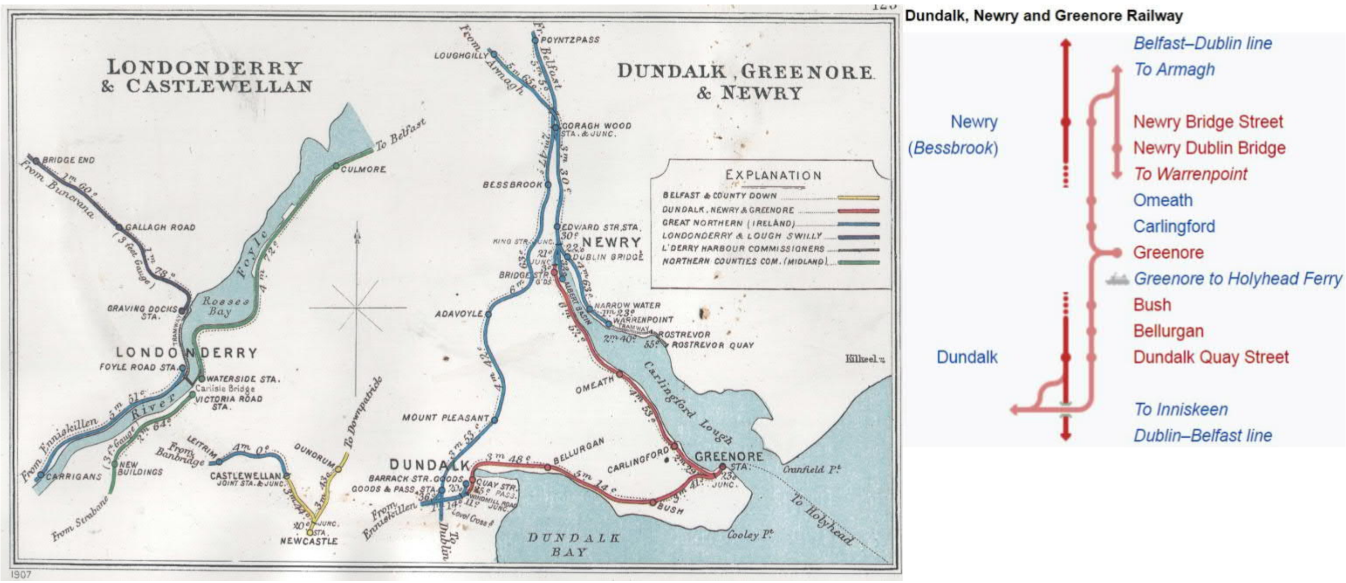


Figure 2.7.2 Dundalk, Newry and Greenore Railway (L&NWR) Source: Library of Railway History

2.8 Existing Environmental Conditions

2.8.1 Local Context

The study area is centred to the south of Newry, within the steep-sided Newry River valley which separates the Ring of Gullion to the west from the Mourne Mountains to the east. The Newry River flows through the centre of Newry, providing a natural boundary between counties Down and Armagh. The city has a dramatic natural setting at the head of Carlingford Lough. Its setting in a river valley means that the settlement has been contained by topography.

Newry occupies a strategic location on the Eastern Seaboard Corridor, 60 kilometres from Belfast and 100 kilometres from Dublin, forming an inter-regional gateway between Northern Ireland and the Republic of Ireland. The cross border rail link between NI and the ROI serves Newry, which enjoys a frequent express service to Belfast and Dublin in addition to local services.

The development of Newry over time has been influenced by the layout of the existing A-Class and B-Class road network, which until relatively recently, took traffic through the centre of the city. The area has generally good road communications with other main centres of population such as Craigavon, Armagh and Banbridge. Due to the strategic location between a number of surrounding settlements, several arterial routes radiate from the city, including:

- A1 to Lisburn/Belfast;
- A1/N1 to Dublin;

- A2 to Warrenpoint;
- A25 to Camlough;
- A25 to Downpatrick;
- A27 to Portadown; and
- A28 to Armagh.

Residential developments predominantly contain the road corridors which radiate out from the city, with more suitable areas of land between these roads giving way to large parcels/clusters of residential development. The city centre naturally consists of mixed developments comprising leisure and cultural facilities (including arts, entertainment and built sport facilities), community centres and meeting places (including places of worship, libraries), facilities for children, education facilities, healthcare facilities, service-orientated businesses (i.e. locally-based shops), and public transport facilities.

2.8.2 Historical

With reference to the Banbridge / Newry and Mourne Area Plan 2015, the origins of Newry can be traced to the founding of the Cistercian Abbey on high ground to the east of the Newry River in 1144. During the 18th Century, the Earl of Hillsborough planned a new town, located on the lower ground adjacent to the river. This period coincided with the Industrial Revolution and the development of the Newry Canal, built between 1731 and 1742. It was the first summit canal to be built in the British Isles. Built to link the Irish Sea with Lough Neagh, it allowed commercial success to thrive in Newry as trade through the port increased both locally and internationally. Principal industries around this time were linen, glassware and printing. Newry prospered and by 1777 was the fourth largest port in Ireland and the largest in the north of Ireland creating many wealthy merchants.

Low-lying marshland along the river and canal was drained and reclaimed. Housing and businesses were built and the town expanded. Industry flourished around the canal, with linen mills, breweries, saltworks, a sugar refinery and an iron foundry. Newry grew to become an international trading centre, trading with America, the Baltics, Poland, France and England. The commercial growth of the town increased its political influence. The arrival of the railways in 1849 and the development of the ship canal helped consolidate Newry's position as an industrial trading centre. However, it was increasingly being overshadowed by Belfast's dominance.

By 1881, the population of Newry had reached nearly 16,000. However, from the turn of the century until the 1960s there was a period of decline as the inland canal, the mills, the tram and the railways all declined in popularity. The town also suffered a long period of economic and social stagnation during the troubles post 1969. The 21st Century has heralded a new era of prosperity and confidence, and in 2002 Newry was granted city status. It is now the fourth largest city in Northern Ireland, with a population of 29,946 in 2011.

The most significant area of development potential lies in the south-western sector of the city, some of which has been constrained by overcapacity on the road network. Through traffic from the north and south passes through the city centre and traffic congestion occurs at peak periods.

2.8.3 Designations

A number of ecological and landscape designations are evident in the general study area, protected sites and areas at a local, national and international level. From a landscape perspective, these include the Ring of Gullion Area of Outstanding Natural Beauty (AONB) and Mourne AONB. From an ecological perspective, there are several parcels of long-established and ancient woodland, Sites of Local Nature Conservation Importance (SLNCI), Areas of Special Scientific Interest (ASSIs), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

2.8.4 Warrenpoint Port

Warrenpoint is a small town in County Down which lies on the northern shore of Carlingford Lough, which has its own port. The proximity of Warrenpoint Port brings trading benefits to Newry, increasing the links with markets both in Great Britain and Europe. Warrenpoint Port is situated in Warrenpoint on Carlingford Lough, to the south-east of the study area. It was originally built in the 1770's, and has been invested in and extended to create the modern port, which is operated by the Warrenpoint Harbour Authority. Due to continued investment over the years, coupled with its strategic location and close proximity to the A1/N1 Belfast-Dublin Corridor, it is the second largest freight port in Northern Ireland. A large percentage of lorry traffic to and from the port passes through Newry. A freight ferry service operates between Warrenpoint and Heysham Port in north-west England.

Figure 2.8.1 Cargo handling and Aerial Photography of Warrenpoint Port

2.8.5 Industry & Commerce

Newry and its wider hinterland (including Warrenpoint) currently have a broad base of manufacturing companies operating in the area. These range from large electrical companies such as Glen Dimplex (Glen Electric), and Scandinavian-controlled SCA Packaging Ltd, to Norbrook Laboratories Ltd (a large pharmaceutical manufacturing company that has achieved exceptional growth since its inception). Also in the area are Haldane Fisher, Newry (Murdock) Building Supplies, Anglo Beef Processors (ABP) Group, First Derivatives (software development company) and FM Environmental; this list is not exhaustive.

Tourism within the area is also a key industry, with a variety of places to stay and visit in the vicinity of Newry, including Rostrevor and Slieve Gullion forest parks, as well as a number of visitor centres, and historic sites. The scenic area is popular with walkers and campers, with annual walking festivals taking place in both the Mourne and Slieve Gullion areas. There are two main shopping centres in Newry, the Quays and Buttercrane which attract visitors both from Northern Ireland and the Republic of Ireland (particularly when the currency exchange rate is favourable).

2.9 Hydrology and Drainage

Information on watercourses is provided by Rivers Agency and classified as either "designated" or "undesignated" watercourses, with designated being maintained by Rivers Agency and undesignated maintained by individual landowners.

Newry River is a main regional designated watercourse with all route options impacting the wider catchment of the Newry River. The Newry River forms the border between County Armagh and County Down. It flows through Newry city centre and discharges into Carlingford Lough near Warrenpoint.

Newry Canal, another designated watercourse, flows from Victoria Lock to the River Bann in Portadown, at which point the River Bann flows on to Lough Neagh. Throughout Newry, there are a number of crossings of the Newry River/Canal with William Street Bridge the first encountered north of Albert Basin. Like all of the crossings, this is a fixed bridge which places limitations on the height of the vessel navigating under it.

The Blue Route options cross Benson's Glen and will require approval with the appropriate Statutory Bodies for the final design. This watercourse is however not designated by Rivers Agency.

The topography of the Study Area slopes downhill from the existing A1/N1 Belfast-Dublin Corridor at the western tie-in to the eastern tie-in on the A2 Warrenpoint Road, adjacent to the Newry River/Canal. As a result, a number of minor, undesignated watercourses are found along the slopes of Fathom Mountain which then discharge into Newry Canal or the estuarine section of Newry River.

2.10 Flood Risk

DfI Rivers Agency has produced a digital Strategic Flood Map for Northern Ireland which provides an overview of the flood risk throughout the country. The Newry River has an associated Q_{100} floodplain which encroaches into the study area as shown in Figure 2.10.1. This represents areas that in any year have a 1% Annual Exceedance Probability (AEP) of flooding from a river.

Figure 2.10.1 highlights the flood risk associated with Newry and in particular, Greenbank Industrial Estate and the mudflats further south. The fluvial flood impacts the Blue Route options at this location.

The map also provides information on areas likely to experience localised surface water flooding during extreme rainfall events (i.e. land naturally vulnerable to surface water or 'pluvial' flooding).

As the study area is also located close to Carlingford Lough, it is also located within a coastal [sea] Q_{200} floodplain, and thus vulnerable to sea surge as shown in Figure 2.10.2.

The Sea Flood Map provides an illustration of the approximate extent of the coastal floodplains which are the relatively flat areas of land around the shoreline subject to periodic coverage by the sea. The outlines of floodplains highlighted in the map identify areas that in any year have a 1-in-200 or greater chance (0.5% AEP) of flooding from the sea which corresponds to a level of approximately 3.67m AOD.

The Sea Flood Map highlights a vast area south of Greenbank susceptible to a sea surge; however, this would likely be contained within the mudflats of Newry River.

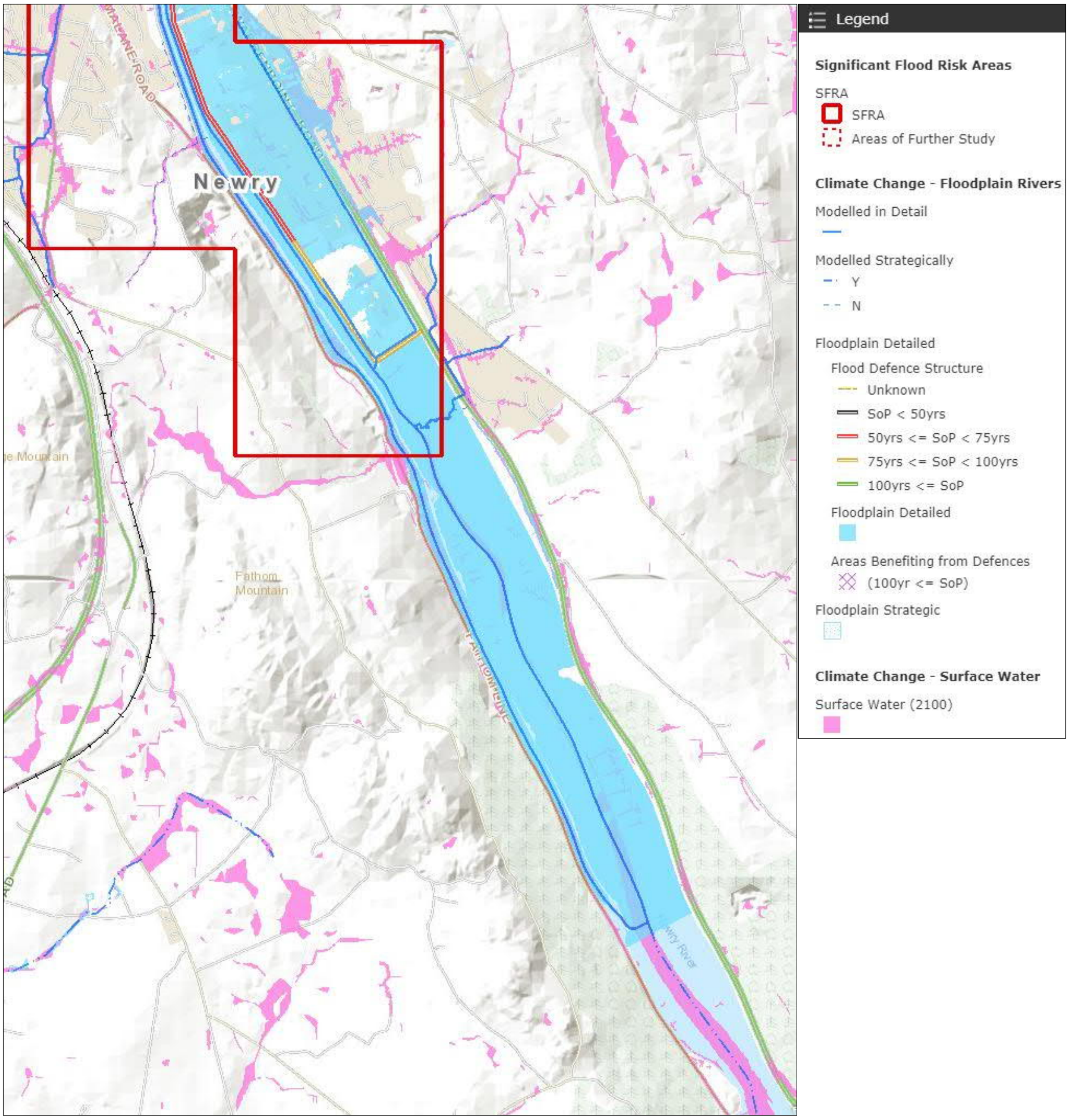


Figure 2.10.1 Q_{100} River and Surfaces Water Floodplain

Source: http://riversagency.maps.arcgis.com/

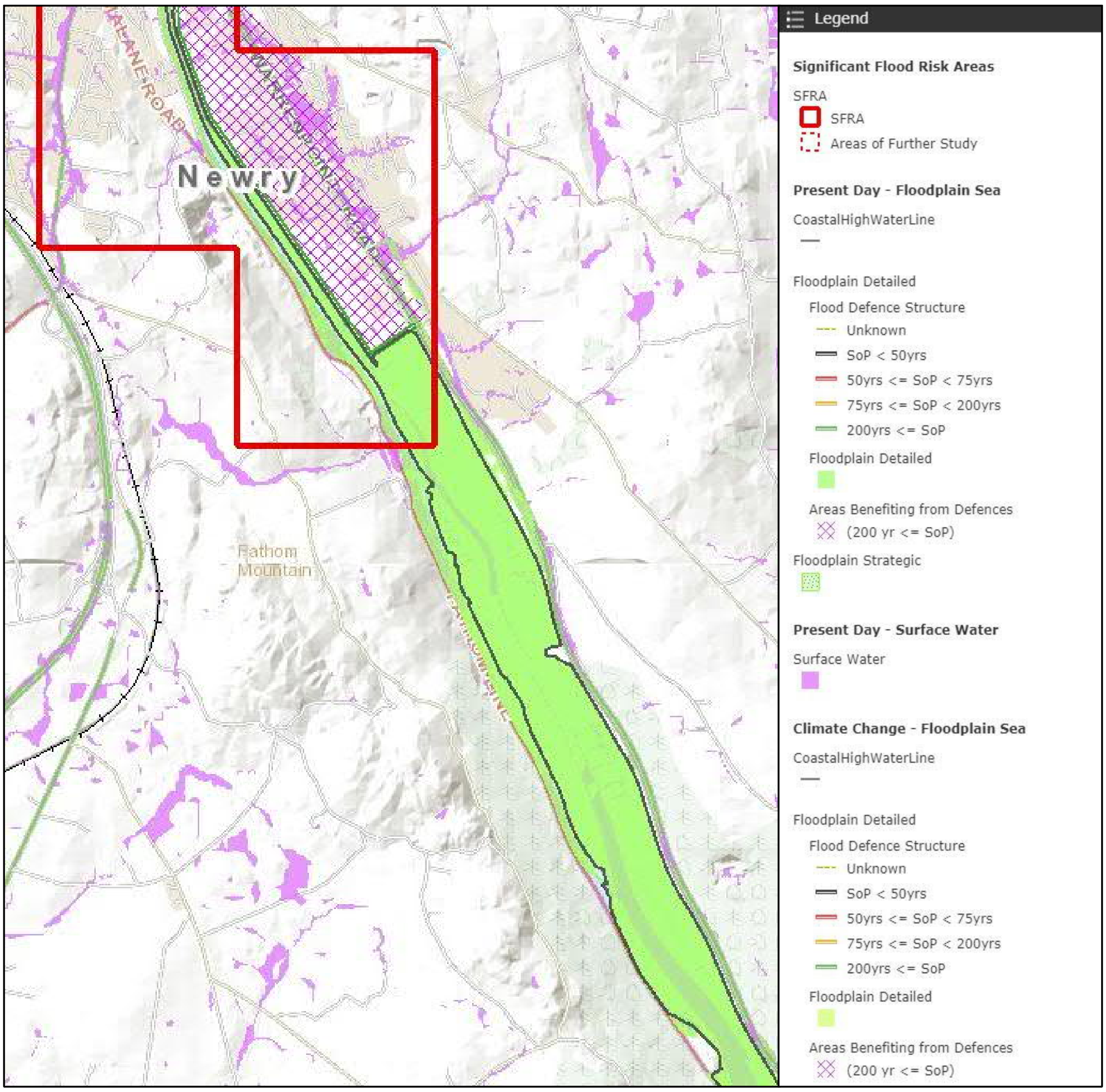


Figure 2.10.2 Q_{200} Sea Floodplain

Source: http://riversagency.maps.arcgis.com/

2.11 Geology

2.11.1 Drift Geology

Based on the 1:250,000 Quaternary Edition Geological Map for Northern Ireland; the study area is predominantly underlain by glacial till deposits. The glacial tills generally consist of clay and silty clay based boulder clay type deposits containing cobbles and boulders mainly of local bedrocks (greywacke sandstone and shale, granodiorite and various other igneous rocks) (Figure 2.10.3 in Appendix A). Much of the study area consists of steep to moderate slopes with rock relatively close to the surface. Consequently, rather than form the typical "drumlin" topography, the till is likely to be thin and form a thin carapace over parts of the bedrock. This is most notable on the slopes of Fathom Mountain around Fathom Forest, and on the slopes of Cloghogue Mountain.

Areas of rock at or near surface can be defined as rock being within 3 metres of existing ground level.

The quaternary mapping identifies areas of recent marine deposits along the line of the canal and Newry River, which comprise mainly estuarine clays with some sands and silts.

Early geological mapping (c. 1880) and subsequent ground investigations indicate that much of the floor of the Newry River valley is filled by a complex sequence of river alluvium, and estuarine alluvium deposits. These deposits, which in central parts of the valley can be in excess of 20 metres thick, consist of clays and silts, fine and coarse stratified sand & gravel with variable organic content including rootlets, shells and buried peat layers. These are underlain by glacial deposits, which may extend to depths of greater than 50 meters.

Made ground is anticipated at various locations within the study area, most obvious in the former railway embankments either side of the Newry River, existing road construction, and in backfilled excavations for example in former quarries. It is anticipated that there are areas of made ground and reclaimed fill associated with the suburbs of Newry, the Greenbank Industrial Estate and areas adjacent to the Newry River. Along the A1 and the Newry to Dublin railway corridor, areas of engineered fill are likely to be present.

Geological Survey Northern Ireland (GSNI) have confirmed that made ground or fill material can be expected to occur along parts of the flat-lying floor of the Newry River valley between Newry and where reclamation has taken place on the shore at the head of the Carlingford Lough. Various materials have been used to reclaim the former tidal mudflats.

2.11.2 Solid Geology

Based on the 1:250,000 Solid Edition Geological Map for Northern Ireland, the bedrock is predominately rocks belonging to the Gala & Hawick Group (Lower Palaeozoic Ordovician - Silurian), the Newry Granodiorite Complex and Slieve Gullion Complex (Palaeogene Intrusive Igneous) together with other minor intrusions.

The Gala and Hawick group have very similar characteristics and comprises mainly greywacke and shales but has various igneous intrusions of dolerite and basalt. They have been deformed and subjected to low-grade metamorphic alteration. The metamorphism and deformation has resulted in the formation of the folds, cleavages and joints, which now determine the physical characteristics of the rock and can lead to extreme local variability of hardness and strength.

GSNI has commented that the bedding, fold structures and related cleavage(s) in the Silurian rocks have broadly parallel orientations and are steeply inclined (70° - 80°) towards northwest and southeast. There may be some local deviation from this trend as a result of faulting or doming due to the position of the major igneous intrusions.

The Newry area is generally underlain by igneous intrusive granodiorites (both 2nd and 3rd phase), of the Newry Granodiorite Complex from the Devonian Period (Figure 2.10.4 in Appendix A). Postdating this, the granodiorites contain several Palaeogene micro gabbro dyke intrusions, including four underlying the Newry River, south of the Rampart.

A band of Palaeogene igneous intrusive felsite, part of the Slieve Gullion Complex, cuts through the granodiorites on the western flanks of the river valley, on the slopes of Fathom Mountain. The Slieve

Gullion Complex represents the 'root' zone of a now deeply eroded volcanic caldera that intruded the southwest end of the Caledonia Newry Igneous Complex.

Several major faults are displayed on available published mapping, shown in Figure 2.10.3. The Newry Fault, trends north to south down towards the Carlingford Lough. Additionally, there are several minor faults trending locally N-S and ENE-WSW. Other unmapped fault lines are likely to be present in the vicinity.

Several major faults are recorded on available geological field slips. The Newry Fault is the dominant fault line in the site area, and trends north to south aligned centrally through Carlingford Lough. Additionally, there are several minor faults trending locally N-S and ENE-WSW and dipping steeply to the NE and NNE.

Surveying carried out by GSNI in 2016 records a potential fault zone on the western backwall of the quarry. This has been described as the likely contact between granodiorite and greywacke. This area of the quarry is considered to be 'very high risk' due to the potential for landslide and rock fall.

Fault gouge and breccia has also been observed locally within granodiorite to the east of the quarry, within 100m of the Newry River.

2.11.3 Mining & Quarrying

Records of current quarry mining information for the study area were accessed from BGS – "The Directory of Mines and Quarries, dated 2014". Two quarries, Drumalane and Bigwood, have been identified in the Corridor options Study Area as shown in Figure 2.10.3 in Appendix A. Bigwood Quarry is still known to be in operation but it is understood that Drumalane is no longer being used for the extraction of materials.

Drumalane Quarry is sited within the study area on the western side of the Newry River/Canal banks and is accessed off the B79 Fathom Line. The quarry is in excess of 90 metres deep with steep and vertical faces towards the western extents of the operations. The site was opencast for the extraction of greywackes used as road construction aggregates and building materials along with the site housing a ready mix concrete depot.

The quarry is now a major obstacle within the western part of the study area. Material extraction methods and extents have disturbed ground surrounding the quarry causing subsidence and slippage which has resulted in a section of Hillhead Road that runs along the top of the quarry being closed and has not reopened. There is also evidence of some movements in the land to the west of Hillhead Road. The quarry's position within the study area means that it will affect various corridors. Bigwood Quarry is also a licensed mineral extraction area and is located off the A2 Warrenpoint Road, within the Narrow Water Forest area. It is not considered that the quarry will affect the route corridors under consideration; however, any junction arrangements to be constructed on the A2 Warrenpoint Road should consider the proximity of the Bigwood Quarry access to minimise any impact with traffic emerging/diverging from the quarry.

In addition to Drumalane and Bigwood, a number of historical quarries were identified on the NIEA Historic Land Use Layer that lies within the Corridor Options Study Area. One of these is points coincides with quarrying operations at Drumalane Quarry.

2.11.4 Geomorphology

The Newry River Valley consists of a steep sided glacial valley, and all route options are required to traverse similar side long sloping ground up the western side of the valley in order to climb to the level of the A1 Dublin Road.

The spur of Fathom Mountain extends northwards and the route options are generally aligned to the north of this.

2.12 Public Utilities

There are numerous services and utilities crossing the study area that may act as constraints upon any potential route option. These include sewers, water mains, BT and Northern Ireland Electricity

(NIE) installations. There are also services (electricity, sewerage, cable, water etc.) associated with the individual properties within the corridors and these will need to be protected or diverted as appropriate when construction commences. In particular at Greenbank Industrial Estate and Flagstaff Road, both NIW and NIE have major items of mains equipment in the ground.

Locations of existing services and utilities are indicated on Figures 4.6.1 to 4.6.4 in Appendix A.

2.12.1 Northern Ireland Electricity

Due to the generally rural nature of the land, the density of utilities infrastructure is limited, particularly to the south of the study area. However, a number of high-voltage NIE lines located within or close to Greenbank Industrial Estate and Flagstaff Road, including 11kV services, 33kV services and MV services, shown in Figure 4.6.1 in Appendix A. A summary of the most relevant equipment is provided below:

- 33kV cable runs along Barracric Road and continues in a south-westerly direction towards Ellisholding Junction and the Belfast/Dublin Railway line;
- 11kV cable has multiple crossing of the A1/N1 Dual Carriageway between Cloghogue Roundabout and Ellisholding Junction before following close to Brogies Road;
- 11kV cable crosses Flagstaff road twice before running to the west of and parallel to the road;
- 11kV cable runs along the western face of Greenbank Industrial Estate; and
- a number of MV supplies feed off the 11kV services and into local dwellings.

2.12.2 British Telecom

BT has a number of apparatus in the study area including:

- Underground and overhead cables along Fathom Line;
- underground cables along lengths of the A2 Warrenpoint Road;
- overhead cables along Barracric Road and Flagstaff Road; and
- underground Cables along Brogies Road in the vicinity of Ellisholding Junction.

2.12.3 Northern Ireland Water

The NI water plant within the area is highlighted in Figure 4.6.2 and summarised below:

- Watermains, foul and storm sewers are situated along the eastern face of Greenbank Industrial Estate and along the A2 Warrenpoint Road; and
- watermains along Fathom Line, Flagstaff Road, Barracric Road and Brogies Road.

2.12.4 Firmus Gas

Firmus gas has some utilities in the area that include:

- Medium Pressure Distribution Pipe along the A2 Warrenpoint Road which serves Greenbank Industrial Estate via the Rampart Road.

2.12.5 Street Lighting

Street lighting is found on the A2 Warrenpoint Road in the central reserve on the approach to Greenbank Roundabout. Greenbank Industrial Estate is illuminated throughout by street lighting either side of the minor roads. The approach to Ellisholding Junction from the old Dublin Road is also lit, as is Ellisholding Junction itself. Most of the minor roads within the study area do not have any street lighting provision due to their rural nature and minor traffic flows.

3. Description of the Scheme and Review of Previous Work

3.1 Introduction

This chapter provides an overview to the Stage 1 Scheme Assessment, from which two Corridors were selected. It also discusses the route options assessed within subsequent chapters of this report.

3.2 Review of Stage 1 Scheme Assessment

The Stage 1 Project Brief outlined the requirement to identify the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated within the broadly defined area of interest to assist DfI in identifying a preferred improvement strategy, which would satisfy the key objectives as outlined in Section 1.7. The Stage 1 Scheme Assessment developed and assessed five potential route corridors; numbered Corridor 1 to Corridor 5 as shown on Figure 3.2.1 below.

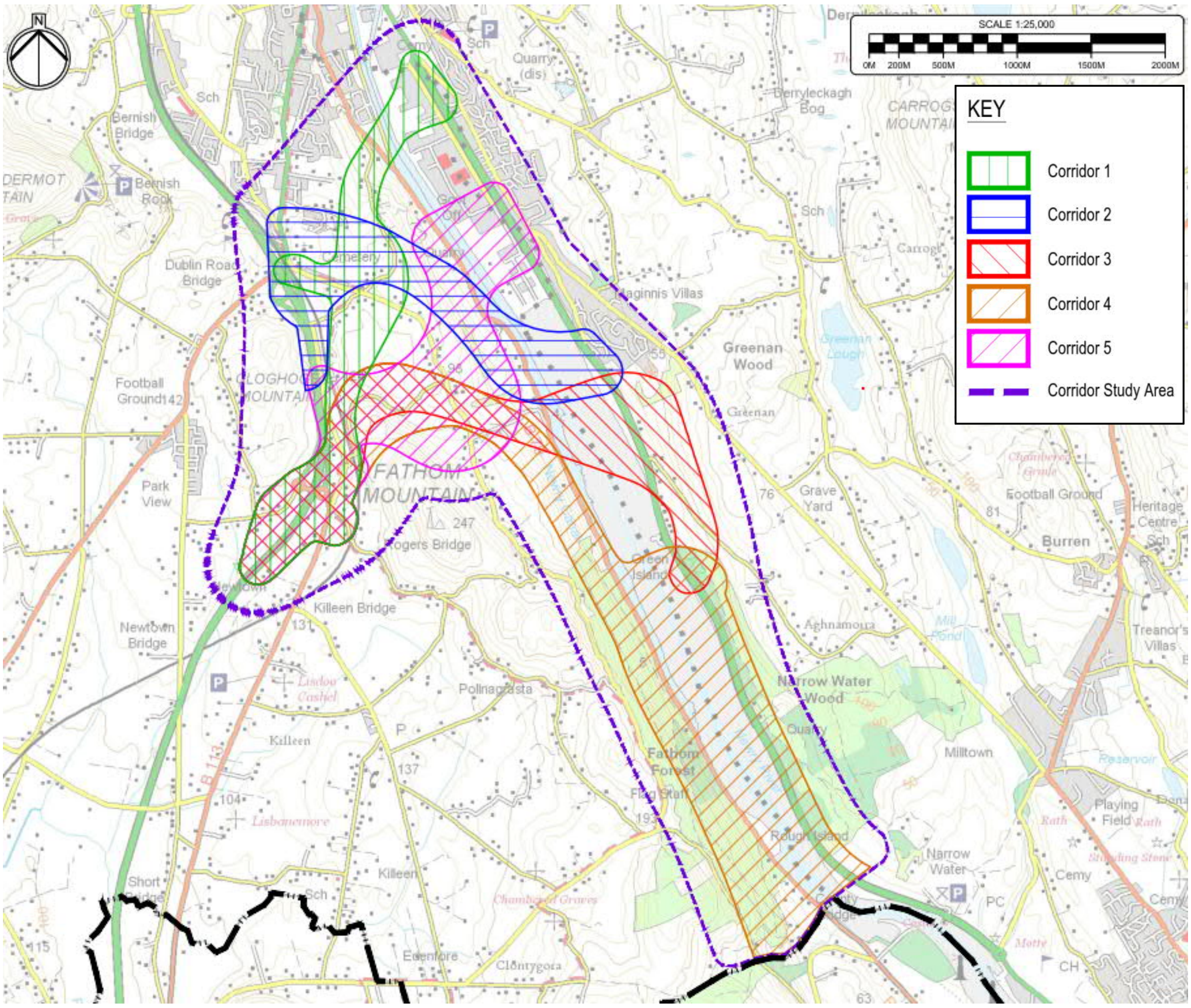


Figure 3.2.1 Corridor options considered at Stage 1

3.2.1 Preferred Route Corridors

The Stage 1 Scheme Assessment determined that two of the corridors; Corridors 1 and 2; both passed through an area which was considered to be geologically unstable and were therefore discounted from further assessment. Similarly, Corridor 3 was discounted - it did have the potential to provide an iconic landmark structure; however, it had the highest cost estimate of £137M and would result in major visual impact.

The Stage 1 Scheme Assessment Report concluded that Corridor 5 would provide the best opportunity for a sustainable solution; however, given the limited alignment scope within this corridor, it was determined that Corridor 4 should also be taken forward to the Stage 2 Scheme Assessment due to the range of route options available within.

3.3 Development of Options at Stage 2

Having identified two potential corridors, the purpose of the Stage 2 Scheme Assessment is to identify a preferred route alignment that will best meet the objectives of the brief.

The Stage 2 Assessment includes the following:

- Identification and assessment of potential route alignment options;
- identification of potential junction locations where it would be suitable to connect alignment options into the existing road network on the A1/N1 Dual Carriageway to the west and the A2 Warrenpoint Road to the east;
- assessment of preferred junction type and geometry at the junction locations; and
- assessment of preferred carriageway cross-section.

3.3.1 Major Alignment Constraints

The study area, as formerly described, has several constraints which affect the alignment of the route options. The major constraints affecting the route options fall into a number of natural and manmade categories as follows:

- The city environment of Newry;
- the mountainous topography of the land;
- the Newry River/Canal;
- the numerous individual properties including residential, agricultural and commercial;
- the Banbridge/Newry and Mourne Area Plan 2015;
- the existing local road network; and
- the numerous services and service mains.

3.4 Development of Alignment Options

With the aim of identifying a preferred alignment, the indicative alignment options as presented within the Stage 1 Scheme Assessment were further developed and refined through an iterative process. These alignments all focused on linking the A2 Warrenpoint Road to the A1/N1 Dual Carriageway whilst remaining within the recommended route Corridors 4 and 5 as defined within the Stage 1 Scheme Assessment Report.

As part of the Stage 2 Scheme Assessment, these alignments have been assigned colours and will be referred to as such within any subsequent chapters of this report.

For clarity of reporting, Table 3.4.1 below details both the Corridors recommended for Stage 2 Assessment and their associated alignment naming.

Table 3.4.1 Route Alignment Options

Stage 1 Corridor Number	Stage 2 Route Alignment Name	Associated Figure Reference
Corridor 4	Red Route	Figure 3.5.1
Corridor 4	Yellow Route	Figure 3.5.2
Corridor 5	Blue Route Option 1	Figure 3.5.3
Corridor 5	Blue Route Option 2	Figure 3.5.4
Corridor 5	Blue Route Option 3	Figure 3.5.5

The Red Route, Yellow Route and Blue Route Option 1 are the three indicative alignments that were presented within the Stage 1 Scheme Assessment Report. Further investigation and development of the Blue Route led to the introduction of two new alignments; Blue Route Option 2 and the Blue Route Option 3.

3.5 Detailed Descriptions

The following sections will provide detailed descriptions of the 5 options listed in Table 3.4.1 in terms of mainline alignment, junction arrangement and the interface with other features such as minor roads and accommodation lanes. It should be noted that further details on the engineering geometry, earthworks and structures is provided within the Engineering Assessment in Section of this report.

3.5.1 Red Route

The Red Route is identified on Figure 3.5.1 in Appendix A and is one of two indicative alignments which were presented at Stage 1 within Corridor 4.

3.5.1.1 Newry River/Canal Crossing

The Red Route starts from a new at-grade roundabout on the A2 Warrenpoint Road dual carriageway. The alignment then crosses the Newry River/Canal in a westerly direction to a location approximately 0.60km upstream of Victoria lock by means of a single carriageway bridge. The bridge would be relatively low, with a clearance of approximately 6m between the canal water level and bridge soffit level. Consequently, an opening structure over the canal would be required. The alignment would gently rise as it crosses the Newry River/Canal to tie into another proposed at-grade roundabout adjacent to the B79 Fathom Line.

3.5.1.2 Proposed Alignment

Following the bridge crossing, the alignment travels in a northerly direction through the slopes of the valley for approximately 1.5km before veering north-west and subsequently crossing Flagstaff Hill, Flagstaff Road and Barracric Road.

The alignment then begins to deviate towards the south-west where it crosses the Belfast-Dublin Railway Line which runs parallel to the A1/N1 Belfast-Dublin Corridor near Ellisholding Junction. An under-bridge is proposed for this crossing where a substantial bridge length would be required due to the skew angle at the intersection.

The alignment would then tie into the A1/N1 Belfast-Dublin Corridor at the existing Ellisholding Junction. The proposal would involve tying into a relocated roundabout to the east of Ellisholding Junction. Minor realignment of the various side roads surrounding the junction would be required in order to connect into the proposed new roundabout. Two new south-facing slip roads would be provided to ensure Ellisholding becomes a full movement grade-separated junction.

3.5.1.3 Side Road Works

The Red Route crosses a number of minor side roads (namely Flagstaff Hill, Flagstaff Road and Barracric Road) as well as a number of minor accommodation and farm access roads where additional side road works may be required.

At this stage, it is envisaged that both Flagstaff Hill and Barracric Road would be stopped up, with alternative access points provided from the B79 Fathom Line and Flagstaff Road respectively.

An overbridge will maintain traffic movements along Flagstaff Road. However, it is expected that Flagstaff Road will carry substantially more traffic than the other minor side roads crossed, and therefore it is likely that significant upgrade works would be required.

3.5.2 Yellow Route

The Yellow Route is the second indicative alignment presented at Stage 1 within Corridor 4 and is shown on Figure 3.5.2 in Appendix A.

3.5.2.1 Newry River/Canal Crossing

Similar to the Red Route, the Yellow Route starts from a new at-grade roundabout on the A2 Warrenpoint Road dual carriageway and crosses the Newry River in a westerly direction towards Rough Island, which is approximately 1.0km downstream from the Victoria lock. This location is at a natural local narrowing of the river channel, and with no canal to cross, provides a shorter crossing point compared to the Red Route. This will provide significant savings in relation to the main structure cost which would again include an opening section. The alignment rises approximately 3.2m over the crossing before tying into a proposed at-grade roundabout on the B79 Fathom Line.

3.5.2.2 Proposed Alignment

Upon crossing Newry River, the alignment travels along the existing B79 Fathom Line for 1.8km before tying into a new roundabout which would provide a link between the relief road and Fathom Line. This would require widening and minor realignment of Fathom Line in order to comply with current DMRB standards.

At this point, the alignment follows a similar path to that of the Red Route with minor variations in vertical alignment before tying into Ellisholding Junction.

3.5.2.3 Side Road Works

The anticipated side road works for the Yellow Route are principally the same as those discussed for the Red Route.

3.5.3 Blue Routes

Due to the challenges of steep topography and environmental designations associated with the Blue Route (Corridor 5 at DMRB Stage 1), two alignment variants were developed of this route during the DMRB Stage 2 process to optimise the earthwork balance and minimise impact on Benson's Glen. Initial assessment of these variants identified significant variation in; the alignments required both horizontally and vertically; the consequential earthworks balance; and the associated cost estimates.

It was therefore decided to present the assessment of these variants as route options in the DMRB Stage 2 assessment process to provide visibility of the sensitivity in achieving:

- a reasonable vertical gradient for the alignment;
- an acceptable earthworks balance; and
- a limited impact on environmentally sensitive areas and existing residential properties.

Blue Route Option 1 achieves a better earthworks balance and adopts a gradient of 6%. However, it impacts on SLNCIs and areas of Long-Established Woodland, including Benson's Glen.

Blue Route Option 2 adopts a gradient of 6% and minimises the impact on the SLNCIs and areas of Long-Established Woodland. However, the topography of the revised horizontal alignment requires a significant volume of imported fill material to achieve the desired vertical profile. This has the consequential impact of a higher scheme cost estimate.

Blue Route Option 3 is on the same horizontal alignment as Blue Route Option 2 and similarly minimises the impact on SLNCIs and areas of Long-Established Woodland. The vertical alignment has been amended in an attempt to optimise the earthworks and reduce the amount of imported fill associated with Option 2. However, to achieve this better balance, the vertical gradient has been increased to 8% over 375m, following a 950m length of 5.5%.

Due to the limited buffer width of the Red and Yellow route options, and the extensive designations and steep topography associated with them, there would be no significant difference in the assessment of alignment variants of these options. Therefore, it was not deemed necessary to investigate further variants for the Red or Yellow routes.

3.5.4 Blue Route Option 1

As noted previously, Blue Route Option 1 is the indicative alignment developed within the Stage 1 Scheme Assessment Report for Corridor 5. However, the alignment has since been developed with the single carriageway link road from the A2 Warrenpoint Road and the bridge structure across the Newry River/Canal being realigned further south. This softens the impact on Greenbank Industrial Estate by reducing the number of facilities that are directly affected. Previously, the alignment directly impacted upon both Murdock Builder's Merchants and Gerry Brown Park; however this new alignment will now mitigate any significant impacts placed upon Murdock Builder's Merchants. Although different alignment options have been considered with an attempt to avoid impacting upon Gerry Brown Park, this alignment will result in its loss.

Blue Route Option 1 is identified on Figure 3.5.3 in Appendix A.

3.5.4.1 Newry River/Canal Crossing

Blue Route Option 1 commences from a new at-grade roundabout in the locality of the Greenbank Industrial Estate approximately 1.3km from the existing Greenbank Roundabout. From here, a single carriageway link road travels west across Gerry Brown Park before tying into a bridge structure which crosses not only the Newry River and Canal, but also spans across the existing B79 Fathom Line on the western side of the river.

The bridge structure then ties into another new at-grade roundabout and provides a direct link to the existing B79 Fathom Line. As this alignment proposes two new roundabout junctions at each side of Newry River/Canal, the alignment is able to cross perpendicular to the river and so reduces the length of bridge required.

This route option, unlike the Red and Yellow Routes, does not cross the flood plain mud flats which therefore reduces the potential environmental impact during construction and the need for temporary works. However, this route option is within an area of reclaimed flood plain and so poor ground conditions are to be expected.

The clearance achieved between the canal water level and bridge soffit level is in the region of 12.2m. Similar to the Red and Yellow Routes, it also has the capacity to contain an opening structure, if required.

3.5.4.2 Proposed Alignment

Following the river and canal crossing, the alignment travels in a south-easterly direction for approximately 0.48km before transitioning into a right-hand curved radius in order to traverse the difficult topography. Although the alignment would avoid direct contact with the most northerly section of an area of long-established woodland, it would have a direct impact on a limited area of SLNCI and long-established woodland to the south which would result in the loss of trees and severance of the sites. As the alignment continues, it crosses the existing Flagstaff Road before transitioning into a left-hand curved radius. The alignment then crosses both the existing Barracric Road and the Belfast-Dublin Railway Line before terminating at a new roundabout on the old Dublin Road. The alignment then follows the old Dublin Road until it ties in at Ellisholding Junction with the same arrangement as described for both the Red and Yellow Routes. Upgrading works will be required for the old Dublin Road to bring it up to current DMRB standards.

3.5.4.3 Side Road Works

Blue Route Option 1 is similar to both the Red and Yellow Routes in that it crosses the B79 Fathom Line, Flagstaff Road, Barracric Road and the Belfast-Dublin Railway Line, albeit at different locations.

This route option allows for a direct link from the relief road to the B79 Fathom Line by means of a connector road from the new roundabout located adjacent to Fathom Line. Furthermore, an overbridge is proposed to maintain traffic along Flagstaff Road.

It is anticipated that Barracric Road as well as other minor roads/accommodation lanes will either be stopped up, or alternative means of access will be provided.

The railway overbridge would have a 0° skew angle, therefore crossing perpendicular to the railway line. This would reduce the total construction cost compared to the Red and Yellow Routes which contain a more skewed crossing.

3.5.5 Blue Route Option 2

As noted within Section 3.5.3, Blue Route Option 1 would impact upon an area of long-established woodland and a SLNCI. As a result, Blue Route Option 2 was developed to reduce direct impact upon these sites. Blue Route Option 2 is shown on Figure 3.5.4 in Appendix A.

3.5.5.1 Newry River/Canal Crossing

The proposals for the two new roundabouts each side of the Newry River and the crossing itself remain the same as per that discussed in Section 3.5.3 relating to Blue Route Option 1 where the crossing has been realigned further south.

3.5.5.2 Proposed Alignment

In order to reduce the impact upon the long-established woodland and SLNCI, the initial uphill climbing section of the alignment after exiting the roundabout was moved slightly east. The alignment travels straight for approximately 0.4km before transitioning into a right-hand curved radius. Similar to Blue Route Option 1, the alignment then continues to follow the topography of the area, climbing through the natural valley and crossing both Flagstaff and Barracric Road, before transitioning into a left-hand curved radius and connecting to the new roundabout on the old Dublin Road approximately 60m further south than that of Blue Route Option 1. This junction location on the old Dublin Road was moved further south in order to provide a more balanced cut/fill ratio, thus reducing the cost associated with earthworks and imported fill in particular.

3.5.5.3 Side Road Works

The side road works required for this option are largely similar to that of Blue Route Option 1, as the alignment crosses the B79 Fathom Line, Flagstaff Road, Barracric Road and the Belfast-Dublin Railway Line.

The crossing of the B79 Fathom Line would be exactly as per that discussed for Blue Route Option 1 and the same direct link would be provided from the new roundabout. However, due to the new crossing point at Flagstaff Road, the existing road would need to be raised considerably in order to accommodate an overbridge. This would also result in significant disruption to at least one property through loss of land and potential relocation of access.

The alignment crosses the Belfast-Dublin Railway Line approximately 60m further south than that of Blue Route Option 1; however it still maintains a 0° skew angle at its crossing.

As with all the other options, it is anticipated that Barracric Road and other accommodation lanes will either be stopped up or alternative means of access will be provided.

3.5.6 Blue Route Option 3

A third Blue Route option has been developed which accommodates both the long-established woodland and SLNCI, whilst providing a more balanced cut/fill ratio. Blue Route Option 3 is shown on Figure 3.5.5 in Appendix A.

3.5.6.1 Newry River/Canal Crossing

The proposals for the two new roundabouts either side of the Newry River and the crossing itself remain the same as per that of Blue Route Option 1 and Blue Route Option 2 where the crossing has been realigned further south.

3.5.6.2 Proposed Alignment

The horizontal alignment for this option is as per Blue Route Option 2, however in order to provide a more balanced earthworks cut/fill ratio, an 8% gradient has been utilised over a 375m stretch. This allows for a longer, more gradual initial climb, resulting in less fill, before increasing quickly to 8% in order to follow the topography and achieve sufficient clearance over the railway line. TD 9/93 states that *'gradients steeper than 8% shall be considered as Departures from Standard.'*

3.5.6.3 Side Road Works

The side road works required for this option are largely similar to that of Blue Route Option 2 with the exception of the crossing of Flagstaff Road. Due to the increased gradient of the uphill climbing section, there are no anticipated issues with achieving sufficient clearance to provide an overbridge.

3.6 Cost Estimates

Cost estimates have been prepared for each alignment option for use in the Economic Assessment. Only estimations of cost can be made at this stage, however it will allow for a meaningful comparison of the alignment options. The cost estimates were developed using Spon's Civil Engineering and Highway Works Price Book 2018 as a reference. This section reports on costs associated with each alignment option, and will cover the following:

- Roadworks costs;
- alignment Earthworks costs;
- alignment Landscaping and Ecology costs;
- alignment Structures costs;
- construction Costs; and
- land and Property Costs.

3.6.1 Roadworks

Roadworks construction costs were based on the total area of pavement construction (allowing for the provision of a 2.5m footway/cycle way to either side if required) and linear length for ancillary items that are required for a road construction project.

In relation to the cost estimate, the carriageway cross sections utilised for all 5 alignment options, vary between a S2 carriageway and a Wide Single Carriageway Climbing Lane Section which is used for the uphill extents.

Ancillary costs in addition to the pavement works include allowances for the following:

- Demolition and Site Clearance Works;
- Permanent Fencing, Safety Fencing, Barriers and Rails;
- Drainage and Service Ducts;
- Kerbs, Footways and Paved Areas;
- Traffic Signs and Road Markings;
- Road Lighting Columns and Brackets, Closed-circuit television (CCTV) Masts and Cantilever Masts; and
- Electrical Work for Road Lighting and Traffic Signs.

Table 3.6.1 Roadworks Costs

Route Option	New Pavement Construction	Ancillary Works	Total
Red Route	£8,802,590	£5,455,597	£14,258,187
Yellow Route	£10,670,799	£5,738,215	£16,409,014

Blue Route Option 1	£6,983,348	£4,606,063	£11,589,411
Blue Route Option 2	£6,753,418	£4,496,208	£11,249,626
Blue Route Option 3	£6,268,618	£4,488,367	£10,756,985

3.6.2 Earthworks

The earthworks of a scheme such as this contribute significantly to the overall cost estimate. The earthworks were derived from the three dimensional Bentley MX Model which was used to create all five approved alignment options.

It should be noted that these profiles are based on preliminary ground contour information and it is anticipated that the option identified to be taken forward to Stage 3 Assessment will be subject to design development following receipt of more accurate topographical information. The percentage of cut reusable as fill varies for each route option based on the available geotechnical information.

The earthworks rates from Spon's are indicated in Table 3.6.2. These rates were adopted and applied to bulk quantities extracted from the MX model for each alignment. All costs below assume earthworks cuttings are to be 1:1 slopes, and embankments vary between 1:2 and 1:2.5 slopes.

Table 3.6.2 Spon's Earthworks Rates

Item	SPON'S Rate (£/m^3)
Excavation of Acceptable Material	3.47
Deposition of Acceptable Material	1.43
Disposal of Acceptable Material	4.52
Imported Material (incl. tax)	25.36
Compaction of Material	0.77

By applying the rates noted in Table 3.6.2 to each of the alignment options, the costs presented in Table 3.6.3 were calculated.

Table 3.6.3 Earthworks Costs

Route Option	Excavation of material	Deposition / Disposal	Import of Material	Compaction of fill	Rock Treatment	Total
Red Route	£3,796,170	£984,043	£5,921,569	£692,589	£440,078	£11,834,449
Yellow Route	£5,023,756	£1,302,258	£10,652,748	£1,069,807	£588,157	£18,636,726
Blue Route Option 1	£3,279,404	£850,087	£4,848,003	£583,753	£276,457	£9,837,704
Blue Route Option 2	£2,101,068	£544,639	£19,115,860	£1,245,199	£252,353	£23,259,119
Blue Route Option 3	£3,519,779	£912,397	£8,353,836	£797,979	£288,654	£13,872,645

3.6.3 Landscape and Ecology

Landscaping and ecology costs were applied to non-carriageway areas and allowed for the following:

- Grass seeding;
- Topsoil (assumed 150mm thick – storing, preparing and handling); and
- Planting.

The anticipated costs for each alignment are shown below in Table 3.6.4.

Table 3.6.4 Landscape and Ecology Costs

Route Option	Grass Seeding	Topsoil	Planting	Total
Red Route	£5,870	£360,883	£324,643	£691,396
Yellow Route	£9,486	£583,181	£524,619	£1,117,286
Blue Route Option 1	£5,348	£328,776	£295,761	£629,885
Blue Route Option 2	£7,737	£475,681	£427,914	£911,332
Blue Route Option 3	£5,896	£362,456	£326,059	£694,411

3.6.4 Structures

The various route options require structures where the mainline crosses the existing Newry River/Canal and a number of existing roads. Two bridge options for the Blue Route River/Canal crossings have been investigated with Blue Route Option 1, Blue Route Option 2 and Blue Route Option 3 utilising a fixed bridge crossing the canal. Blue Route Option 1A, 2A and 3A represent the cost associated with an opening Bascule Bridge crossing the canal. The total structures costs for each route option are shown below in Table 3.6.5.

Table 3.6.5 Structures Costs

Route Option	Newry River/Canal Bridge	Railway Crossing	Flagstaff Road Overbridge	Ellisholding Accommodation Overbridge	Foundations	Structures Total
Red Route	£28,549,800	£2,240,000	£602,000	£602,000	£7,137,450	£39,131,250
Yellow Route	£16,036,600	£2,176,000	£644,000	£602,000	£3,909,150	£23,367,750
Blue Route Option 1	£3,978,000	£576,000	£658,000	£602,000	£994,500	£6,808,500
Blue Route Option 1A	£22,429,800	£576,000	£658,000	£602,000	£994,500	£25,260,300
Blue Route Option 2	£3,978,000	£576,000	£406,000	£602,000	£994,500	£6,556,500
Blue Route Option 2A	£22,429,800	£576,000	£406,000	£602,000	£994,500	£25,008,300
Blue Route Option 3	£3,978,000	£576,000	£658,000	£602,000	£994,500	£6,808,500
Blue Route Option 3A	£22,429,800	£576,000	£658,000	£602,000	£994,500	£25,260,300

3.6.5 Civils Cost

Each of the individual construction elements presented above can now be combined to determine the total cost of the civil engineering element of the scheme. In order to establish the appropriate price level for the projects location, with reference to Spon's Civil Engineering and Highway Works Price Book 2018, a regional variation factor of 0.75 has been applied to the total civils cost.

Table 3.6.6 Total Civils Cost

Route Option	Roadworks	Earthworks	Landscape & Ecology	Structures	Total (Including Regional Variation factor of 0.75)
Red Route	£14,258,187	£11,834,449	£691,396	£39,131,250	£49,436,462
Yellow Route	£16,409,014	£18,636,726	£1,117,286	£23,367,750	£44,648,082

Blue Route Option 1	£11,589,411	£9,837,704	£629,885	£6,808,500	£21,649,125
Blue Route Option 1A	£11,589,411	£9,837,704	£629,885	£25,260,300	£35,487,975
Blue Route Option 2	£11,249,626	£23,259,119	£911,332	£6,556,500	£31,482,433
Blue Route Option 2A	£11,249,626	£23,259,119	£911,332	£25,008,300	£45,321,283
Blue Route Option 3	£10,756,985	£13,872,645	£694,411	£6,808,500	£24,099,406
Blue Route Option 3A	£10,756,985	£13,872,645	£694,411	£25,260,300	£37,938,256

3.6.6 Land and Property Costs

The costs for land and property are based upon recent experience. However, at this early stage it is difficult to make accurate estimates. Therefore, the costs shown below may be subject to change during the Stage 3 Assessment, when more detailed information is received.

Table 3.6.7 Land and Property Costs

Route Option	Land and Property Costs	Land Risk Allowance	Total Land and Property Cost
Red Route	£1,112,659	£132,500	£1,245,159
Yellow Route	£1,390,522	£132,500	£1,523,022
Blue Route Option 1	£893,372	£132,500	£1,025,872
Blue Route Option 2	£907,863	£132,500	£1,040,363
Blue Route Option 3	£881,426	£132,500	£1,013,926

3.6.7 Construction Costs

As the route options are still in a relatively early design stage, accurate estimates as to the construction costs are difficult and subsequent detailed estimates may vary. Based on historical information of construction projects of similar size and nature, an estimate has been made for the preliminaries during the construction period and has been included as 15% of the total civils cost.

Table 3.6.8 Construction Costs

Route Option	Civils Cost	Preliminaries (15%)	Construction Cost	Construction Risk Allowance	Total Construction Cost
Red Route	£49,436,462	£7,415,469	£56,851,931	£14,886,667	£71,738,598
Yellow Route	£44,648,082	£6,697,212	£51,345,294	£14,886,667	£66,231,961
Blue Route Option 1	£21,649,125	£3,247,369	£24,896,494	£9,401,744	£34,298,238
Blue Route Option 1A	£35,487,975	£5,323,196	£40,811,171	£9,401,744	£50,212,915
Blue Route Option 2	£31,482,433	£4,722,365	£36,204,798	£9,401,744	£45,606,542
Blue Route Option 2A	£45,321,283	£6,798,192	£52,119,475	£9,401,744	£61,521,219
Blue Route Option 3	£24,099,406	£3,614,911	£27,714,317	£9,401,744	£37,116,061

Blue Route Option 3A	£37,938,256	£5,690,738	£43,628,994	£9,401,744	£53,030,738

Furthermore, additional factors of 9% and 5% have been included for the design preparation and construction supervision respectively, as advised within the DMRB for this stage of scheme preparation.

Table 3.6.9 Scheme Cost (before application of Optimism Bias)

Route Option	Total Construction Cost	Total Land Cost	Total Construction & Land Cost	Preparation (9%)	Supervision (5%)	Scheme Cost
Red Route	£71,738,598	£1,245,159	£72,983,757	£6,568,538	£3,649,188	£83,201,483
Yellow Route	£66,231,961	£1,523,022	£67,754,983	£6,097,948	£3,387,749	£77,240,681
Blue Route Option 1	£34,298,238	£1,025,872	£35,324,110	£3,179,170	£1,766,205	£40,269,485
Blue Route Option 1A	£50,212,915	£1,025,872	£51,238,787	£4,611,491	£2,561,939	£58,412,217
Blue Route Option 2	£45,606,542	£1,040,363	£46,646,905	£4,198,221	£2,332,345	£53,177,471
Blue Route Option 2A	£61,521,219	£1,040,363	£62,561,582	£5,630,542	£3,128,079	£71,320,204
Blue Route Option 3	£37,116,061	£1,013,926	£38,129,987	£3,431,699	£1,906,499	£43,468,185
Blue Route Option 3A	£53,030,738	£1,013,926	£54,044,664	£4,864,020	£2,702,233	£61,610,917

3.6.8 Total Scheme Cost

H.M. Treasury's New Green Book on Appraisal and Evaluation in Central Government recognises that there is a tendency for all projects to be overly optimistic. The Green Book aims to ensure that at the Outline Business Case Stage, a better estimate is made of the capital cost that will eventually be incurred. To mitigate optimism, the Green Book recommends that uplifts should be applied to estimates so that earlier on in the appraisal process, decision-makers have a more realistic idea of the likely out-turn cost of the project. As the project develops, the scope becomes more defined and specific project risks are identified, the level of Optimism Bias can be reduced.

A high Optimism Bias is added where investors require a high degree of certainty that cost over-runs will not occur. A lesser optimism bias can be added where investors are funding a large number of projects and where savings (or under-runs) cost on one project may be used to cover the costs of over-runs on others.

A scheme cost estimate, including 36.3% Optimism Bias has been used for the economic assessment of each route option. This figure was determined in line with advice relating to the Roads Service Policy & Procedure Guide: RSPPG_E058 for Major Works Estimates.

Additionally, both a lower bound scheme cost estimate and an upper bound scheme cost estimate have been prepared, incorporating 15% and 45% Optimism Bias respectively. These figures have been prepared for programming purposes only and do not form part of the economic assessment.

Table 3.6.10 Total Scheme Cost (15% Optimism Bias)

Route Option	Scheme Cost	Optimism Bias (15%)	Total Scheme Cost (15% OB)
Red Route	£83,201,483	£12,480,222	£95,681,705
Yellow Route	£77,240,681	£11,586,102	£88,826,783
Blue Route Option 1	£40,269,485	£6,040,423	£46,309,908

Blue Route Option 1A	£58,412,217	£8,761,833	£67,174,050
Blue Route Option 2	£53,177,471	£7,976,621	£61,154,092
Blue Route Option 2A	£71,320,204	£10,698,031	£82,018,234
Blue Route Option 3	£43,468,185	£6,520,228	£49,988,412
Blue Route Option 3A	£61,610,917	£9,241,638	£70,852,555

Table 3.6.11 Total Scheme Cost (36.3% Optimism Bias)

Route Option	Scheme Cost	Optimism Bias (36.3%)	Total Scheme Cost (36.3% OB)
Red Route	£83,201,483	£30,202,138	£113,403,621
Yellow Route	£77,240,681	£28,038,367	£105,279,048
Blue Route Option 1	£40,269,485	£14,617,823	£54,887,308
Blue Route Option 1A	£58,412,217	£21,203,635	£79,615,852
Blue Route Option 2	£53,177,471	£19,303,422	£72,480,893
Blue Route Option 2A	£71,320,204	£25,889,234	£97,209,438
Blue Route Option 3	£43,468,185	£15,778,951	£59,247,136
Blue Route Option 3A	£61,610,917	£22,364,763	£83,975,680

Table 3.6.12 Total Scheme Cost (45% Optimism Bias)

Route Option	Scheme Cost	Optimism Bias (45%)	Total Scheme Cost (45% OB)
Red Route	£83,201,483	£37,440,667	£120,642,150
Yellow Route	£77,240,681	£34,758,306	£111,998,987
Blue Route Option 1	£40,269,485	£18,121,268	£58,390,753
Blue Route Option 1A	£58,412,217	£26,285,498	£84,697,715
Blue Route Option 2	£53,177,471	£23,929,862	£77,107,333
Blue Route Option 2A	£71,320,204	£32,094,092	£103,414,295
Blue Route Option 3	£43,468,185	£19,560,683	£63,028,868
Blue Route Option 3A	£61,610,917	£27,724,913	£89,335,830

4. Engineering Assessment

4.1 Introduction

This section of the report assesses the engineering standards for the route alignment options and describes in detail the following criteria relating to the alignments:

- geometry;
- junction/access provision;
- geotechnical;
- public utilities;
- structures;
- flood risk assessment; and
- buildability.

Additionally, the engineering assessment of each route option also considers factors that would have an impact on the design and consequently the cost of the scheme. Each of the assessments carried out for the above criteria are reported within this section of the report.

It should be noted that the designs for each of the route options described below have been developed to a level appropriate for the Stage 2 Preferred Options Report. Following selection of the preferred option, the design of the mainline, junctions and side roads would be subject to further development under the subsequent stage.

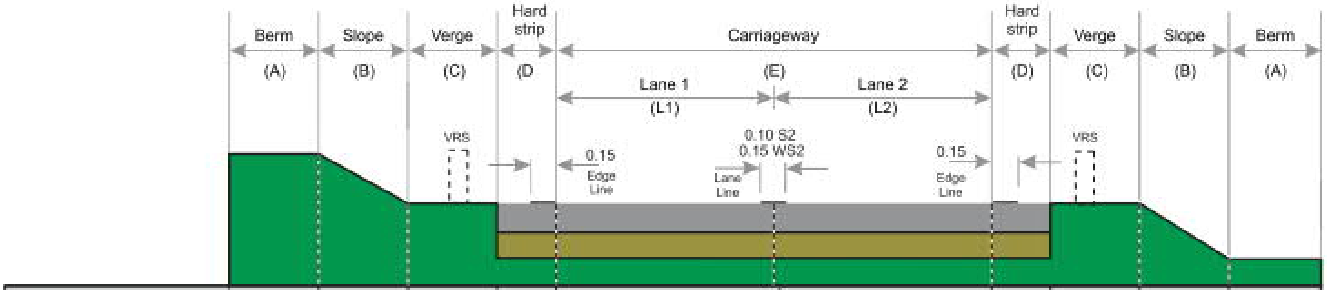
4.2 Geometry

Each route alignment option has been designed in accordance with the geometric standards defined in DMRB TD 9/93 – '*Highway Link Design*'. The mainline design speed has been set as 100A kph as recommended in the Department for Infrastructure Director of Engineering Memorandum (DEM) 118/16 '*Design Speed for Roads*'.

4.2.1 Carriageway Cross Section

All alignment route options vary in cross section along their length with a S2 carriageway utilised either side of a Wide Single Carriageway Climbing Lane Section along the uphill extents. This would be introduced directly from the exit lanes of the roundabouts adjacent to B79 Fathom Line and would terminate at a new roundabout on the old Dublin Road or at Ellisholding Junction, so that the overtaking lane becomes the right hand entry lane into the roundabout.

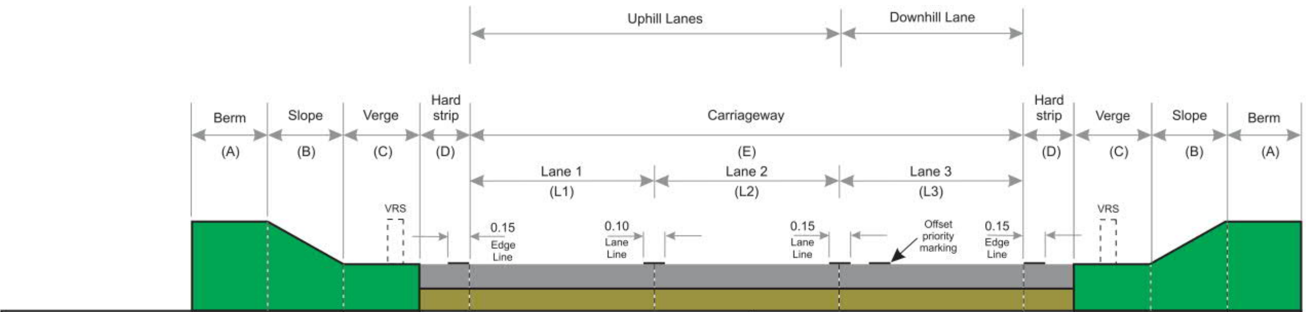
The S2 carriageway, as shown in Figure 4.2.1, consists of two 3.65m lanes with a 1m hard strip and 2.5m verge either side, giving a total carriageway width of 14.3m.



Road Type	A	B	C^2	D^{3,11}	E^3	E^3 L1	E^3 L2	D^{3,11}	C^2	B	A
Single (S2)	Varies	Varies	2.50	1.00	7.30	3.65	3.65	1.00	2.50	Varies	Varies
Wide Single (WS2)	Varies	Varies	2.50	1.00	10.00	5.00	5.00	1.00	2.50	Varies	Varies

Figure 4.2.1 S2 Carriageway Cross Section

The Wide Single Carriageway Climbing Section which will be utilised along the ascent of Fathom Mountain will consist of one 3.2m wide lane, two 3.4m wide lanes, two 1m hard strips and two 2.5m wide verges, as shown in Figure 4.2.2.



Road Type	A	B	C^2	D^{3,11}	E^3	E^3 L1	E^3 L2	E^3 L3	D^{3,11}	C^2	B	A
Wide Single (WS2) Climbing Lane Section	Varies	Varies	2.50	1.00	10.00	3.20	3.40	3.40	1.00	2.50	Varies	Varies

Figure 4.2.2 Wide Single Carriageway Climbing Lane Section

This arrangement will provide two lanes in the direction of slow moving vehicles allowing motorists an immediate overtaking opportunity upon exiting the roundabout which should contribute to improved traffic flows and reduced driver frustration.

4.2.2 Geometric Design

To accommodate the alignment and account for the effect of existing topography, land take and environmental factors it has been necessary, when designing the scheme, to drop below desirable minimum DMRB standards at certain locations. This is permitted in DMRB and is accounted for by either Relaxations or Departures from Standard that will be applied for during the next stage of the scheme's development. The designs at this stage have been progressed to allow a comparative assessment of the alignment options to take place. The preferred alignment will be subject to further optimisation in line with more detailed design considerations at the subsequent Stage 3 design stage.

4.2.2.1 Vertical Alignment

The vertical alignments of all options have been designed to take account of DMRB in order to provide a suitable road alignment, whilst also remaining sensitive to the local topography and ensuring adequate clearances are provided at constraints.

The vertical alignments, taking cognisance of Paragraph 7.30 of TD9/93, have been designed with a target Crest K value One Step below Desirable Minimum, whilst maintaining Desirable Minimum Stopping Sight Distance (SSD) from a point 1.5 times SSD on the approach to the changeover and junctions. The use of Crest K values below the desirable minimum will need to be supported by corresponding Relaxations in line with TD9/93.

Whilst a suitable vertical alignment has broadly been achievable for all options, the constraints of the local topography, result in a steeper than desirable approach to the roundabout adjacent to Fathom Line for the Blue Route Options. Whilst it is not a mandatory requirement, DMRB TD16/07 – *'Geometric Design of Roundabouts'* notes that roundabouts should not be sited at the bottom of descents. A maximum gradient of 3.0% before roundabout entry is achieved for all five route options.

4.2.2.2 Visibility Analysis

Visibility Analysis undertaken on each of the options indicates that it may not be possible to achieve the Desirable Minimum Stopping Sight Distance (SSD) of 215m along the full extent of each alignment. This is largely due to the departures from standard associated with horizontal geometry which is explained below under each route option. Further analysis and design will be carried out on the preferred route at a later stage when it is envisaged that with verge widening a SSD of 160m (one step below desirable minimum) would be achieved.

4.2.2.3 Horizontal Alignment

The geometric design criteria used in the design of each alignment option is detailed in Table 4.2.1 along with the standards and guidelines set out in TD9/93. Drawings illustrating the proposed horizontal and vertical alignments can be found in Appendix A.

4.2.3 Red Route

4.2.3.1 Proposed Alignment

The Red Route would tie into the existing A2 Warrenpoint Road via an at-grade roundabout with Inscribed Circle Diameter (ICD) of 50m. It crosses perpendicular to Newry River and Canal with a constant gradient of 1.3% over a length of 435m, before connecting into another roundabout which links the route to Fathom Line. The route travels straight in a north westerly direction for approximately 1100m, along the slopes of Fathom Mountain, climbing at a gradient of 2.0% over the initial 200m before transitioning into consecutive sag and crest curves with k values of 37 and 182 respectively. A gradient of 3.75% is then maintained for 1700m. Following the initial straight section, the alignment transitions into a left handed 1020m radius curve until Ch 1+765 where it again transitions into a straight for 350m to Ch 2+195.

The first of two Departures from Standard is encountered at Ch 2+300 where a left handed curve radius of 360m is required in order to lessen the impact on Fathom Mountain. Using a larger radius at this location would have significantly more impact upon an Area of Outstanding Natural Beauty (AONB) resulting in a major section of cut. This extends to Ch 2+950, where the alignment transitions into an opposite 360m radius curve, the second departure. This is required at this location in order to navigate the railway line and the existing properties located on the old Dublin Road. Following the gradient of 3.75%, a crest curve of k value 100 precedes the maximum gradient of 6.0% which occurs from approximate Ch 2+525 to Ch 2+850. From Ch 3+240, the alignment transitions into a straight section connecting into a relocated roundabout at Ellisholding Junction. This straight section corresponds to a relatively flat gradient of 0.5% providing a suitable tie in at the roundabout which has an ICD of 54m.

4.2.3.2 Topography and Physical Limitations

The Red Route originates at a low level of approximately 2m AOB and crosses Newry River where the existing ground on either side remains relatively even before a dramatic increase in existing ground levels occurs along the slopes of Fathom Mountain, where a maximum level beyond 245m AOD is reached. This dramatic difference in elevation highlights the constraints associated with traversing Fathom Mountain and further justifies the requirement for a number of departures from standard. The alignment follows the contours where possible, climbing the topography gradually in order to avoid extensive earthworks. However, coinciding with the 1020m radius noted above, the alignment traverses the contours much more rapidly before the existing ground plateaus as the alignment passes through a natural valley, navigating around the toe of Fathom Mountain. The existing ground once again rises as the alignment crosses the railway line and ties into Ellisholding

Junction at approximately 134m AOD.

Figure 4.2.3 View from Victoria Lock, highlighting the steep topography to the north and west

4.2.3.3 Red Route Alignment: Relaxations and Departures from Standard

The following Departures and Relaxations from Standard occur in the mainline geometry for the Red Route alignment:

- Horizontal curvature includes two radii of 360m. This is two steps below the desirable minimum radius of 720m and so would result in Departures. This is a result of navigating through the extremely steep topography;
- a vertical curve with K-value of 55 has been used at one location which is one step below the desirable minimum K-value of 100, resulting in a Relaxation. This is a result of navigating through the extremely steep topography; and
- it is anticipated that a Stopping Sight Distance of 160m would be achieved at a number of locations due to the horizontal and vertical curvature Departures and Relaxations. This is one step below the desirable minimum SSD of 215m and so would require a Relaxation. A full assessment will be carried out on the preferred route when further design has been carried out.

4.2.4 Yellow Route

4.2.4.1 Proposed Alignment

The Yellow Route would also connect into the A2 Warrenpoint Road via an at grade roundabout with ICD of 50m. It would cross Newry River at the narrowest point with a small skew and connect into a realigned Fathom Line by a new roundabout situated on Rough Island. Except for the connections into the proposed roundabout on Rough Island and another new roundabout approximately 1850m further north, Fathom Line will remain online and where required, will be upgraded to conform to a S2 carriageway as shown in Figure 4.2.1. The connection to Fathom line will again be provided via an at grade roundabout of ICD 50m. Due to the topography at this location, substantial cutting slopes would be required. From the proposed roundabout approximately 1850m north of the crossing, the Yellow Route alignment is very similar to that of the Red Route. A short right handed curve radius of 720m extends for the initial 60m before transitioning into a straight travelling north west for approximately 690m to Ch 0+850. Following the roundabout, a gradient of 2.5% is maintained for 46m before a sag curve with k value 26 transitions into the maximum gradient within the alignment of 5.95%, lasting for approximately 410m to Ch 0+550. A crest curve of k value 100 precedes a gradient of 3.5% over a substantial distance of 1010m until Ch 1+800. Following the initial straight section, the alignment transitions into a left handed 1020m radius curve until Ch 1+490 where another straight section travels north-west, crossing Flagstaff Road, to Ch 1+865.

Similar to the Red Route, the first of two Departures from Standard occurs when a left handed curve of radius 360m navigates around Fathom Mountain until Ch 2+670. Again, using a larger radius curve would prevent the alignment from connecting into Ellisholding Junction and would result in more extensive earthworks, through an AONB if realigned to do so. From approximate Ch 1+850, the gradient of the alignment increases to 5.0% and maintains this for 790m. This is necessary to achieve a sufficient clearance over the railway line. A crest curve with k value 55 extends for 340m before a negative gradient of -1.2% provides a connection into the proposed roundabout at Ellisholding Junction. Again, similar to the Red Route, the second of two Departures occurs when the previous 360m radius curve transitions into an opposite 360m radius curve before connecting into Ellisholding following a 60m straight section.

4.2.4.2 Topography and Physical Limitations

As noted previously, the Yellow Route follows a similar horizontal alignment to the Red Route and so is affected by the same topography and physical limitations as mentioned previously. One difference of note is the upgrading of Fathom Line which may, in places, cause dramatic cut slopes due to the steepness of the existing ground to the west of Fathom Line. Furthermore, the proposed new roundabout, which would connect Fathom Line to the relief road, and the initial 350m would result in extremely large cut slopes. Again this is due to the extremely steep topography with the existing ground levels rising very quickly from 4m AOD on Fathom Line to 23m AOD where the proposed roundabout would be located.

4.2.4.3 Yellow Route Alignment: Relaxations and Departures from Standard

The following Departures and Relaxations from Standard occur in the mainline geometry for the Yellow Route alignment:

- Horizontal curvature includes two radii of 360m. This is two steps below the desirable minimum radius of 720m and so would result in Departures. This is a result of navigating through the extremely steep topography;
- a vertical curve with K-value of 55 has been used at one location which is one step below the desirable minimum K-value of 100, resulting in a Relaxation. This is a result of navigating through the extremely steep topography; and
- it is anticipated that a Stopping Sight Distance of 160m would be achieved at a number of locations due to the horizontal and vertical curvature Departures and Relaxations. This is one step below the desirable minimum SSD of 215m and so would require a relaxation. A full assessment will be carried out on the preferred route when further design has been carried out.

4.2.5 Blue Route Option 1

4.2.5.1 Proposed Alignment

Blue Route Option 1 originates on the A2 Warrenpoint Road from an at grade roundabout with ICD of 50m, travelling westward over Newry crossing Gerry Brown Park, Newry Canal and Fathom Line to another roundabout with an ICD of 44m. The connection between the two roundabouts would be a 470m straight link with a typical S2 Carriageway cross section. This link rises gradually following a 2.0% gradient from the roundabout on the A2 Warrenpoint Road for approximately 40m, before a sag curve of k value 26 transitions into a gradient of 5.0% over 165m. This gradient provides a canal clearance of approximately 12.2m from water level to soffit level. The link connects into the roundabout adjacent to Fathom Line following a crest curve of 55m and a short 20m section with a 2.0% gradient. Following the roundabout adjacent to Fathom Line, the relief road continues in a south easterly direction with a straight length of 480m. Over this length, a gradient of 2.0% is maintained for approximately 50m providing a reasonable approach to the roundabout, before a sag curve of k value 26 transitions to a 4.0% gradient over 285m to approximate Ch 0+375. Another sag curve of k value 26 precedes the maximum gradient of 6.0% which is maintained over a significant distance of 1365m to approximate Ch 1+800.

Following the initial straight section, the route transitions into the first of three Departures from Standard associated with the horizontal alignment. A right handed 360m radius curve extends from Ch 0+680 to Ch 1+400 and is required at this location in order to reduce the level of impact on Benson's Glen, the SLNCI, long established woodland and a number of residential dwellings located along Flagstaff Road. The alignment then transitions into an opposite 360m radius curve, which again would require a Departure. Similar to the previous routes, a Departure would be required at this location in order to provide a suitable connection to the proposed roundabout on the old Dublin Road and minimise the extensive earthworks associated with traversing Fathom Mountain, an AONB. The alignment then connects into a proposed new roundabout on the old Dublin Road following the railway crossing and a straight section of 20m. The vertical alignment of the climbing section concludes with a crest curve of k value 55 followed by a 2.0% gradient over a distance of 48m. The alignment continues following the horizontal realignment of the existing old Dublin Road. Due to the levels required to cross the existing railway line, there is a significant height difference between the existing old Dublin Road and the proposed relief road. Following the proposed new roundabout, a gradient of -1.0% is maintained for 30m before a sag curve with k value 26 spans a distance of 108m. A gradient of 3.2% is then maintained for approximately 160m. The final Departure associated with the horizontal alignment occurs with another 360m radius curve. This currently exists on the old Dublin Road due to the limited space between the existing railway line and the A1/N1. The alignment connects into the existing Ellisholding Junction following a 1.0% gradient over a distance of 61m.

4.2.5.2 Topography and Physical Limitations

Given the close proximity of the three Blue Route options, the following description is relevant for each route. Similar to the Red and Yellow Routes, the topography that the Blue Route options traverse is extremely challenging with dramatic variations in levels, as highlighted by Figure 4.2.4. This view highlights the area south of the crossing where the alignment will travel south before turning west and navigating through a natural valley.

Figure 4.2.4 View looking west over Middlebank, highlighting the steep topography

The proposed roundabout on the A2 Warrenpoint Road would be constructed at the existing ground level of 2m AOD. Fathom line currently has levels of approximately 4m AOD, while the proposed roundabout adjacent to Fathom Line would be constructed in an area where the existing levels are approximately 28m AOD. This dramatic increase in height over a short distance further highlights the difficulty in traversing this topography. Consequently, this results in substantial cutting slopes on the western side of the proposed roundabout. Again, as highlighted in Figure 4.2.4, the existing ground continues to rise to the west, as the alignment tries to follow the contours in order to reduce the extent of earthworks. Similar to the Red and Yellow Routes, following the alignment running west and traversing the contours much more rapidly, the existing ground plateaus at a height of approximately 90m AOD and passes through a natural valley before traversing the toe of Fathom Mountain where the existing height is up to 122m AOD. The existing ground falls again before rising to approximately 123m AOD prior to crossing the railway line.

4.2.5.3 Blue Route Option 1 Alignment: Relaxations and Departures from Standard

The following Departures and Relaxations Standard occur in the mainline geometry for the Blue Route Option 1 alignment:

- Horizontal curvature includes three radii of 360m. This is two steps below the desirable minimum radius of 720m and so would result in Departures. This is a result of navigating through the extremely steep topography;
- a vertical curve with K-value of 55 has been used at one location which is one step below the desirable minimum K-value of 100, resulting in a Relaxation. This is a result of navigating through the extremely steep topography; and
- it is anticipated that a Stopping Sight Distance of 160m would be achieved at a number of locations due to the horizontal and vertical curvature Departures and Relaxations. This is one step below the desirable minimum SSD of 215m and so would require a Relaxation. A full assessment will be carried out on the preferred route when further design has been carried out.

4.2.6 Blue Route Option 2

4.2.6.1 Proposed Alignment

The same crossing and roundabouts either side of the river and canal are common for all three of the Blue Route options. Following the roundabout adjacent to Fathom Line, a straight travelling south east extends for approximately 360m before transitioning into a right handed 360m radius curve, the first of two Departures associated with the horizontal alignment. Similar to Blue Route Option 1, this Departure from Standard is required to reduce the level of impact on Benson's Glen, the SLNCI, long established woodland and a number of residential dwellings located along Flagstaff Road. A gradient of 3.0% is maintained for 43m upon exiting the roundabout before a sag curve, k value 26, increases the gradient to a maximum 6.0% which is then maintained for 1577m to approximate Ch 1+700.

The 360m radius curve extends to Ch 1+200 before transitioning into the first horizontal Relaxation from Standard where a curve radius of 510m is utilised from Ch 1+536 to Ch 1+664. Due to the larger radius compared to Blue Route Option 1, the alignment has less associated earthworks, with significantly less fill required at this location. The alignment transitions back into a straight section of approximately 100m before connecting into a proposed roundabout on the old Dublin Road, 60m further south than Blue Route Option 1. Following the substantial length of 6.0% gradient, a crest curve with k value 55 precedes a 43m length of 3.0% gradient which connects into the proposed roundabout.

Following the roundabout the alignment runs to the east of the old Dublin Road with a straight section extending a distance of 127m before transitioning into a right handed 360m radius curve. This is the second horizontal Departure, and is again required as a result of the limited space between the existing railway line and the A1/N1. Again, this curve transitions into a straight length of approximately 80m where it connects the relocated Ellisholding Junction. Following the proposed roundabout on the old Dublin Road, a gradient of 2.0% is maintained for approximately 60m before a sag curve with k value 26 and crest curve of k value 55 transitions to a gradient of 0.6% which is then maintained for 150m before connecting into the proposed Ellisholding Roundabout.

4.2.6.2 Blue Route Option 2 Alignment: Relaxations and Departures from Standard

The following Departures and Relaxations from Standard occur in the mainline geometry for the Blue Route Option 2 alignment:

- Horizontal curvature includes two radii of 360m. This is two steps below the desirable minimum radius of 720m and so would result in Departures. Furthermore, the alignment includes one radius of 510m – one step below desirable minimum and therefore would result in a Relaxation. This is a result of navigating through the extremely steep topography;
- a vertical curve with K-value of 55 has been used at one location which is one step below the desirable minimum K-value of 100, resulting in a Relaxation. This is a result of navigating through the extremely steep topography; and
- it is anticipated that a Stopping Sight Distance of 160m would be achieved at a number of locations due to the horizontal and vertical curvature Departures and Relaxations. This is one step below the desirable minimum SSD of 215m and so would require a Relaxation. A full assessment will be carried out on the preferred route when further design has been carried out.

4.2.7 Blue Route Option 3

4.2.7.1 Proposed Alignment

As noted previously, Blue Route Option 3 follows the same horizontal geometry as Blue Route Option 2 and so the description above regarding the horizontal elements is applicable. Following the roundabout adjacent to Fathom Line, a gradient of 2.0% is maintained for 91m before a sag curve with k value 26 also covers a distance of 91m. A gradient of 5.5% is then maintained for 956m to approximate Ch 1+140 where another sag curve of k value 26 extends for 65m. The maximum gradient of 8.0% then spans for 375m from Ch 1+200 to Ch 1+575 where a crest curve with k value 55 precedes a constant gradient of 2.5% for the final 25m before connecting into the proposed roundabout on the old Dublin Road. Following the roundabout, Blue Route Option 3 follows the same horizontal geometry as that described for Blue Route Option 2.

4.2.7.2 Blue Route Option 3 Alignment: Relaxations and Departures from Standard

The following Departures and Relaxations Standard occur in the mainline geometry for the Blue Route Option 3 alignment:

- Horizontal curvature includes two radii of 360m. This is two steps below the desirable minimum radius of 720m and so would result in Departures. Furthermore, the alignment includes one radius of 510m – one step below desirable minimum and therefore would result in a Relaxation. This is a result of navigating through the extremely steep topography;
- a vertical curve with K-value of 55 has been used at one location which is one step below the desirable minimum K-value of 100, resulting in a Relaxation. This is a result of navigating through the extremely steep topography; and
- it is anticipated that a Stopping Sight Distance of 160m would be achieved at a number of locations due to the horizontal and vertical curvature Departures and Relaxations. This is one step below the desirable minimum SSD of 215m and so would require a Relaxation. A full assessment will be carried out on the preferred route when further design has been carried out.

Table 4.2.1 Standards Provided in Route Alignment Design

	Geometrical Design Element			
	Horizontal Curvature	Vertical Curvature	Gradient	Stopping Sight Distance (Expected to be achieved through verge widening)
Desirable Minimum Standard	Min R = 720m	Min Sag K = 26 Min Crest K = 100	Min Grade = 0.5% Max Grade = 6.0%	SSD = 215m
Red Route Standard Provided	Min R = 360m	Min Sag K = 26 Min Crest K = 55	Min Grade = 0.5% Max Grade = 6.0%	SSD = 160m
Yellow Route Standard Provided	Min R = 360m	Min Sag K = 26 Min Crest K = 55	Min Grade = 1.2% Max Grade = 6.0%	SSD = 160m
Blue Route Option 1 Standard Provided	Min R = 360m	Min Sag K = 26 Min Crest K = 55	Min Grade = 2.0% Max Grade = 6.0%	SSD = 160m
Blue Route Option 2 Standard Provided	Min R = 360m	Min Sag K = 26 Min Crest K = 55	Min Grade = 3.0% Max Grade = 6.0%	SSD = 160m
Blue Route Option 3 Standard Provided	Min R = 360m	Min Sag K = 26 Min Crest K = 55	Min Grade = 2.0% Max Grade = 8.0%	SSD = 160m

4.3 Junction/Access Provision

4.3.1 Introduction

This section of the report aims to outline various road intersection types considered for the five alignments within the Stage 2 Preferred Options Report. Preliminary Stage 2 Assessments determined at-grade roundabouts as the preferred junction option due to suitability to deal with the anticipated flows and their applicability as a safe gateway type feature between the Rural and Urban road environment. A number of priority junctions between minor side roads have also been considered.

4.3.2 Roundabouts

The principal objective of roundabout design is to secure the safe interchange of traffic between crossing traffic streams with minimum delay. Guidance is provided in TD 16/07 *Geometric Design of Roundabouts*. This is achieved by a combination of geometric layout features that, ideally, are matched to the volumes of traffic in the traffic streams, their speed and to any location constraints that apply.

Roundabouts are particularly suitable in rural areas, characterised by high approach speeds, low tidal variation and few physical constraints. They are normally the safest form of at-grade junction over a wide range of entry flows and approach speeds. Roundabouts are especially effective where a heavy right turn occurs, which can lead to road traffic collisions at major/minor junctions.

Small roundabouts do not use large amounts of land and can thus be attractive in sensitive areas. Since it should be recognised that roundabouts are generally safer than other forms of at-grade junction, road lighting should be considered an essential safety requirement and the decision to use a roundabout should not be abandoned solely because of lighting problems. Indeed TD 16/07 recommends the provision of road lighting at roundabouts.

According to TD 9/93 on single carriageways where overtaking opportunity is limited, the sighting of roundabouts can optimise the length of straight overtaking sections on either side of them.

Preliminary roundabout layouts have been developed taking cognisance of TD16/07. It is proposed that road lighting will be provided on each arm of the proposed roundabouts in accordance with TD16/07.

4.3.3 Priority Junctions

Major/minor priority junctions are the most common form of junction control. Guidance is provided in DMRB TD 42/95 - *'Geometric Design of Major/Minor Road Junctions'*. Traffic on the minor road gives way to traffic on the major road and is normally controlled by, "Give Way" signs and road markings. However, where there are severe visibility restrictions, "Stop" signs and road markings may be considered, with appropriate reference to the Traffic Signs Regulations and General Directions.

The advantage of all major/minor priority junctions is that through traffic on the major road is not delayed. However, high major road speeds or the possibility of major road overtaking traffic manoeuvres should not be encouraged at priority junctions.

4.3.4 Access to the relief road

Direct access to the relief road will be limited to the junctions either end on the A2 Warrenpoint Road, Ellisholding Junction and via the Fathom Line connections. This will improve safety and reduce the number of road traffic collisions by eliminating cross carriageway manoeuvres.

All five alignments tie into the A2 Warrenpoint Road and Ellisholding Junction via at grade roundabouts.

4.3.4.1 Red Route

The Red Route would tie into the A2 Warrenpoint Road approximately 1km south of the Aghnamoira Road junction through an at grade roundabout with an Inscribed Circle Diameter (ICD) of 50m. Upon crossing the Newry River and Canal, another elongated roundabout linking the route option to Fathom Line provides an additional access location.

All of the options terminate at Ellisholding Junction where the most easterly roundabout would be relocated and has been redesigned with an ICD of 60m to accommodate the new alignment along with a new south facing slip road and two minor side roads. The existing roundabout to the east would be replaced by a priority junction to provide southbound traffic, from the A1/N1 Belfast to Dublin corridor, access to the grade separated junction and the new relief road. Another south facing slip road for northbound traffic on the A1/N1 would be constructed – upgrading Ellisholding Junction to a full movement grade-separated junction.

4.3.4.2 Yellow Route

The Yellow Route would tie into the A2 Warrenpoint Road approximately 2km further south of the proposed Red Route tie in location via an at grade roundabout with an ICD of 50m. After crossing the Newry River, another equally sized roundabout, cited on Rough Island, connects into the diverted Fathom Line before a third roundabout, with an ICD of 42m, located west of Fathom Line allows traffic to access the proposed route and travel towards Ellisholding Junction where the same arrangement as the Red Route would be encountered.

4.3.4.3 Blue Route Option 1

Blue Route Option 1 would tie into the A2 Warrenpoint Road in the vicinity of Greenbank Industrial Estate via an at grade roundabout with an ICD of 50m, located approximately 1.25km south of the existing Greenbank Roundabout. This roundabout will serve three arms; two from the existing A2 Warrenpoint Road and another travelling west from the roundabout, crossing Newry River and Canal, where, upon encountering another roundabout, a connection to Fathom Line would provide another access location. A priority junction will provide the connection onto Fathom Line. This arrangement is common for all three Blue Route options.

An additional access location would also be offered at the proposed roundabout on the old Dublin Road. Traffic would have access to and from the existing network following the realignment of the old Dublin Road to tie into the proposed new 44m diameter roundabout. Again, the route option ties into Ellisholding Junction where the same arrangement as the previous routes would be encountered.

4.3.4.4 Blue Route Option 2

Blue Route Option 2 has the same access points as Blue Route Option 1 as it only differs in the alignment of the uphill climbing section. The proposed roundabout on the old Dublin Road is slightly further south; however, offers the same connectivity as the roundabout associated with Blue Route Option 1.

4.3.4.5 Blue Route Option 3

Blue Route Option 3 offers the same access points as Blue Route Option 2.

4.4 Side Road Proposals

As the proposed routes mainly affect the same side roads, the following discussion on side road proposals covers each alignment, should however any matter of note affect only one or two alignments attention will be drawn to this fact.

In deciding on the side road proposals, due consideration of each side road's importance, both to the individual and to the local communities, has been taken into account.

The side road proposals are at a conceptual layout stage, and are subject to change during the optimisation of the preferred route during the Stage 3 assessment of the scheme. Future discussions would be required to decide on the typical road cross-sections in accordance with DMRB TD 27/05 – *'Cross Sections and Headrooms'* which will be dependent on other factors such as the Annual average daily traffic (AADT) figure in the design year.

The objective of maintaining the local road network has also been taken into consideration and it is therefore envisaged that at locations where the route options cross Flagstaff Road an overbridge would be provided.

A number of side road realignments along the route options have been designed with substandard geometry in order to minimise the impact on the surrounding area. In these cases a Relaxation or, where the geometry has had to be significantly reduced in standard, a Departure from Standard will be applied for.

4.4.1 Fathom Line

Fathom Line would require significant work if the Red or Yellow Route was the preferred option. This would result in Fathom Line being diverted from the crossing of Newry River and or Canal to the respective roundabouts adjacent to the existing Fathom Line. A significant stretch would remain online and would be overlain and widened to conform to a single carriageway cross section. No Departures from Standard would be anticipated along this upgrade.

Should any of the Blue Route options be determined as the preferred option, no significant work would be required in relation to Fathom Line.

4.4.2 Flagstaff Road

For all route options, Flagstaff Road would be maintained by means of an overbridge. The degree of additional works varies for each option with Blue Route Option 1 and Blue Route Option 3 causing the least disruption due to the significant difference between the existing and proposed levels. For the other three route options, Flagstaff Road would require significant works to raise the level in order to achieve sufficient clearance over the relief road.

4.4.3 The old Dublin Road

The old Dublin Road would suffer significant disruption with all five route options resulting in the road being stopped up.

With reference to the three Blue Route Options, the old Dublin Road to the north of the relief road would require realignment to connect into the proposed roundabout adjacent to the railway line crossing. This therefore provides an access to the relief road from the old Dublin Road. South of this roundabout, the old Dublin Road would be stopped up and in places overlaid to form part of the relief road.

For the Red and Yellow Routes, the old Dublin Road would be stopped up before being overlain in its approach to the relocated roundabout at Ellisholding.

Alternative access to all residential dwellings would be provided where necessary.

4.4.4 Dublin Road

Impacts on Dublin Road would not be significant for any of the five route options. Only minor realignment would be required on the approach to the relocated roundabout at Ellisholding.

4.4.5 Upper Fathom Road

Impacts on Upper Fathom Road would not be significant for any of the five route options. Only minor realignment would be required on the approach to the relocated roundabout at Ellisholding.

4.4.6 Ellisholding Road

All five route options would result in the stopping up of a small section of Ellisholding Road.

In order to maintain access to Ellisholding Road, the road would be realigned on its exit from the most western roundabout at Ellisholding Junction where a one-way southbound lane would be provided, adjacent to the north bound slip lane. At this point, a priority junction would be required to allow for safe crossing of the slip lane, where no left turns would be allowed. After passing through the priority junction, minor realignment of Ellisholding Road would be required to tie the alignment back into the existing road.

4.5 Geotechnical Assessment

4.5.1 Earthworks

At the early stages of projects in the absence of any geotechnical information and where poor conditions are not anticipated, side slopes of 1 (vertical):2.5 (horizontal) are often assumed as an initial indication of the required landtake. Due to the general site topography some of the earthworks may cover a large footprint, particularly for route alignments located on the side of Fathom Mountain and therefore measures are likely to be taken to reduce these where possible.

It may be possible to steepen up the side slopes which would reduce the overall footprint of the earthworks and the subsequent landtake at key locations. Additional stabilisation measures may be required to facilitate the cuttings in rock and soils which would be determined following a ground investigation. Measures such as berms and rock traps are also likely to be required for rock cuts to reduce the risk of rock fall on to the carriageway. Localised use of walls may also potentially be considered to limit the cutting heights and extents.

The finished slope profile in cuttings may also be impacted by the groundwater level, particularly in the superficial deposits and weathered bedrock zones. A high ground water level may necessitate slacker slopes or additional stabilisation measures in conjunction with drainage measures to be implemented.

Where embankments are to be constructed on weak ground including peat, organic clays or weak alluvial deposits, additional measures may be required to provide a suitable founding stratum. These will be considered in more detail following a ground investigation.

The earthworks design and assessment of the reuse of site won material will be further developed once more detailed ground information is available. Where appropriate the tops of slopes could be gently rounded off to create smoother profiles which would be less intrusive than abrupt changes of slope. Similarly the toes of the higher embankments could be smoothly graded into the adjoining ground to help blend the landscape and avoid a harsh, geometric shape.

4.5.1.1 Red and Yellow Routes

Extensive cutting on the upslope side of the proposed carriageway is likely to be required for both the Red and Yellow Routes where the route traverses up the western side of the Newry River Valley, and extends past the crossing of Flagstaff Road. Cuttings over this section vary in height, but may be in excess of 20m at the Fathom Line connector road roundabout (Red Route crossing location), and on the mainline immediately north of this roundabout. Limited ground investigation information is available at these locations, but it is anticipated that the cuts are likely to be formed in both soil and rock, with bedrock potentially being shallow.

Additional upslope cuttings may be required for the Yellow Route for the case where widening of the existing Fathom Line road is required between the roundabout to the west of the crossing, and the Fathom Line link road roundabout to the north.

Consideration should be given to steepening the proposed cutting slopes along the east of Flagstaff Road in order to limit the height and extent of the cuts.

Minor cuttings may be present for the Red and Yellow Routes over part of the link road located to the west of the Belfast-Dublin railway line.

Structural faulting orientated approximately NW-SE, is shown on geological mapping to be present between approximately Fathom Mountain and Green Island. This faulting runs parallel with the Yellow Route over this section. Undercutting of the faulting in this area may potentially cause instability within rock cuts and requires further investigation at a later stage.

Embankments are likely to be required on the downslope side of the carriageway where the route traverses up the western side slopes of the Newry River Valley for both the Red and Yellow Routes.

Embankments located on partially side sloping ground are likely to be present at the western extents of the Red and Yellow Routes. These may have embankment heights in excess of 15m. Based on limited available ground information, the ground within this area is expected to comprise glacial till overlying bedrock. Localised compressible and weak deposits of peat or soft alluvial deposits may also be present to limited depths within depressions and hollows. This may include approach embankments for the crossing of the railway line.

4.5.1.2 Blue Route Options

Upslope cuttings are likely to be required for the Fathom Line Connector road and immediately to the south of the western crossing roundabout for all Blue Route options. Based on inspection of the adjacent Drumalane Quarry, it is anticipated that much of this cutting may be formed within shallow bedrock, with possibly a thin layer of glacial till at surface.

Cuttings may also be required where the route passes beneath Flagstaff Road. The depth of cutting varies between the Blue Route options, but may be in excess of 15m.

Varying degrees of cutting may be required on the upslope of the carriageway where the route traverses around the northern spur of Fathom Mountain. The extent of cut varies between the Blue Route options, with Blue Route Option 1 likely to require the greatest extent of cut. Consideration of steepened side slopes locally may limit the depth and extent of the cutting.

Minor cuttings may be present for all Blue Route options over part of the link road located to the west of the Belfast-Dublin railway line.

Based on the information available, it is anticipated that most cuttings are likely to encounter bedrock, with only shallow depth cuttings potentially formed within superficial deposits alone.

Embankments of up to 10m in height may be required for the eastern approaches to the Newry River and Canal crossing structure. Based on available ground investigation information these are likely to be located on reclaimed land which overlies compressible and/or loose alluvial deposits with depth potentially in excess of 18m below ground level (bgl). These deposits may require further treatment to provide a suitable founding stratum in the form of improving the ground or supporting the embankments by transferring the load to a suitable depth.

Embankments are required for all Blue Route options particularly where the route traverses up the western side slopes of the Newry River Valley. These may comprise embankments in excess of 18m for Blue Route Options 2 and 3, with Blue Route Option 1 anticipated to have slightly lower embankments. Based on limited available ground information, the predominant founding stratum to the west of the Newry River Valley is likely to comprise Glacial Till, which may overlie shallow bedrock.

Localised compressible and weak deposits of peat or soft alluvial deposits may also be present to limited depths within depressions and hollows. This may include approach embankments for the crossing of the railway line. It is likely that this material will be removed.

4.5.2 Significant Geotechnical Risks

The most significant known existing geotechnical risk is the stability of the western extents of Drumalane Quarry and the land adjacent to this.

The footprint of this quarry is extensive and there have been some historical reports of instability of the quarry face and on ground movements to the west of the quarry. These movements were considered to cause part of the existing road network to collapse towards the quarry leading to the decision to close a section of Hillhead Road in 2005. Following some remedial works the road was reopened for a short period of time but was again closed in 2007 and remains closed.

There is currently very limited information available on the stability of the quarry face and surrounding land to the west of the quarry face. The exact cause of failure and the extents of this instability to the surrounding area are not known at this stage and further works would be required in order to assess this. Site visits undertaken in 2016 to Hillhead Road area indicated further movement has occurred since the road was closed.

The Blue Route options all pass close to the quarry and will require careful consideration to ensure that it is out with any areas of instability.

4.5.3 Structural Foundations

The main structural crossing of the scheme that is required for all route options will be the Newry River and the Newry Canal crossing. There will also be a requirement on all route options to construct a bridge over the existing Dublin to Belfast railway line along with some local road crossings. It is likely that the Newry Canal and River crossing will be a significant structure and will require detailed land and marine based ground investigations in order to assess the foundations both within the river and on the land at the supports.

Deep alluvial deposits can be expected under the river and existing information suggests that these may occur at depths in excess of 20 metres in places. These alluvial deposits will not provide adequate bearing capacity for shallow structure foundations. Alluvial deposits are underlain by glacial deposits, which may extend to depths of greater than 50 meters. For all Route Options, the construction of the Newry Canal and River crossing is likely to require deep piled foundations extending in to the glacial deposits or bedrock to support the structure and the piers.

All route options require a crossing of the Dublin to Belfast railway line. The available geological maps suggest that they will be founded either on shallow bedrock or on glacial tills; although this will need to be confirmed with focussed ground investigations. Depending on the results of the ground investigations it may be possible to construct the railway crossing structure on shallow foundations.

There is likely to be a requirement for structures crossing the local road network. Further ground investigations local to these structures will be required at a later date to determine the foundation requirements.

4.5.4 Re-use of excavated materials

The cutting excavations within all route alignments are likely to yield some site-won fill which could be re-used for embankment construction and as landscape fill. In addition where the vertical road alignments are close to existing ground level the road box may also yield site-won fill.

Where encountered, glacial till may meet the requirements of a Class 2 fill as defined in the Specification for Highway Works. Where granular fill is excavated, there may also be potential to use this as Class 1 fill as defined in the Specification for Highway Works.

It is likely that deeper cuttings will require excavation in rock. Rock encountered in cuttings may include Greywacke and Shales eastwards towards the river, with Granodiorite and Felsite present over much of the area between the river and the A1 Dublin Road. Rock obtained from Drumalane Quarry is understood to have been used for road construction, and intact site-won rock would be expected to be suitable for use as embankment fill. Where used as fill, rock would require grading, with potential further crushing likely in order to meet the requirements of the MCDHW Series 600 fill categories.

A suite of contamination testing should be completed to determine the characteristics of the existing embankment fill and thereafter potential for re-use or the requirements for disposal to landfill, and its classification for landfill tax.

Further ground investigation is required to delineate and characterise the materials likely to be excavated from the selected scheme option.

4.5.5 Subgrade

Ground investigation at a later stage will be required to confirm the ground conditions at subgrade.

With the exception of soft weathered material, glacial till where encountered could be expected to perform adequately as a sub-grade material. For intact fine grained glacial till, a typical upper bound CBR value of 3 or 4% may be used for preliminary assessment. Where the glacial till encountered is weathered, it is possibly that the design CBR value will be lower and may also require additional subgrade treatment.

Intact bedrock at subgrade is likely to have a CBR>15% although further assessment would be required where weathered bedrock is encountered.

To the east of the river, the Blue Route options are mainly on embankment and the CBR value will be determined by the material used for its construction. However, there may be some localised ground with low strength soils with CBR < 2.5% close to subgrade towards the proposed roundabout at the A2 tie-in.

The fill used for the reclaimed land is thought to have been obtained from dredging works of the river, and is therefore considered likely to consist of a mix of estuarine deposits. The limited ground investigation information available suggests that the reclaimed land is likely to comprise very loose sands and very soft silts, with shells and organic deposits also potentially present. For the purpose of preliminary assessment, this material should be considered to have a subgrade CBR 2.5% if encountered.

Localised areas of peat and soft organic deposits may be present for all route options within level areas and depressions between the river and the A1 Dublin Road. These areas are likely to have a subgrade CBR < 2.5% and are therefore likely to require excavation and replacement with competent fill.

4.5.6 Potentially Contaminated Land

As a consequence of past and present land use, there is a potential for contaminated land to be encountered along the proposed route options. Information on current and historical land use was reviewed as part of a desk study. Potential contamination sources were identified which may affect the route options and may need to be considered as part of the route constraints.

Further investigation and risk assessment reviews will be required as part of the future development stages of the new relief road. The risk assessment process follows the methodology adopted in the Environment Agency/Defra publication, Model Procedures for the Management of Land Contamination (CLR11), and relies on the development of a site specific conceptual site model consisting of three components:

- a source of contamination, for example due to historical site operations;
- a pathway, a route by which receptors can become exposed to contaminants. Examples include vapour inhalation, soil ingestion and groundwater migration; and
- a receptor, a target that may be exposed to contaminants via the identified pathways. Examples include human occupiers/ users of the site, the water environment, property or ecosystems.

For a potential risk to either environmental and/or human receptors to exist, a plausible pollutant linkage involving each of these components must exist. The impact of the confirmed potential contamination source with respect to identified sensitive receptors can be quantified and remediation/mitigation measures designed to address unacceptable risks.

A desk based study has been carried out to identify the possibility of potential ground contamination relevant to the Stage 2 Blue, Yellow and Red Routes for the relief road. Information on potential contamination sources was sourced from historical ordnance survey mapping, the NIEA land use database, aerial photographs and current maps. The contaminated land review has identified the potential for contamination to be present at or near to the route options as a result of historical and ongoing industrial activity. Potential contamination sources have been identified for each of the proposed route options as shown on Figure 4.5.6 in Appendix A.

The Blue Route options are considered the most likely to encounter potentially contaminated land. Bridge crossing and approach embankments for all Blue Route options are located within the Greenbank Industrial Estate and works in this area may encounter potential contamination from a historical railway line, a landfill site, a garage and fuel station and a number of Works/ factories. To the west of the river, potential contaminant sources include the current Belfast-Dublin railway line, a historical railway line, Drumalane Quarry and old mineral sites. Potential contaminants are also associated with agricultural land use and existing roads.

The Red and Yellow Routes are located to the south and downstream of the Greenbank Industrial Estate and are therefore considered to have a lower likelihood of encountering potential sources of contamination, although some risk still exists.

The potential contaminant sources which may affect the Yellow Route include historical railway lines, the current Belfast-Dublin railway line, dockyards & docklands and mineral workings. The Red Route may be affected by historical railway lines, the current Belfast-Dublin railway line and mineral workings. Potential contamination is also associated with agricultural land use and existing roads. The Red Route is considered the least likely route option to encounter potential contamination sources during construction works.

All bridge structure foundations for the river crossings are likely to require piled foundations to bedrock, and therefore appropriate measures may have to be put in place to prevent forming of a pathway between shallow ground contaminants, and the bedrock. The bedrock in this area is likely to comprise an aquifer of limited potential productivity which would indicate that the risk of aquifer pollution from surface may be quite low. Consideration of the potential for contamination may also inform the selection of suitable ground treatment/improvement techniques, such as at approach embankments. A solution that minimises excavation of the ground may be preferable to other, more excavation intensive, techniques.

4.5.7 Significant Geotechnical Risks

The above route option comparisons have identified a number of potential geotechnical risks. A comprehensive ground investigation is required across the site to further understand and assess these risks.

The following provides a summary of the primary risks that are considered most significant from a geotechnical perspective:

4.5.8 Red/Yellow Route

4.5.8.1 Both options

Primary Risks:

- Embankments located on steeply sloping sidelong ground;
- cuttings in soil and rock over a considerable length within steeply sloping sidelong ground. Locally steepened cut profiles may be required in order to limit cutting heights, which may exceed allowable design cut angles requiring stabilisation measures in soil and rock for these areas;
- River/Canal crossing structures: Deep bedrock depths for piled foundations; and
- rock cutting instability caused by undercutting of structural faulting orientated parallel and adjacent to cuttings at the road traverses of the west side of the Newry River Valley.

4.5.9 Blue Route

4.5.9.1 All options

Primary Risks:

- Embankments located on steeply sloping sidelong ground;
- cuttings may locally require steepened side slopes in order to limit cutting heights, which may exceed allowable design cut angles requiring stabilisation measures in soil and rock for these areas;
- construction adjacent to Drumalane Quarry;
- embankment construction over reclaimed land and underlying soft deep estuarine deposits which may be highly compressible;

- River/Canal crossing structure: Deep bedrock depths for piled foundations; and
- potential for encountering contaminated land within the Greenbank Industrial Estate area.

4.6 Public Utilities

4.6.1.1 Red Route

Table 4.6.1 shows the number of service crossings within the Red Route. Due to the predominately rural nature of the land, it is not anticipated that service crossings will be problematic.

NIE provided details of their infrastructure network within the study area. A series of underground and overhead cables stand to be affected by the scheme. The following cables would be crossed by the proposed route;

- 11kV cable running parallel to Fathom Line before turning west;
- 11kV cable running along Flagstaff Road;
- 11kV cable running parallel to Barracric Road;
- 11kV cable running parallel to the old Dublin Road and crossing where the proposed Ellisholding Roundabout would be;
- 11kV cable crossing Dublin Road;
- Two 11kV cables crossing the proposed northbound diverge;
- 11kV cable crossing the proposed southbound on slip;
- MV cable crossing the old Dublin Road;
- MV cable crossing Ellisholding Road; and
- 33kV cable crossing Barracric Road.

NIW also have a series of distribution watermains in the vicinity of the Red Route including crossings at the following locations:

- Flagstaff Hill;
- Flagstaff Road;
- Barracric Road;
- Brogies Road;
- Upper Fathom Road;
- Dublin Road;
- Ellisholding Road; and
- Both proposed northbound and southbound connections to the A1/N1.

BT apparatus within the study area consists of both underground and overhead services. These services are located along the verges of the A2 Warrenpoint Road and Fathom Line. The route crosses an overhead cable on Flagstaff Road and at two locations at Barracric Road. Two more underground cables are also crossed along the old Dublin Road and Dublin Road.

Firmus Gas also has a medium pressure distribution pipe running the extent of the A2 Warrenpoint Road which would be crossed at the proposed tie in location.

Table 4.6.1 Services crossing the Red Route

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	2
	11kV	8

	33kV	1
Northern Ireland Water	Watermains	12
	Sewerage	0
Communications	BT	O/H = 3 U/G = 6
	Virgin Media and Eircom	0
Firmus Gas	Medium Pressure Distribution Pipe	1

4.6.1.2 Yellow Route

The Yellow Route has similar interaction with utility service apparatus to the Red Route. Table 4.6.2 shows the number of service crossings within the alignment.

Table 4.6.2 Services crossing the Yellow Route

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	2
	11kV	8
	33kV	1
Northern Ireland Water	Watermains	12
	Sewerage	0
Communications	BT	O/H = 3 U/G = 3
	Virgin Media and Eircom	0
Firmus Gas	Medium Pressure Distribution Pipe	1

The information above corresponds to the locations as mentioned for the Red Route; however, the Yellow Route crosses three less BT underground cables.

4.6.1.3 Blue Route Option 1

Blue Route Option 1 has a similar level of interactions with service utilities to both the Red and Yellow Routes. Greenbank Industrial Estate has a much more dense number of utilities compared to the more rural areas within the study area.

The impact on utilities is deemed to be relatively minor within the route when compared to other road schemes of a similar scale. It is anticipated that service diversions would not make up a high proportion of the overall scheme cost. The utility providers will be consulted throughout the design process to ensure that their requirements are satisfied and the most cost effective solutions are provided.

Table 4.6.3 Services crossing Blue Route Option 1

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	3
	11kV	9
	33kV	1
Northern Ireland Water	Watermains	13
	Combined Foul & Storm Sewer	0
	Foul Sewer	1

	Storm Sewer	1
Communications	BT	O/H = 2 U/G = 3
	Virgin Media and Eircom	0
Firmus Gas	Medium Pressure Distribution Pipe	1

Table 4.6.3 highlights the number of utilities that the proposed route would cross. A narrative breakdown is found below.

NIE provided details of their infrastructure network within the study area. A series of underground and overhead cables stand to be affected by the scheme. The following cables would be crossed by the proposed route;

- 11kV cable running parallel to Newry River along Greenbank Industrial Estate;
- 11kV cable following the roundabout adjacent to Fathom Line;
- 11kV cable running perpendicular to the route 500m further south;
- 11kV cable running to the west of Flagstaff Road;
- 11kV cable running parallel to Brogies Road;
- 11kV cable at the position of the relocated Ellisholding roundabout;
- Two 11kV cables crossing the proposed northbound diverge;
- 11kV cable in the vicinity of the southbound on slip;
- MV cable parallel to Barracric Road;
- MV cable crossing Brogies Road;
- MV cable crossing Ellisholding Road; and
- 33kV cable crossing Barracric Road.

NIW also have a series of distribution watermains and sewers in the vicinity of Blue Route Option 1 including crossings at the following locations;

- Greenbank Industrial Estate;
- Fathom Line;
- Flagstaff Road;
- Barracric Road;
- Brogies Road
- Upper Fathom Road;
- Dublin Road;
- Ellisholding Road; and
- both proposed Northbound and Southbound connections to the A1/N1.

BT apparatus within the study area consists of both underground and overhead services. The route crosses two overhead cables along Flagstaff Road and Barracric Road. Three more underground cables are also crossed along the old Dublin Road.

Firmus Gas also has a medium pressure distribution pipe running the extent of the A2 Warrenpoint Road which would be crossed at the proposed tie in location.

4.6.1.4 Blue Route Option 2

Blue Route Option 2 has a similar level of interactions with service utilities to Blue Route Option 1.

Table 4.6.4 highlights the number of utilities that the proposed route would cross:

Table 4.6.4 Services crossing Blue Route Option 2

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	3
	11kV	10
	33kV	1
Northern Ireland Water	Watermains	14
	Combined Foul & Storm Sewer	0
	Foul Sewer	1
	Storm Sewer	1
Communications	BT	O/H = 2 U/G = 4
	Virgin Media and Eircom	0
Firmus Gas	Medium Pressure Distribution Pipe	1

From the information that NIE has provided, it is evident that Blue Route Option 2 affects the same services as Blue Route Option 1 with the addition of an 11kV cable running along Barracric Road.

As with the previous alignments, there are a number of distribution watermains that would be affected by the proposed Blue Route Option 2. These are in the same locations as outlined for Blue Route Option 1 with an additional watermain affected along Fathom Line.

Blue Route Option 2 would also disturb BT apparatus in a similar manner to the previous Blue Route option; however, an additional underground cable would be affected parallel to Fathom Line.

Firmus Gas would be affected in the same fashion by all three proposed Blue Route options.

4.6.1.5 Blue Route Option 3

As both Blue Route Options 2 and 3 follow the same horizontal alignment, they affect the same number of services in the locations as described above.

Table 4.6.5 Services crossing Blue Route Option 3

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	3
	11kV	10
	33kV	1
Northern Ireland Water	Watermains	14
	Combined Foul & Storm Sewer	0
	Foul Sewer	1
	Storm Sewer	1
Communications	BT	O/H = 2 U/G = 4
	Virgin Media and Eircom	0
Firmus Gas	Medium Pressure Distribution Pipe	1

4.7 Structures

4.7.1 Introduction

As set out previously, there are five route options considered for assessment, labelled Red Route, Yellow Route, Blue Route Option 1, Blue Route Option 2 and Blue Route Option 3. Each route and their alignment(s) will be assessed based on their structures requirement and detailed within this section.

4.7.1.1 Site and Location

The primary physical constraints affecting this scheme, which in turn influence the nature and scale of the bridges, are as follows;

- the steep topography of existing ground between the A1/N1 and the Newry River/Canal and the level difference between the tie-ins, in particular between the A1/N1 and A2, which results in winding horizontal alignments for many of the route options. This results in skewed crossings or even horizontal curvature on bridge decks in some instances, which adds to the length and complexity of the bridge;
- the Newry River/Canal which requires a navigable channel for a variety of vessels including tall ships. Navigation could be facilitated by either providing an opening bridge giving unrestricted height for navigation consistent with current conditions or a fixed bridge with a restricted height depending on the crossing location;
- all options cross over the existing Belfast to Dublin railway line. Some of the crossings are at high skew angles which increases the scale and cost of the bridges;
- the proposed mainline alignments intersect with the existing local road network in the area between the A1/N1 and the Newry River/Canal and it is envisaged that an overbridge will be required for all options at Flagstaff Road in order to maintain connectivity for local traffic;
- the Drumalane Quarry on the western bank of the Newry River/Canal and the suspected instability of the surrounding land represents a major obstacle for the Blue Route options; and
- deep alluvial deposits can be expected under the river and existing information suggests that these may occur at depths in excess of 20 metres in places. These alluvial deposits will not provide adequate bearing capacity for shallow structures foundations and the construction of the Newry River/Canal Bridge is likely to require deep piled foundations.

In addition to the above physical constraints, the environmental designations of the Newry River, the Scheduled Monument status of the Newry Canal and the general scenic value of the valley add to the constraints on the new bridges, both in terms of the finished permanent structures and the construction methods adopted.

4.7.2 Description of Structures

The structures requirements vary between the different alignments but all route options will require the following main bridge structures, which will be considered in detail:

- Newry River/Canal Bridge (ST01);
- Flagstaff Road Bridge (ST02); and
- Belfast/Dublin Railway Bridge (ST03).

The alignments cross the existing local road network in several locations in the area between the A1/N1 and the Newry River/Canal; these include Flagstaff Road, B79 Fathom Line, and the old Dublin Road. It is anticipated that realignment of some of these roads would be possible which eliminates a bridge crossing.

4.7.2.1 Newry River/Canal Bridge (ST01)

In order to provide a link between the A1/N1 and A2, all routes require a crossing of Newry River/Canal. The crossing of the Newry River/Canal is the single most significant engineering element on this scheme. The structural form and scale of the bridge varies considerably between the different route options.

There are a number of factors that will influence this bridge but the most significant is a desire to maintain navigation along the Newry Canal north of Victoria Lock (Blue and Red Routes) and designated navigable channel along the Newry River south of the lock (Yellow Route).

The opening span, if required, of the Newry River/Canal Bridge would be a bascule bridge span. A bascule bridge is the most common form of opening bridge throughout the world. The opening span is formed by the bridge deck pivoting upwards on a horizontal axis allowing a clear navigable channel for vessels to pass underneath. The bascule bridge is effectively formed as a balanced cantilever structure where a large counterweight is provided to the rear of the opening span to act as the balancing force and help reduce the requirements of the opening mechanism on the bridge. The bascule bridge can be either a single or double leaf bascule, the opening span length will generally dictate the requirements for a single or double leaf. In a single leaf bridge, the opening span is formed by a number of members connected together as one with a single opening mechanism provided to one side of the bridge. In a double leaf bridge, the opening is formed of two spans which meet in the middle; two opening mechanisms are required in this case to allow both spans to open simultaneously.

The main advantage of a bascule bridge is that the opening mechanism is generally one of the quickest to open and also operates on very little energy. As the bridge opens through an upward pivot movement, no additional horizontal clearance is required during opening, unlike a Swing Bridge e.g. Samuel Beckett Bridge, Dublin. The requirements for a large central pier to house the counterweight and opening mechanism can detract from the aesthetics of the bridge and can cause environmental issues particularly if the opening span is located to the centre of the river channel.

If Waterways Ireland were the owners of the Newry Canal, an application to erect a bridge over Waterways Ireland property would be required. All relevant approvals and consents will be issued prior to works commencing and if Waterways Ireland approves the development they will then seek the necessary approvals to execute the lease agreement.

Any new bridge over any navigable waters requires a bridge order under Article 4 of The Roads (Northern Ireland) Order 1993 and possibly Diversion of navigable watercourses (Article 5) and Extinguishment of certain public rights over navigable waters and foreshore (Article 6). These articles will be further investigated within Stage 3 and ensure that all information and requirements are considered and/or implemented before submission of the bridge order.

A marine licence will be required for the proposed bridge and any works to the river bed, including ground investigation. Marine and Fisheries Division carries out licencing and enforcement functions in Northern Ireland territorial waters, under the Marine and Coastal Access Act 2009 Part 4.

4.7.2.2 Flagstaff Road Bridge (ST02)

The alignments cross the existing local road network in several locations in the area between the A1/N1 and the Newry River/Canal; this includes Flagstaff Road which will need to be maintained for local traffic connectivity. This bridge will be a two/three span overbridge which will span the proposed Wide Single Carriageway Climbing Lane cross-section and would be required for all routes.

4.7.2.3 Belfast/Dublin Railway Bridge (ST03)

A mainline crossing of the Belfast/Dublin railway line is required for all routes. The railway line is dual track at this location but the length of the bridge varies considerably between routes due to the proposed skew. A number of Translink requirements will also need to be considered during the route assessment such as the lateral clearance to eliminate the abutment design for derailment loading and vertical clearance for future proofing for new overhead line equipment. A vertical clearance of 4.5m is currently required; however, in order to future proof the bridge for Overhead Line Electrification (OLE), a minimum clearance of 5.3m should be designed. It is expected that the Belfast –Dublin line would be one of the first lines in Northern Ireland to receive OLE. The proposed structure will be fully integral (if possible <30° skew) which reduces the requirements for inspection and maintenance which is important as rail possessions will be required to carry out these routine inspections/maintenance works. The design of this railway bridge shall be in accordance with NR/L3CIV/020: (Level 3 Design of Bridges Network Rail). An Asset Protection Agreement (APA) will be required which will contain all approvals, acceptances and consents required for the design and construction of the new bridge which will impact upon Translink's network and property.

4.7.2.4 Minor Structures

Minor structures may be required including culverts for small watercourses and earth retaining structures but will not be explored in detail at this early stage of assessment. An allowance is included in the cost estimate as appropriate for the anticipated requirements.

4.7.3 Options Considered

The five route options have been assessed as part of this report which focuses on the potential locations for the bridges based on the frozen highway alignments. The assessment will determine the length, width, skew and support requirements for each alignment which will be used in the economic evaluation of each route.

4.7.3.1 Red Route

The Red Route is the middle alignment in terms of length and provides a roundabout junction with the existing roads either side of the river/canal. ST01 spans Newry Canal and River with an approximate overall length of 420m. This structure would have 10 spans with one opening span of 57m to ensure that the navigable channel is maintained as this crossing is approximately 700m north of Victoria Lock. As the opening span is greater than 45m, due to the requirement to span the Scheduled Monument (Newry Canal), a double leaf bascule bridge would be required. A double leaf bascule bridge uses two deck structures, each rotating vertically around a pivot on either side of the crossing. The rotation causes the bridge decks to lift to allow vessels to pass as there is reduced headroom clearance (approx. 6m) due to the vertical alignment of the Red Route.

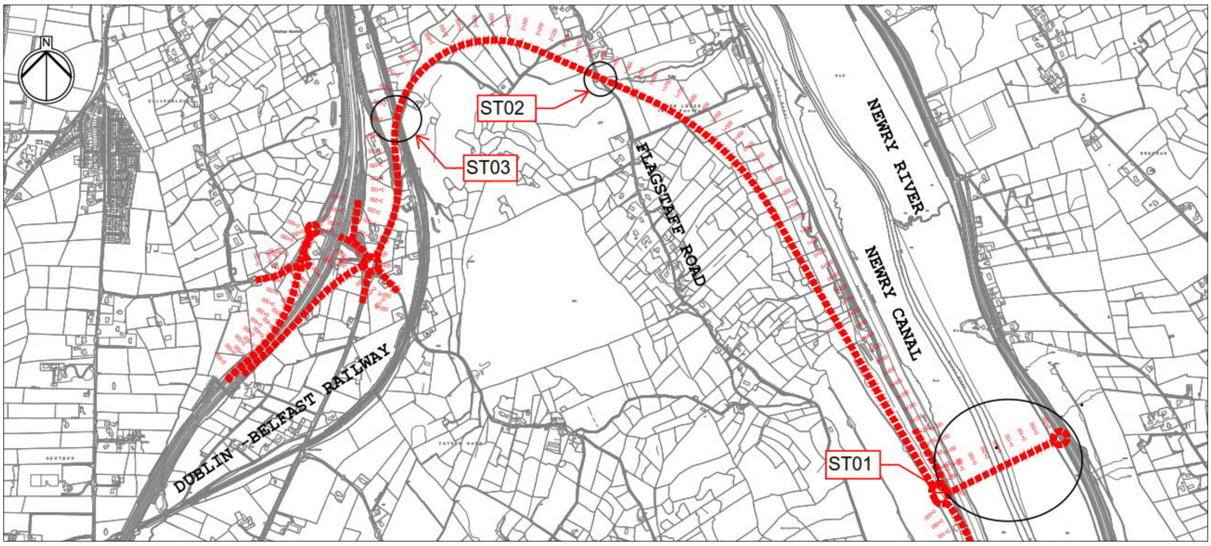


Figure 4.7.1 Red Route - Structure Locations

Flagstaff Road Bridge (ST02) is located at chainage 2+000 and would be a two/three span overbridge which will carry Flagstaff Road. The approximate overall length would be 43m with a 6m wide carriageway assumed to match the existing. The structure overall width used within the economic evaluation is 7m which includes 0.5m parapet upstand on both sides. The approximate skew is 57 degrees which would categorise the structure as a category 3 structure (skew > 45degrees); however, local realignment of Flagstaff road will reduce the skew and category which can be investigated if the Red Route is the preferred route.

Belfast/Dublin Railway Bridge (ST03) is located at chainage 2+900 and would be a single underbridge which would span the dual track Belfast/Dublin Railway line. The approximate span would be 16m which also accommodates a 4.5m lateral clearance from the railway lines to the abutments. The overall structural width would be 70m due to the high skew.

4.7.3.2 Yellow Route

The Yellow Route is the longest alignment with similarities to the Red Route with the exception of the location of ST01. ST01 spans Newry River only, with an approximate overall length of 223m. This structure will have 5 spans with one opening span of 32m to ensure that the navigable channel is maintained along the Newry River. A single leaf bascule bridge is proposed which uses a single deck structure that rotates vertically around a pivot on one side of the crossing. The rotation causes the bridge deck to lift to allow vessels to pass as there is a reduced headroom clearance (approx. 5m) due to the vertical alignment of the yellow route. The opening span would be the middle span located within the centreline of the river; therefore, a fendering system will be required to prevent accidental impact with the intermediate supports located within the river.

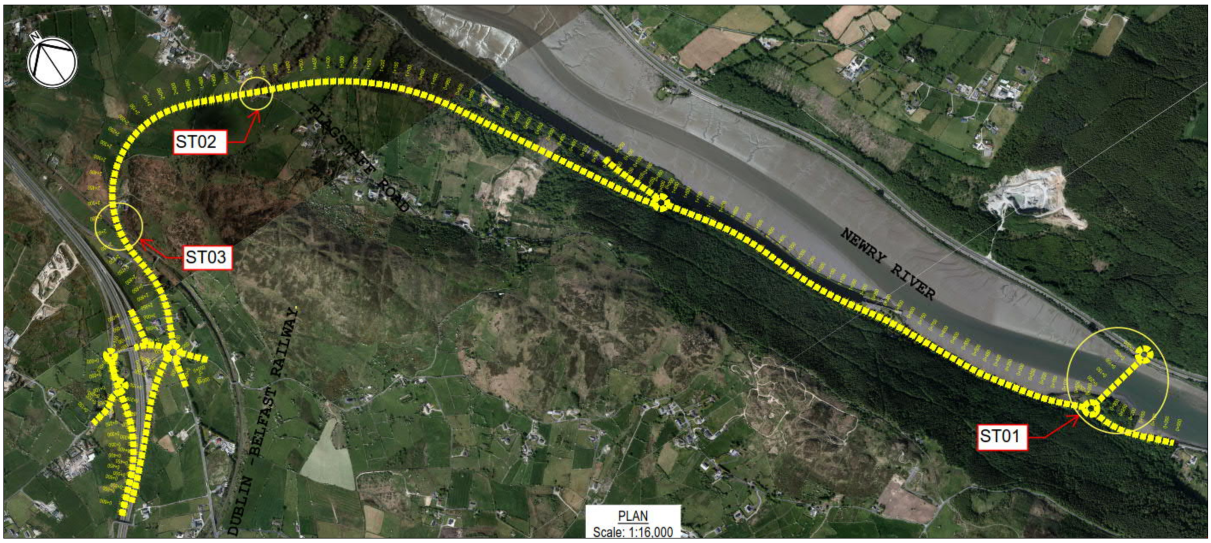


Figure 4.7.2 Yellow Route - Structure Locations

Flagstaff Road Bridge (ST02) is located at chainage 1+725 and would be a two/three span overbridge which would carry Flagstaff Road. The approximate overall length would be 46m with a 6m wide carriageway assumed to match the existing. The structure overall width used within the economic evaluation is 7m which includes 0.5m parapet upstand on both sides. The approximate skew is 57 degrees which would categorise the structure as a category 3 structure (skew > 45degrees); however, local realignment of Flagstaff road would reduce the skew and category which can be investigated if the Yellow Route is the preferred route.

Belfast/Dublin Railway Bridge (ST03) is located at chainage 1+860 and would be a single underbridge which would span the dual track Belfast/Dublin Railway line. The approximate span will be 16m which also accommodates a 4.5m lateral clearance from the railway lines to the abutments. The overall structural width would be 68m due to the high skew.

4.7.3.3 Blue Route Options

The three Blue Route options are the shortest alignments and have the most northerly crossing of Newry River/Canal. The three Blue Route options vary on plan and vertical geometry; however, the Newry River/Canal Bridge (ST01) location is same. ST01 spans B79 Fathom line, Newry Canal, Newry River and ties into the Greenbank Industrial Estate on eastern bank of the river. The approximate overall length is 130m with three spans of 66m, 32m and 32m from west to east. The 66m span is required to span the B79 Fathom Line and the scheduled monument status of Newry Canal. ST01 would be a fixed structure due its northerly location and vertical alignment. The vertical headroom clearance is approximately 12m which would provide a restricted height for vessels travelling further north on the Newry canal. ST02 and ST03 parameters vary between alignments and are detailed below per option.

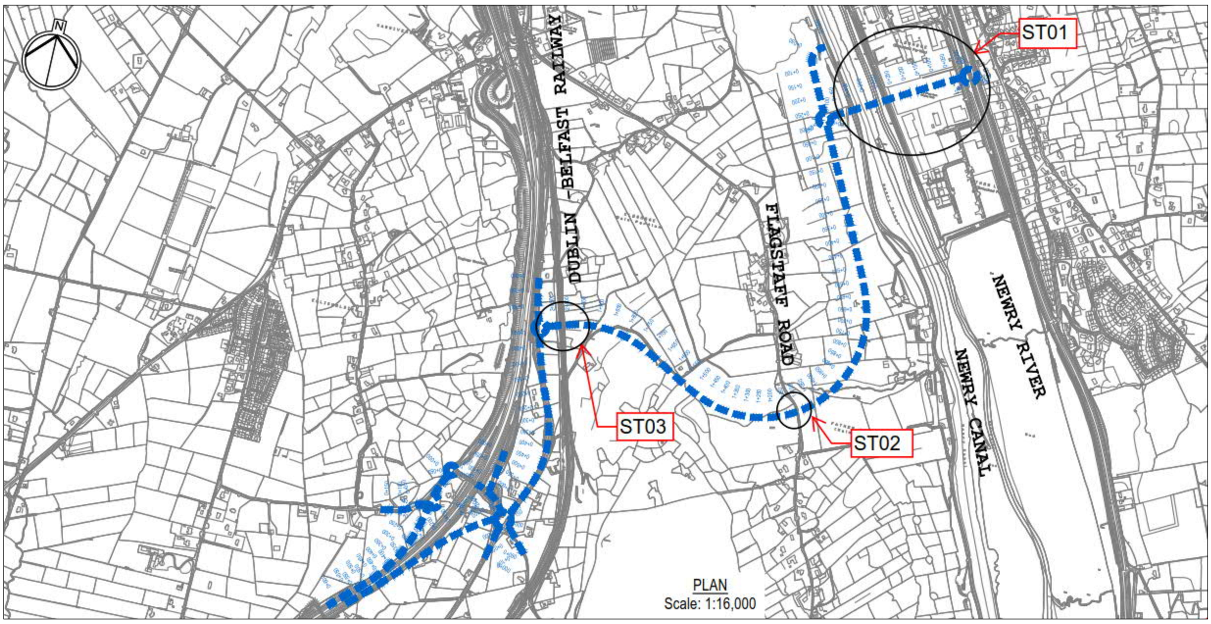


Figure 4.7.3 Blue Route Option 1 – Structure Locations

Flagstaff Road Bridge (ST02) is located at chainage 1+100 and would be a two/three span overbridge which would carry Flagstaff Road. The approximate overall length would be 47m with a 6m wide carriageway assumed to match the existing. The structure overall width used within the economic evaluation is 7m which includes 0.5m parapet upstand on both sides. The skew is approximately 7 degrees.

Belfast/Dublin Railway Bridge (ST03) is located at chainage 2+025 and would be a single underbridge which would span the dual track Belfast/Dublin Railway line. The approximate span would be 16m which also accommodates a 4.5m lateral clearance from the railway lines to the abutments. The overall structural width would be 18m which includes the parapet upstands for high containment parapet system.

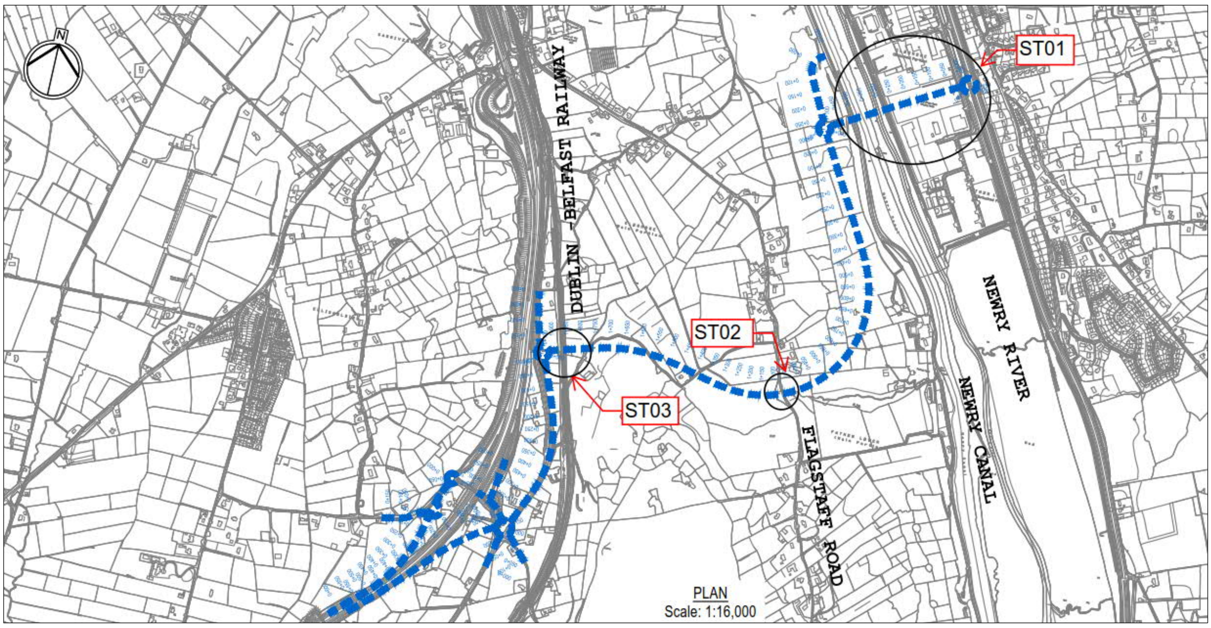


Figure 4.7.4 Blue Route Option 2 - Structure Locations

Flagstaff Road Bridge (ST02) is located at chainage 1+125 and would be a two/three span overbridge which would carry Flagstaff Road. The approximate overall length would be 29m with a 6m wide carriageway assumed to match the existing. The structure overall width used within the economic evaluation is 7m which includes 0.5m parapet upstand on both sides. The skew is approximately 15 degrees.

Belfast-Dublin Railway Bridge (ST03) is located at chainage 1+860 and would be a single underbridge which would span the dual track Belfast/Dublin Railway line. The approximate span would be 16m which also accommodates a 4.5m lateral clearance from the railway lines to the abutments. The overall structural width would be 18m which includes the parapet upstands for high containment parapet system.

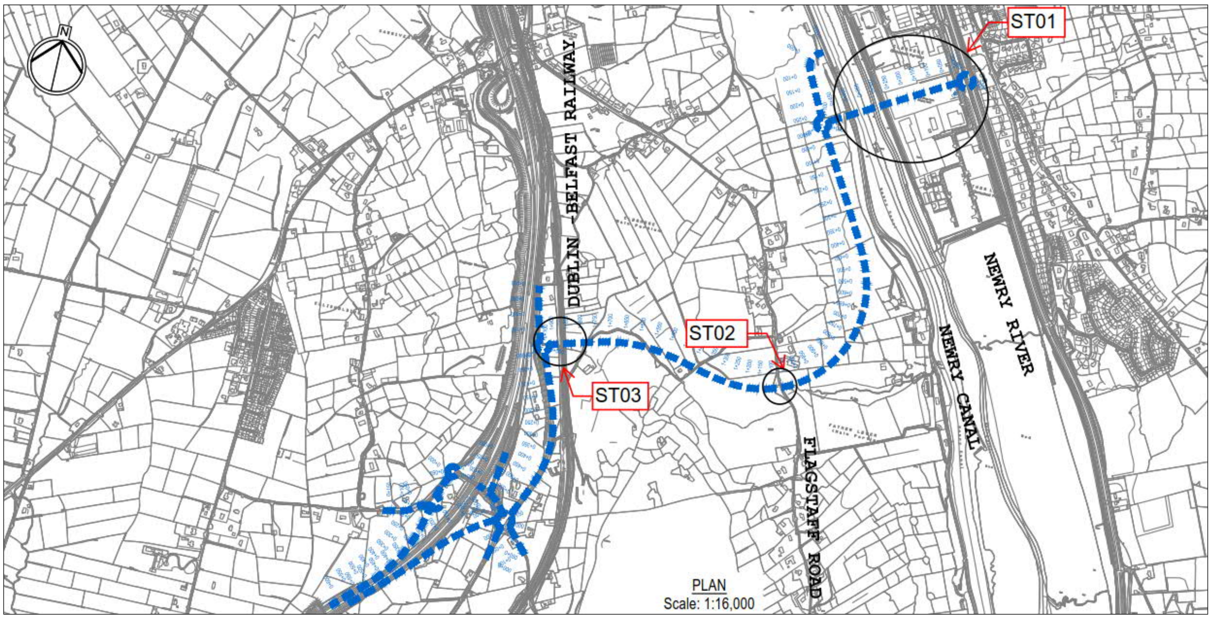


Figure 4.7.5 Blue Route Option 3 - Structure Locations

Flagstaff Road Bridge (ST02) is located at chainage 1+125 and would be a two/three span overbridge which would carry Flagstaff Road. The approximate overall length would be 47m with a 6m wide carriageway assumed to match the existing. The structure overall width used within the economic evaluation is 7m which includes 0.5m parapet upstand on both sides. The skew is approximately 15 degrees.

Belfast/Dublin Railway Bridge (ST03) is located at chainage 1+860 and would be a single underbridge which would span the dual track Belfast/Dublin Railway line. The approximate span would be 16m which also accommodates a 4.5m lateral clearance from the railway lines to the abutments. The overall structural width would be 18m which includes the parapet upstands for high containment parapet system.

4.7.4 Technical Evaluation

The route options presented above have not been sufficiently developed to allow a detailed technical evaluation to be carried out, however, a general technical evaluation has been provided below.

4.7.4.1 Structural Form

Where feasible, integral bridges will be proposed which are continuous over intermediate supports and integral within their abutments. An integral bridge shall not exceed 60m in length or exceed 30 degrees in accordance with BA 42 *(The Design of integral Bridges).* The main benefits of an integral construction is that bearings can be eliminated, thus removing the need for access for bearing inspections and maintenance which can be difficult and expensive along a live railway line like the Belfast to Dublin Line.

The structural form will be determined at conceptual design stage; however, span lengths should be maximised to reduce the number of river supports. Minimising the number of support piers will help to reduce any negative effects on the conveyance capacity of the Newry River, particularly in times of flood. Minimising the number of river supports will reduce the number of support foundations and reduce the construction cost.

There are several different types of opening bridge that can be considered for the scheme, each with their advantages and disadvantages. Such types are described below:

- Single Leaf Bascule Bridge uses a single deck structure that rotates vertically around a pivot on one side of the crossing. The rotation causes the bridge deck to lift to allow vessels to pass;
- double Leaf Bascule Bridge uses two deck structures, each rotating vertically around a pivot on either side of the crossing. The rotation causes the bridge decks to lift to allow vessels to pass;
- single Swing Bridge is a single deck structure with a pivot around which it can rotate horizontally. The pivot allows the bridge to swing away from the channel to allow vessels to pass;
- Double Swing Bridge is a two deck structure with a pivot to each deck to enable them to rotate on plan. The pivots allow the bridge decks to swing away from the channel to allow vessels to pass; and
- Vertical Lift Bridge uses a single span bridge deck with towers on each bank. The towers contain a drive unit to lift the bridge vertically to the required height for the vessels to pass.

At this stage, the preferred type of opening bridge is Single/Double Leaf Bascule Bridge. Single leaf bascule bridges can span a maximum of 45m and it is recommended that if greater than 45m, a double leaf bascule bridge will be required. A single leaf bascule with a very long length to width ratio may also have an undesirable amount of lateral overturning force due to horizontal wind during operation. This may lead to an uneconomical design at the pivot points of the bridge due to the large overturning forces generated. A double leaf bridge is generally designed with an arched shape that cannot be achieved with a typical single leaf bascule or a single leaf swing bridge. This arched shape creates a stiffer bridge in both the vertical and lateral directions.

4.7.4.2 Vertical Alignment

It is assumed that this scheme would not be designated as an abnormal load route, therefore minimum headroom of 5.3m plus any structural deflection and additional clearance for sag curves would be required for new bridges, in accordance with TD 27. The vertical clearance for future proofing for new overheard line equipment will need to be considered for the Belfast-Dublin Railway Bridge (ST03) and shall be in accordance with NR/L3CIV/020: *Level 3 Design of Bridges Network Rail*.

4.7.4.3 Design Life

The design life of the bridge will be as defined in BD 57 *Design for Durability*, with a working design life of 120 years minimum. Maintainable elements and components listed below are subject to greater wear and will require replacement within the design life. The design and detailing combined with thorough routine inspections, quality control and supervision on site during execution will help achieve the minimum expected design life listed in the following table.

Table 4.7.1 Minimum Design Life for Structural Elements

Component	Years
Bridge Bearings	50
Expansion Joints	50
Parapets	50
Drainage Systems	50
Deck Waterproofing	50
Steelwork Paint Systems	20

4.7.4.4 Structure Classification

The proposed bridges will be categorised in accordance with BD 2 *Technical Approval of Highway Structures*. The Newry River/Canal Bridge and high skew bridge (>45 degree) will be category 3 structure in accordance with BD2 and will require an independent design check at detailed design stage. Section 3.4.4 within BD2 defines a category 3 structure as shown in Figure 4.7.6:

> 3.4.4 **Category 3**
>
> Complex structures, which require sophisticated analysis or with any one of the following features:
>
> (a) High structural redundancy.
>
> (b) Unconventional, novel or esoteric design aspects.
>
> (c) Any span exceeding 50m.
>
> (d) Skew exceeding 45°.
>
> (e) Difficult foundation problems.
>
> (f) Moveable bridges.
>
> (g) Moveable inspection access gantries, gantry rail and gantry support systems.
>
> (h) Bridges with suspension systems.
>
> (i) Steel orthotropic decks.
>
> (j) Internal grouted duct form of post tensioned concrete structures.
>
> (k) Earth retaining structures with an effective retained height of 14m or greater.
>
> (l) Rock anchorages (Wales only).

Figure 4.7.6 Extract from BD2 Section 3.4.4

The Category 3 check will cover the design of elements including foundations, substructures, superstructures and the mechanical and electrical mechanisms, where appropriate.

4.7.4.5 Navigation Channel and Ship Manoeuvring

The requirements for the navigation channel should be defined prior to conceptual design of the Newry River/Canal Bridge. Consultation with all third parties should be carried out to understand the requirements of the expected size and speed of vessels using the Newry River/Canal. This information will also be used to inform the design of the fendering system required for the Yellow Route only.

The manoeuvring of vessels within the channel will also be considered as part of the design of the bridge and fendering system. Where possible, the bridge should avoid restricting movements of vessels within the channel.

A marine traffic assessment should be carried out in accordance with BS 6349-1-1 *Maritime Works – General – Code of practice for planning and design for operations*. This assessment will demonstrate the following:

- The channel and manoeuvring area dimensions are adequate for the total shipping traffic forecast for the design working life; and
- risks of collision between moving ships or between moving ships and berthed ships or port and terminal infrastructure are minimised and managed to levels considered appropriate by the relevant regulatory body.

4.7.4.6 Fendering System

A permanent fendering system will be required as part of the design of the Newry River/Canal Bridge. The system will help prevent accidental impact with intermediate supports in the navigable channel. The fendering system will be designed in accordance with BS 6349-4 *Code of Practice for Design of*

Fendering and Mooring Systems to provide protection from vessels approaching from the north and south of the bridge.

4.7.5 Economic Evaluation

The cost of all route options will vary considerably and will be dependent on the development of the conceptual design. The construction cost estimates will be based on “all-in” rates per m^2 of gross bridge deck plan area, which is the typical approach adopted for this stage of assessment. The cost rates have been derived based on experience from recent schemes in Northern Ireland and it is proposed that a baseline rate of £2,000/m^2 be adopted. This is the upper end of the range observed in other schemes but is considered appropriate given the early stage of design development on the NSRR scheme. The rates are also supported by 2018 SPONS Book for Civil Engineering and Highway Works, as shown in Figure 4.7.7.

BRIDGEWORK

ROAD BRIDGES

per m^2 of deck maximum span between piers or abutments; include for the works described to the bridge decks and abutments, but exclude any approach works

Reinforced in situ concrete viaduct
including excavation; reinforcement; formwork; concrete; bearings; expansion joints; deck waterproofing; deck finishings; P1 parapet

span:	15m	m^2	£2,475.00 to £4,800.00
span:	20m	m^2	£2,350.00 to £4,550.00
span:	25+m	m^2	£2,275.00 to £4,400.00

Reinforced concrete bridge with precast beams
including excavation; reinforcement; formwork; concrete; bearings; expansion joints; deck waterproofing; deck finishings; P1 parapet

span:	12m	m^2	£2,425.00 to £4,650.00
span:	17m	m^2	£2,225.00 to £4,300.00
span:	22m	m^2	£2,150.00 to £4,150.00
span:	30+m	m^2	£2,075.00 to £4,000.00

Reinforced concrete bridge with prefabricated steel beams
including excavation; reinforcement; formwork; concrete; bearings expansion joints; deck waterproofing; deck finishings; P1 parapet

span:	20m	m^2	£2,750.00 to £5,500.00
span:	30m	m^2	£2,600.00 to £5,200.00
span:	40m	m^2	£2,550.00 to £5,100.00

Figure 4.7.7 Extract from 2018 SPONS Book for Civil Engineering and Highway Works

AECOM recommend using an “all-in” construction rate of £20,000 per m^2 for the opening spans. The opening span construction rate includes the opening mechanism and electrical components and is based on AECOM’s previous project experience with opening bridges. The “all-in” construction costs are exclusive of VAT. The length of opening span will have the largest impact on the total construction cost of the bridge. The economic evaluation assumes that the bridge will not be considered a landmark structure and will be low key in nature. At conceptual design stage, the choice of materials and quality of finish may have a large effect on the cost of the bridge. The most significant cost element for bridges will be the provision of an opening section on the river/canal crossing. Research has been carried out regarding the appropriate cost rates to adopt for preliminary costings of a bascule bridge and the findings are that construction costs of bascule bridges run at approximately 10 times the rate for standard fixed bridge construction. This is supported by per square foot data published by Florida Department of Transportation in 2014, shown in Table 4.7.2:

Table 4.7.2 Bridge Construction Cost Rates 2014

Bridge Types	Low	High
Short Span Bridges:		
Reinforced Concrete Flat Slab Simple Span	\$115	\$160
Pre-cast Concrete Slab Simple Span	\$110	\$200
Reinforced Concrete Flat Slab Continuous Span	N/A	N/A

Medium and Long Span Bridges:

Concrete Deck/Steel Girder – Simple Span	$125	$142
Concrete Deck/Steel Girder – Continuous Span	$135	$170
Concrete Deck/Pre-stressed Girder – Simple Span	$90	$145
Concrete Deck/Pre-stressed Girder – Continuous Span	$95	$211
Concrete Deck/Steel Box Girder –Span Range, 150' to 280' (for curvature, add 15%)	$140	$180
Segmental Concrete Box Girders – Cantilever Construction, Span Range, 150' to 280'	$140	$160
Movable Bridge – Bascule Spans and Piers	$1,800	$2,000

Source: Florida, DOT

On this basis it is proposed that a rate of £20,000/m^2 is adopted for pricing the opening span section of bridges. This rate will include for the piers and mechanical/electrical workings of the bascule span and the rate should be applied to the full footprint of the Bascule Bridge and piers, i.e. not just the navigable opening span.

AECOM have also included a construction rate for a permanent fendering system for ST01 Yellow Route as the bridge supports are located within the Newry River. The prices are based on consultation with marine pile suppliers and fender system suppliers. A combined rate of £50,000 ex VAT has been applied per fender which includes both the pile and fender system.

Deep alluvial deposits can be expected under the river and existing information suggests that these may occur at depths in excess of 20 metres in places. These alluvial deposits will not provide adequate bearing capacity for shallow structures foundations and the construction of the Newry River/Canal Bridge is likely to require deep piled foundations.

4.7.5.1 Cross-sections

As set out previously, the carriageway cross section varies along the alignments. A single (S2) carriageway cross section consisting of two 3.65m lanes with a 1m hard strip and 2.5m verge either side would be considered. In addition, a 0.5m parapet upstand either side would result in a total cross section width of 15.3m. This width will be considered for ST01 only. A wide single carriageway climbing lane section with a total carriageway width of 17m consisting of one 3.2m wide lane, two 3.4m wide lanes, two 1m hard strips and two 2.5m wide verges would need to be considered in the overall structure width. Again, in addition 0.5m parapet upstands would be required either side resulting in a total cross section width of 18m. This width would be considered for ST02 and ST03.

4.7.5.2 Red Route Economic Evaluation

Table 4.7.3 Red Route Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01 - Fixed Section	363	15.3	5553.9	m^2	2,000	11,107,800
ST01 - Opening Section	57	15.3	872.1	m^2	20,000	17,442,000
ST01 – Support Foundations						7,137,450
ST02	43	7	301	m^2	2,000	602,000
ST03	16	70	1,120	m^2	2,000	2,240,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000

Total Construction Cost (excluding VAT)	39,131,250

4.7.5.3 Yellow Route Economic Evaluation

Table 4.7.4 Yellow Route Economic Evaluation

Structures	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01 - Fixed Section	191	15.3	2,922.3	m^2	2,000	5,844,600
ST01 - Opening Section	32	15.3	489.6	m^2	20,000	9,792,000
ST01 – Fendering System	-	-	8	No.	50,000	400,000
ST01 -Support Foundations						3,909,150
ST02	46	7	322	m^2	2,000	644,000
ST03	16	68	1,088	m^2	2,000	2,176,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000
Total Construction Cost (excluding VAT)						23,367,750

4.7.5.4 Blue Route Economic Evaluation

ST01 would be a fixed bridge due to the vertical clearance over the Newry Canal which is approximately 12m; therefore, a restricted clearance would be provided for the vessel traffic on the canal; however, economical evaluation has also been carried out for an opening bridge option too.

Table 4.7.5 Blue Route Option 1 Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01	130	15.3	1,989	m^2	2,000	3,978,000
ST01 – Support Foundations						994,500
ST02	47	7	329	m^2	2,000	658,000
ST03	16	18	288	m^2	2,000	576,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000
Total Construction Cost (excluding VAT)						6,808,500

Table 4.7.6 Blue Route Option 2 Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01	130	15.3	1,989	m^2	2,000	3,978,000
ST01 – Support Foundations						994,500

ST02	29	7	203	m^2	2,000	406,000
ST03	16	18	288	m^2	2,000	576,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000
Total Construction Cost (excluding VAT)						6,556,500

Table 4.7.7 Blue Route Option 3 Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01	130	15.3	1,989	m^2	2,000	3,978,000
ST01 – Support Foundations						994,500
ST02	47	7	329	m^2	2,000	658,000
ST03	16	18	288	m^2	2,000	576,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000
Total Construction Cost (excluding VAT)						6,808,500

Table 4.7.8 Blue Route Option 1(w/ Opening Span) Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01 - Fixed Section	63	15.3	963.9	m^2	2,000	1,927,800
ST01 - Opening Section	67	15.3	1,025.1	m^2	20,000	20,502,000
ST01 Foundation	-	-	-	-	-	994,500
ST02	47	7	329	m^2	2,000	658,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000
ST03	16	18	288	m^2	2,000	576,000
Total Construction Cost (excluding VAT)						25,260,300

Table 4.7.9 Blue Route Option 2(w/ Opening Span) Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01 - Fixed Section	63	15.3	963.9	m^2	2,000	1,927,800
ST01 - Opening Section	67	15.3	1,025.1	m^2	20,000	20,502,000
ST01 Foundation	-	-	-	-	-	994,500
ST02	29	7	203	m^2	2,000	406,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000

ST03	16	18	288	m^2	2,000	576,000
Total Construction Cost (excluding VAT)						25,008,300

Table 4.7.10 Blue Route Option 3(w/ Opening Span) Economic Evaluation

Structure	Length	Width	Quantity	Unit	Rate	Amount (£)
ST01 - Fixed Section	63	15.3	963.9	m^2	2,000	1,927,800
ST01 - Opening Section	67	15.3	1,025.1	m^2	20,000	20,502,000
ST01 Foundation	-	-	-	-	-	994,500
ST02	47	7	329	m^2	2,000	658,000
Ellisholding Accommodation Bridge	43	7	301	m^2	2,000	602,000
ST03	16	18	288	m^2	2,000	576,000
Total Construction Cost (excluding VAT)						25,260,300

4.7.6 Evaluation of Maintenance Requirements

Maintenance of the bridges would be required throughout the 120 year design life. The type and cost of maintenance will have a large effect on the Total Lifecycle cost of the bridges. Further to this, the proposed Newry River/Canal Bridge would contain a number of different spans and could contain different articulation arrangements which may pose large maintenance costs throughout the design life.

4.7.7 Maintenance and Inspection Regime

The maintenance and inspection of the bridges shall be carried out in accordance with DfI procedures by suitably qualified personnel who shall be responsible for providing all relevant equipment and obtaining authorisation from all relevant authorities.

All inspections carried out to the bridges should be in accordance with BD 63 *Inspection of Highway Structures*. The exact frequency of inspection will be determined at a later date and will depend upon anticipated usage and levels of vandalism. The following regime should be required as a minimum;

- visual Inspections to be undertaken monthly for the first 6 months following opening of the scheme;
- general Inspections to be undertaken every two years; and
- principal Inspections to be undertaken every six years.

The above recommendations are the maximum recommended intervals and are dependent on the condition of the bridge and levels of deterioration since the previous inspection. If high levels of deterioration are identified the inspection interval should be decreased.

4.7.7.1 Opening Mechanism

DfI procedures do not cover the inspection or maintenance of the opening mechanical and electrical systems. It is recommended that these elements should be inspected in line with the manufacturer’s recommendations and best practice guidelines.

Best practise is to design opening bridges with robust M&E machinery components which consists of a motor and drive operating an enclosed gear reducer, or several depending on the configuration, driving a final set of open gearing. The rack, attached to the opening span, would be driven by a pinion and driven by the enclosed reducers on the fixed pier. This is the preferred option as enclosed speed reducers have proven reliability and require little maintenance over their life span. Enclosed gear reducers, when designed properly, can last the lifetime of the bridge with little maintenance. Access for maintenance of the operating equipment is an important yet often overlooked part of the design of opening bridges. Without proper inspection and maintenance, the operating systems of opening bridges will fail within a relatively short time frame. The machinery for an opening bridge should be robust in design and capable of operating for an extended period of time but must also be easy to maintain. The design must also account for accessibility so that in the long term components can be easily removed and replaced when they reach the end of their design life. All of these issues will be taken into account during the development of the design options.

Electrical components tend to be replaced every 15 – 20 years due to component obsolescence. Manufacturers will stop manufacturing and servicing certain components after a number of years. This requires a complete replacement of the bridge's electrical system which is the case no matter which type of movable bridge is selected. This time can be extended by acquiring a number of the proper spare components to allow replacement as needed.

4.7.7.2 Bearings

Bridge bearings are likely to be required on the Newry River/Canal Bridge (ST01) due to the length of the bridge, the opening span and the thermal movements. Bearings with stainless steel components should be specified to maximise resistance to the tidal conditions and exposure classes.

Proper maintenance and inspection of the bridge will ensure that the bearings exceed the 50 year design life. Maintenance works such as repainting and lubricating should be carried out as required to maximise the design life.

The replacement of bearings will likely to be a large cost item, with the bearings replaced twice during the bridges design life. Ensuring easy access to bearings and good detailing at detailed design will maximise the efficiently of replacement.

4.7.7.3 Expansion Joints

Expansion joints will be required due to the length of the bridge and the presence of bridge bearings. The joints should be designed in accordance with BD 33 *(Expansion Joints for Use in Highway Bridge Decks)*.

Expansion joints allow movement of the bridge at an expansion gap while providing a continuous surface for users. The expansion joint material prevents water leakage from upper deck surfaces to lower surfaces. The type of expansion joint will be determined based on the likely movements within the bridge, with particular attention paid to the movements due to thermal loading.

4.7.7.4 Materials

The preferred construction material will have an effect on the maintenance and inspection requirements for the bridge. Structural steel is typically used for opening bridges; however there are various other steel options which can reduce the maintenance and inspection requirements over the design life.

Painting and inspection of structural steel can be an expensive maintenance item over the life time of the bridge. Stainless steel sections may be considered due to the lower maintenance requirements and reduced susceptibility to corrosion. However, the construction cost of stainless steel may make it uneconomical when compared to equivalent standard steel elements.

Weathering steel, which is commonly specified in marine environments, offers an attractive solution providing advantages over both standard steel and stainless steel. A sacrificial thickness of additional steel is specified which forms a corrosive steel layer immediately after construction and provides protection to the section, preventing further corrosion. The cost of the weathering steel will be lower when compared to stainless steel; however, the sacrificial thickness may increase the dead load and increase the cost of foundations.

4.7.8 Construction and Buildability

The construction and buildability will be of paramount concern for the preferred option. The location of the route options is within a highly constrained area and the available construction envelope poses an issue for construction.

4.7.8.1 Marine Piling

Piled foundations will be required within the Newry river channel for the preferred ST01 bridge option. Marine piles are an expensive construction item, which are not only difficult to construct, but also pose particular health and safety concerns. Few companies within Ireland have sufficient capacity to carry out marine piling and contractors may need to be sourced from outside Ireland, this may affect lead in times for construction programming.

Piling for river piers will be carried out from floating pile driving equipment located within the river channel. All piling works will require consultation with all third parties and the River Newry navigable channel (Yellow Route) may need to remain operational at all times.

4.7.8.2 Construction over Watercourses

The location of the proposed bridges would be within an environmentally sensitive area and it is important that due consideration be given to the practicality of construction over the watercourse. It is recommended that where possible elements of the bridge should be prefabricated off site and lifted into position to minimise works over the river. Suitable platforms or scaffolding should be provided to ensure safety of workers during construction. Safety boats will be required within the river during any works over water deemed to be high risk.

Construction within a river channel will have an effect on the natural flow of the river and conveyance capacity of the river in times of flood. Avoidance of works within the river channel is not always possible when providing new infrastructure and negative flow effects may be experienced. Where possible, the design of the bridges should look to minimise the number of restrictions within the river channel.

4.7.8.3 River Traffic

The proposed bridges would be located within the navigable channel of the Newry River/Canal and during construction the channel should remain open at all times. Where this is not possible, alternative arrangements for vessels may need to be considered. Closing or impinging on the navigable channel may also give rise to compensation events for river users and will need to be considered at conceptual design stage.

The clearance requirements, for both vertical and horizontal should be considered through consultation with third parties and river/canal users. The clearance should be considered for any temporary construction platforms, formwork and falsework. The rising and falling tide levels will need to be considered to ensure adequate clearance is maintained at high tides to temporary works.

4.8 Hydrology and Drainage

4.8.1 Hydrology

Planning Policy Statement 15 states “development within floodplains will not normally be permitted unless the proposed scheme is an exceptional case or it is of overriding regional importance”. As this scheme is regionally important, the works may be considered within the river floodplain, subject to the implementation of measures to mitigate any loss of flood storage capacity, the adoption of design and construction measures to minimise the impact of flooding and the provision of safe means of evacuation in the event of a flood.

4.8.1.1 Red Route

Based on the evidence gathered from the research undertaken and the surveys carried out, the Red Route tie-in with the A2 Warrenpoint Road is unlikely to impact on any of the existing minor tributaries discharging into the Newry River. The route alignment which crosses the Newry River and Newry Canal will have a vertical elevation above the coastal and pluvial flood levels in the area.

The Red Route then continues north-west affecting a number of minor tributaries of the Newry River/Estuary/Canal which flow through Fathom Forest before outfalling into the Canal. The scheme alignment curves west towards Ellisholding Junction, and crosses Benson's Glen Stream. There is the possibility to rationalise and minimise the length of any potentially elongated culverts through the construction of diverted watercourses where appropriate and agreed by the statutory authorities.

4.8.1.2 Yellow Route

The Yellow Route tie-in with the A2 Warrenpoint Road is located further south than the Red Route and similarly is unlikely to impact on any of the existing minor tributaries discharging into the Newry River. As this route is further south than the Red Route, the alignment crosses only the Newry River as the end of the Newry Canal is located further north. The vertical elevation of this route will also be developed in consideration of any potential impact on the Q_{200} coastal flood levels as appropriate.

The Yellow Route then continues north-west affecting a number of minor tributaries of the Newry River/Estuary/Canal which flow through Fathom Forest before outfalling into the Canal. The scheme alignment curves west towards Ellisholding Junction, and crosses Benson's Glen. There is the possibility to rationalise and minimise the length of any potentially elongated culverts through the construction of diverted watercourses where appropriate and agreed by the statutory authorities.

4.8.1.3 Blue Route Options

All three Blue Route options are similar in terms of alignment and cross the same watercourses at various locations. Adjacent to the tie-in with the A2 Warrenpoint Road, the Knox-Peebles drain runs parallel to the A2 and will be crossed at this location. Just upstream from the crossing point is an existing culvert structure comprising twin 1000mm diameter pipes. A structure would therefore be required at the crossing point on these routes.

This alignment then crosses through Greenbank including the Q_{100} river floodplain, and therefore consultation with DfI Rivers on how this is to be taken forward is required. The existing Q_{200} sea defences will be impacted in this area and must be adequately protected and incorporated into the scheme to negate the risk of a breach. The vertical alignment of the scheme in this area will be set with appropriate cognisance to the coastal and pluvial flood levels.

The alignment crosses the Newry River and Newry Canal and then continues west where there is an impact to Benson's Glen Stream. Blue Route Option 1 will impact the stream at 1 no. location, whereas Blue Route Options 2 and 3 will impact at 2no. locations each. In this area there may be opportunities to rationalise and minimise the length of elongated culverts by diverting flows where appropriate.

For Blue Route Options 2 and 3, the alignments would impact a short length of open watercourse running perpendicular to the old Dublin Road which will require a length of culvert.

4.8.2 Drainage

Two principal watercourses are located within the study area, the Newry River and the Newry Canal. Subject to the establishment of the statutory consents, these rivers and their tributaries provide potential outfalls for the road drainage system. Outfalls to these watercourses will be considered once the permitted rates of discharge have been evaluated and water quality standards have been agreed.

Upon selection of the preferred route, meetings will be held with DfI Rivers to establish if discharge restrictions apply, and if so appropriate attenuation facilities within the scheme would be provided. Subject to appropriate land being available, attenuation facilities may also offer the opportunity for water quality improvement to road drainage, and has the added benefit of providing a landscaped amenity habitat area.

It should be noted that on the proposed southbound onslip from Ellisholding Junction for all three route options, the proposed alignment impacts upon an existing highways drainage detention basin.

The basin was constructed as part of the A1-N1 Cross Border Project which was completed in 2007 and attenuates highways drainage runoff from the scheme prior to discharge at an appropriate rate. The impact to this basin will be assessed further to agree a solution with the appropriate Statutory Authorities.

A walkover survey was completed to assess the nature and extents of existing fluvial and other, features likely to be impacted by each route option and these are summarised as follows:

Table 4.8.1 Conflicts with Watercourses

Route Option	Potential Feature Type Required	Number of Conflicts
Red Option	Culvert	7
	Diverted Watercourse	1
	Detention Basin	1
Yellow Option	Culvert	10
	Diverted Watercourse	1
	Detention Basin	1
Blue Route Option 1 *	Culvert	5
	Diverted Watercourse	1
	Detention Basin	1
Blue Route Option 2 *	Culvert	4
	Diverted Watercourse	1
	Detention Basin	1
Blue Route Option 3 *	Culvert	4
	Diverted Watercourse	1
	Detention Basin	1

* The walkover survey did not include the area for the Blue Routes to the west of the Fathom Line up to approximate Ch 1+000m due to landowner permissions not being in place. Therefore there may be a small number of additional culverts required for these options in the event that any are to be taken forward into the Stage 3 Assessment process.

4.9 Buildability

All route options would require some form of temporary traffic management system during construction. In particular, the Red and Yellow routes would require a temporary traffic management system to be in place at the online section along the B79 Fathom Line. Speed would be restricted over the affected length of road, 24 hours a day, and 7 days a week. This would require staged construction and the use of contraflows or temporary traffic signals to maintain at least a single lane of traffic open. As the Blue Route options are predominately offline, delays to the existing B79 Fathom Line should be largely avoided.

For all routes there may be delays and disruption to traffic using the affected sideroads during the construction phase.

All route options would require rock excavation and possible blasting at cut locations in the vicinity of Fathom Line and Flagstaff Road. The Blue Route options would also require rock excavation of Fathom Mountain towards the tie in with the old Dublin Road. There would be restrictions on blasting in the vicinity of the Belfast-Dublin railway line with the possible requirement of temporary works and monitoring of the existing Wellington Cut and adjacent retaining wall located on the rail line. Temporary road closures and traffic diversions maybe required during blasting works.

For all routes, the overbridge at Flagstaff Road would carry the side road over the mainline. As the proposed structure is online, either construction of a temporary road or a temporary road closure would be required with traffic diversions during the construction phase. The duration of any road closure would be dependent on the Contractor's programme and method of working.

For all routes, the construction of the at-grade roundabout on the A2 Warrenpoint Road, the tie in at old Dublin Road/Ellisholding Junction and the A1 on/off slip roads would require staged construction and traffic management during the construction phase to maintain traffic flow on the existing A2 and the old Dublin Road.

For the Newry River/Canal crossing, deep piled foundations would be required within the river channel for all route options. Marine piles are an expensive construction item, which are not only difficult to install, but also pose particular health and safety concerns.

The location of the proposed bridges are within an environmentally sensitive area and it is important that due consideration be given to the practicality of construction over the watercourse. Where possible elements of the bridge should be prefabricated off site and lifted into position to minimise works over the river or canal. Suitable platforms or scaffolding should be provided to ensure safety of workers during construction. Safety boats would be required within the river and canal during any works over water deemed as high risk.

Piling for river piers would be carried out from floating pile driving equipment located within the river channel. It may be possible, dependant on geometry and foundation extents to construct any abutment piles from the river banks. All piling works would require consultation with the Newry Mourne and Down District Council and the navigable channel and canal would need to remain operational at all times.

All routes require a crossing of the Belfast-Dublin railway line in the vicinity of Ellisholding Junction. All construction works of the bridge structure would need to be carried out in consultation with Translink/NIR and undertaken in line with any specific restrictions.

Generally, all the approved route options have buildability issues, particularly in construction of the bridge across Newry River/canal. The Red and Yellow Routes are more complex due to the online sections on Fathom Line. Further work would be necessary during the design development stage of the 'Preferred Route' to investigate the buildability of the design with the aim to provide the most buildable design within land available.

The construction of all routes would involve extensive earthworks and structures and it is considered that the majority of operations would be carried out using normal practices and in accordance with the requirements of current health and safety legislation, in particular Construction (Design and Management) Regulations (Northern Ireland 2016).

The construction of structures in the form of overbridges and river/canal bridges will, by their nature, involve working at height or over water; however none of the proposed structures pose significant difficulties or hazards that could not be safely overcome by an experienced Contractor.

Private access to properties would require to be maintained throughout the works. Noise and vibration as well as working hours would be restricted and would be monitored vigorously along the entire length of the works to minimise the construction effects on local residents and residences.

Hazards posed by Public Utilities are considered to be minimal for a scheme of this size.

With the exception of marine piling referred to previously the construction of the remaining works should be within the ability of most competent highway contractors.

4.10 Engineering Assessment Summary

All five routes have been assessed thoroughly with merit given to each route. Below is an engineering summary of each route:

Table 4.10.1 Engineering Summary Assessment

Route	No. of Relaxations	No. of Departures	No. of Junctions	Maximum Gradient	No. of Utility crossings	No. of Drainage conflicts	No. of Major Structures
Red Route	2	2	3	6%	33	8	3
Yellow Route	2	2	4	6%	30	11	3
Blue Route Option 1	2	3	4	6%	34	6	3
Blue Route Option 2	2	2	4	6%	37	5	3
Blue Route Option 3	2	2	4	8%	37	5	3

Table 4.10.1 provides a quantitative summary of the engineering characteristics associated with each proposed route. However, it does not consider the complexity of each element with major engineering challenges associated with the structures on both the Red and Yellow Routes. Both the Red and Yellow Routes have significantly larger river/canal crossings which have the added complexity of an opening structure. Furthermore, both routes would contain a category 3 structure (skew > 45 degrees) crossing the Belfast-Dublin railway line, again adding to the complexity.

As previously described, the nature of the departures and relaxations from standard associated with each route are the same; however, Blue Route Option 1 would require an additional departure from standard compared to the other four routes.

All five proposed routes would have significant earthworks which would require further consideration during Stage 3. The Yellow Route would have the most significant sections of cut along the slopes of Fathom Line.

5. Environmental Assessment

5.1 Introduction

5.1.1 Introduction

This section provides an Environmental Assessment of the approved route options identified from the Stage 1 'Preliminary Options Report' published in June 2017. As noted in previously, AECOM has been commissioned by DfI Roads to:

- undertake a DMRB Stage 2 Scheme Assessment of these options; and
- prepare a DMRB Technical Directive (TD) 37/93 Stage 2 Scheme Assessment Report (the "Preferred Routes Report").

The environmental assessment process has been undertaken, managed and compiled by AECOM and this section of the Stage 2 Scheme Assessment Report has been prepared in accordance with the guidelines detailed in DMRB Volume 11, which sets out the methods to be used and the level of detail required when assessing the environmental aspects under consideration. Assessment of major road schemes is undertaken in the following three stages:

- Stage 1 Assessment – identification of the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with broadly defined improvement strategies or corridors. This concludes in the selection of a preferred corridor(s) with a number of potential routes or scheme options.
- Stage 2 Assessment (current stage) – identification of the factors to be taken into account in choosing alternative routes or improvement schemes and to identify the environmental, engineering, economic and traffic advantages and constraints associated with those routes or schemes. This concludes in the selection of a preferred route or scheme option.
- Stage 3 Assessment – clear identification of the advantages and disadvantages, environmental, engineering, economic and traffic terms of the preferred route or scheme option. A particular requirement at this stage is an assessment of the significant environmental effects of the project, in accordance with the requirements of Part V of The Roads (Northern Ireland) Order 1993 as substituted by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 and amended by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2007. The initial Directive of 1985 and its three amendments have been codified in Directive 2011/92/EU of 13 December 2011. Directive 2011/92/EU was amended by Directive 2014/52/EU which entered into force on 15th May 2014 and transposed in national legislation by The Roads (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 and became operational on 16th May 2017.

5.1.2 Design Manual for Roads and Bridges

Volume 11 of the Design Manual for Roads & Bridges (DMRB) provides the methodology for the environmental assessment of the options under consideration. The relevant sections from DMRB applied to the assessment are described below and referenced in each of the technical Sub-Sections within Section 5 of this report. The DMRB is occasionally updated to take account of changes in policy and best practice. Where applicable, changes have been fully incorporated into the assessment methodology.

5.1.3 Stage 2 Environmental Impact Assessment

In August 2008, DMRB Volume 11, Section 1, Part 1 (Aims and Objectives of Environmental Assessment (HA 200/08)) amended the 'Stage 1, 2 & 3' approach to EIA, to instead ensure that the level of environmental assessment undertaken is appropriate to the project, irrespective of what stage in the design process the project is at. The overall objective is to define the depth of assessment necessary to enable informed decision making at as early a stage of the project as possible. It necessitates a 'fit-for-purpose' assessment method and relies on four 'Assessment Levels', as detailed below:

- Scoping;
- Simple;
- Detailed; and
- Mitigation/enhancement and monitoring.

For ease of reference, this report has retained the term 'Stage 2 Environmental Assessment'. Although this document may refer to both assessment methods, the outcome of the assessment has not been affected. The route options are subject to a Stage 2 Scheme Assessment, as defined in the DMRB TD 37/93. This Stage 2 Environmental Assessment has been prepared in accordance with the requirements of and guidance in DMRB 11.3. It identifies the relevant baseline conditions of the area which could be significantly affected by any of the approved route options, giving an indication of likely environmental effects. An overall assessment of the importance of impacts on the baseline environment is provided, highlighting any major problems or benefits. All figures mentioned in this section of the report are contained in Appendix A.

A number of environmental topics are assessed in relation to the route options, namely:

- Air Quality;
- Cultural Heritage;
- Ecology and Nature Conservation;
- Landscape and Visual;
- Land Use;
- Traffic Noise and Vibration;
- Pedestrian, Cyclist, Equestrian and Community Effects;
- Vehicle Travellers;
- Road Drainage and the Water Environment; and
- Geology and Soils.

To standardise the approach in reporting, each topic section is structured as follows:

- Introduction;
- Methodology;
- Consultations;
- Regulatory & Policy Framework
- Baseline Environmental Conditions & Constraints;
- Assessment of Environmental Impacts;
- Mitigation & Enhancement Measures; and
- Presentation of Key Issues.

The study area as shown on Figure 5.1.1 provides sufficient coverage to assess the impacts in relation to the majority of environmental topics listed above. However, there are instances (i.e. Air Quality, Ecology and Nature Conservation, Landscape and Visual) where the study area is different to that shown on Figure 5.1.1 in order to consider environmental effects appropriately. For all environmental topics, the study area has been defined by the methodologies outline in the DMRB Volume 11: Environmental Assessment and/or other relevant supplementary or superseding guidance (i.e. Interim Advice Notes) where appropriate.

5.2 Air Quality

5.2.1 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 in the vicinity, and may have a detrimental effect on people's health.

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 produced by DEFRA 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 regarding Nitrogen Deposition and the formation of ozone, while emissions of Carbon Dioxide (CO_2) are linked with climate change.

A new road project, such as the Newry Southern Relief 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. A relief road to the south of the City not only would relieve congestion on the existing road network, but can lower emissions and subsequently reduce overall pollutant levels by keeping traffic flowing steadily throughout the region.

At present, strategic traffic from Warrenpoint seeking access to the A1 must pass through Newry when travelling to/from Belfast or Dublin and as such, traffic conditions within the City are influenced significantly by this large volume of traffic. This includes a significant proportion of HDVs. Several signalised junctions exist on the Abbey Way/William Street/Dublin Road section of the route which, combining with the volume of local traffic in the City Centre, leads to significant delays and congestion, especially during periods of peak traffic demand. This is particularly the case on the approaches to the City Centre from A28 Dublin Road, A2 Kilmorey Street, Abbey Way and along Bridge Street/William Street.

5.2.2 Methodology

The DMRB Volume 11, Section 1, Part 1 sets out the aims and objectives of environmental assessment. The overall objective is to define the depth of assessment necessary to enable informed decision making at an early a stage of the project as possible. This necessitates a 'fit-for-purpose' assessment method and relies on four 'Assessment Levels':

- Scoping;
- Simple;
- Detailed; and
- Mitigation/Enhancement and Monitoring.

For air quality, each assessment level has two components. The first is for Local air quality, which is an estimation of pollutant concentrations that could change as a result of the proposals at specific locations. These concentrations are compared with the air quality criteria set to protect human health or vegetation, as appropriate. Both construction and operational effects are considered for local air quality.

The second component is for the Regional impact assessment, which examines the change in emissions for a range of pollutants as a result of scheme implementation, as these pollutants can have impacts on a regional, national and international scale. The two components may require different assessment levels, as detailed in the following sub-sections.

At this stage, a Transport Analysis Guidance (TAG) (Department for Transport, 2014) assessment was not carried out as it does not assist in the selection of a preferred route. The assessment will be used as necessary to complement the DMRB assessment procedure at Stage 3.

Traffic data for the air quality assessment has been extracted from COBA Models prepared as part of the Traffic & Economic Assessment for the scheme. Data has been extracted for the 'Base Year' (2017) and projected flows for the 'Do-Minimum' and 'Do-Something' scenarios (by incorporating the specific National Road Traffic Forecast (NRTF) for both 2023 (assumed year of Opening) and 2037 (Design Year).

5.2.2.1 Local Air Quality Assessment

A 'Simple' local air quality assessment was deemed 'fit-for-purpose' at this secondary stage, based on professional judgement and a review of projected traffic volumes and previous air quality assessments for this area. Although the Scheme 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 an extent to warrant a 'Detailed' assessment.

The 'Simple' assessment requires the identification of affected roads, junction locations, properties which may be in exceedence of the Air Quality Strategy objectives or limit values, sensitive locations, Air Quality Management Areas (AQMAs) and designated ecological sites (e.g. SPAs, SACs or ASSIs). The steps taken include:

- 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 route options. Affected roads are those for which the road alignment will change by 5m or more; daily traffic flow will change by 1000 Annual Average Daily Traffic (AADT) or more; Heavy Duty Vehicle (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. The roads which meet these criteria are shown on Figures 5.2.1 – 5.2.6;
- estimating pollutant concentrations at a wide range of properties that are likely to be affected by the route options, including those likely to have the highest concentrations, those likely to have the largest changes in concentrations (either decrease or increase), those representative of large numbers of properties, and those that house the young, elderly or other susceptible populations (Figure 5.2.7). The estimates are made using the 'Local' application of the DMRB Screening Method;
- producing a map showing all properties where people might possibly be subjected to a change in air quality and areas which may be more sensitive to changes in air quality, such as hospitals, schools or nursing homes within 200m of the existing route and the route options (Figure 5.2.8). It should also highlight areas where pollution may be more severe and incorporate the boundaries of AQMAs and ecologically designated sites (where appropriate);
- in the unlikely event that any of the National Air Quality Standard (NAQS) limit values are estimated to be exceeded with the route options, in any of the years in which they apply further calculations would be carried out to determine the first year in which the criteria would be achieved. Furthermore, a 'Detailed' assessment would be deemed necessary; and
- if a designated ecological site has been identified as likely to be affected by the route options, 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 (2023), for both the 'Do-Minimum' and 'Do-Something' scenarios. The estimates are also made using the 'Local' application of the DMRB Screening Method. 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 route options, determined in the assumed year of Opening.

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. The IAN suggests air quality modelling should continue to be completed in accordance with the assessment methodology set out in HA207/07 and with reference to Defra's LAQM.TG(09) guidance where applicable. However, the verified modelled NO_2 concentrations should be adjusted using a Highways Agency Long-Term Gap Analysis Calculator (v1.0) spreadsheet which has been developed to support scheme assessments to take into account the impact of future alternative NO_2 projections.

Selection of Representative Receptor Sites

As noted earlier, for the purpose of assessment, it is necessary to identify representative locations in proximity to the existing route and various route options that are likely to be most affected. Hence the location of sensitive properties was examined and representative receptor sites carefully chosen. Each receptor site was selected to illustrate the impact that the various route options would have on local air quality, in order to portray the level of change that a receptor would experience and whether these key properties would be close to, or in breach of, the NAQS limit values.

In order to establish 'Base Year' and assumed year of Opening (2023) 'Do-Minimum' and 'Do-Something' local air quality pollutant concentrations, ten existing residential properties / community facilities were selected (Figure 5.2.7). In order to compare the respective impacts of the various scenarios, the location of these 10 receptor sites remains unchanged throughout the assessment.

Receptor Site 1: [redacted] This sensitive community facility at [redacted] is currently exposed to a high volume of traffic movement, and was selected to demonstrate the effect that construction of any of the Approved Options would have on local air quality at this location, due to a reduction in passing strategic traffic. This receptor is located within the Newry (Urban Centre) AQMA, which has been declared for NO_2. It is likely that with implementation of any of the route options, this sensitive facility may experience a marginal improvement in air quality.

Receptor Site 2: [redacted] – This residential property was selected to be representative of the typical effect that a southern relief road would have on the Cloghogue area, as a proportion of strategic traffic would be reassigned away from Cloghogue Junction. It is likely that a marginal improvement in air quality may be experienced in this area.

Receptor Site 3: [redacted]– This residential property may experience either a deterioration, or improvement in air quality depending on the Approved Option. Any of the Blue Route options would likely result in a deterioration due to the introduction of a junction in close proximity, with the Red or Yellow Route options likely resulting in an improvement, due to reassignment of a proportion of strategic traffic away from this property.

Receptor Site 4: [redacted]– This residential property was chosen to be representative of the impact of the Red Route, and the associated reassignment of some traffic away from the front of this property, situated close to the A2. Implementation of the Red Route may result in an overall improvement in air quality at this receptor.

Receptor Site 5: [redacted]– This residential property was selected to be representative of the typical affect that any of the Approved Options would have on nearby properties. With implementation, it is likely that the property may experience a marginal deterioration in air quality as a proportion of strategic traffic would be brought much closer to it.

Receptor Site 6: [redacted] – This residential property was selected to be representative of the typical affect that any of the Approved Options would have on nearby properties. With implementation, it is likely that the property may experience a marginal deterioration in air quality as a proportion of strategic traffic would be brought much closer to it.

Receptor Site 7: [redacted] - This residential property was selected to be representative of the typical affect that the Red or Yellow routes would have on properties close to the upgrade of Fathom Line. With implementation, it is likely that the property may experience a marginal deterioration in air quality as a proportion of strategic traffic would be brought much closer to it.

Receptor Site 8: [redacted] – This residential property was selected to be representative of the typical affect that the any of the Approved Options, but particularly the Blue Route Options would have on properties close to the Dublin Road tie-in. With implementation, it is likely that the property may experience a marginal deterioration in air quality as a proportion of strategic traffic would be brought much closer to it.

Receptor Site 9: [redacted] – This residential property was chosen to be representative of the impact of the indicative junction arrangement at Ellisholding, which is congruent for all Approved Options at this location. As this property is currently close to the existing A1 and Ellisholding Junction, the reassignment of traffic may have only a slight impact on air quality in the area.

Receptor Site 10: [redacted]- This residential property was chosen to be representative of the impact of the indicative junction arrangement at Ellisholding, which is congruent for all Approved Options at this location. As this property is currently close to the existing A1 and northbound onslip at Ellisholding Junction, the reassignment of traffic may have only a slight impact on air quality in the area.

5.2.2.2 Background Concentrations

As part of the air quality assessment, it is necessary to establish background pollutant concentrations for the study area. The local background concentrations are provided by the Department for Environment, Food and Rural Affairs (Defra) via their Local Air Quality Management (LAQM) support pages [online]. These pages contain a variety of support functions for local authorities and practitioners of local air quality management.

Background concentrations of NO_x, NO_2 and PM_{10} are provided for each 1x1km grid for the Newry, Mourne and Down District Council (NMDDC) area. The 2015 base year maps and the projections for each year up to 2030 are used for all new assessments.

With reference to DMRB 11.3.1 Annex D, background concentrations may be directly appropriate for most urban situations, for which several monitoring sites have been used for verification. However there are few measurements available for rural locations, such as the outskirts of Newry. An analysis of the rural background concentrations allocated to individual grid squares containing road links indicates that they may be unduly influenced by the road. As this may be the case with the A2, concentrations used are derived from the average background concentrations up to four grid squares away from either side of the road where there are no other significant sources of pollution, as per guidance in DMRB 11.3.1, Annex D, para. 5.2.

5.2.2.3 Regional Air Quality Assessment

The Regional air quality ‘Simple’ assessment seeks to establish the total and change in emissions that would result with the various route options, 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 more wide 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’ (2023), and (c) ‘Do-Minimum’ and ‘Do-Something’ scenarios in the ‘Design Year’ (2037) for the total emissions of CO, Total HydroCarbons (THC), NO_X, PM_{10} and Carbon (C). The procedure requires the calculation of total forecast emissions after the various route options would have been built, and deduction of the estimated emissions from the existing road network, where traffic patterns are affected by the scheme. As a result of the global nature of the impact of some pollutants, a consideration of the change in emissions resulting from the various route options is therefore useful in the context of regional air pollution.

Again, the Regional assessment incorporates all roads likely to be affected by the route options. 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 various route options, calculations are undertaken using the 'Regional' application of the DMRB Screening Method v.1.03c.Construction Assessment

At present, there are no statutory UK or EU standards for use in the assessment or control of nuisance dust. The emphasis of the regulation and control of demolition and construction dust should therefore be the adoption of good working practices on site.

Good design practice is a process that is informed by impact assessments and is able to avoid the potential for significant adverse environmental effects at the design stage. This approach assumes that mitigation measures beyond those inherent in the proposed designs are identified as being necessary in the impact assessment and would be applied during the works to ensure potential significant adverse effects are minimised. Examples of accepted good site practice include guidelines published by the IAQM (IAQM, 2014) and the Considerate Constructors Scheme.

As scheme construction would last for at least 2 years, traffic management measures and the effect of additional construction vehicles should also be assessed as an additional scenario. However, at this stage in the process, a qualitative assessment is deemed appropriate, as details of construction phase traffic flows and types of plant used are not yet available.

The locations of any sensitive receptors within 200m of the construction site should be clearly identified, such as housing, schools and hospitals or designated species or habitats within a Designated Site, so that mitigation measures to reduce dust emissions can be rigorously applied.

5.2.2.4 Assessing the Significance of Effects

With reference to DMRB 11.2.5.2, it is not sufficient to 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 impact (change). In other words, significance criteria are used to report the effect of the impact; however DMRB does not provide an approach to determining the significance of effects resulting from changes to air quality associated with the various route options.

Although not contained within the DMRB itself, guidance contained within IAN 174/13 has recommended an approach to defining the magnitude of changes and describing air quality impacts at specific receptors. No specific guidance on assigning the environmental value (or sensitivity) of receptors is provided, however all locations including residential properties, and places where members of the public or sites designated for their ecological value might be regularly exposed to airborne contaminants attributable to vehicular activity would be considered sensitive, and therefore highly important.

As recommended by IAN 174/13, the magnitude of impact should be described using the criteria set out in Table 5.2.1.

Table 5.2.1: Magnitude of Impact for changes in Annual Mean NO_2 and PM_{10} concentrations at a receptor

Magnitude of Change	Annual Mean Change
Large	Increase/Decrease >4 µg/m^3
Medium	Increase/Decrease 2-4 µg/m^3
Small	Increase/Decrease 0.4 – 2 µg/m^3
Imperceptible	Increase/Decrease <0.4 µg/m^3

Source: Highways Agency IAN 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07)

When describing an air quality impact, the actual concentration at that specific receptor should be taken into account, in combination with the magnitude of impact as a means of estimating the significance of potential effects, as detailed in Table 5.2.2. Professional judgement and awareness of the relative balance of importance between sensitivity and magnitude allows the overall significance of impact to be assessed with mitigation (if required) to define residual impacts.

Table 5.2.2: Air Quality impact descriptors for changes to annual mean NO_2 and PM_{10} concentrations at a receptor

Absolute Concentration in relation to Objective/Limit Value	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value with Scheme (>40 µg/m^3)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with Scheme (36-40µg/m^3)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with Scheme (30-36µg/m^3)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with Scheme (<30µg/m^3)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value without Scheme (>40 µg/m^3)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value without Scheme (36-40µg/m^3)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value without Scheme (30-36µg/m^3)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value without Scheme (<30µg/m^3)	Negligible	Negligible	Slight Beneficial

Source: Development Control: Planning for Air Quality (2010 update)

Interim Advice Note (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 (HA207/07)’, 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 5.2.1), due to a route option, which causes any of the below to occur at a 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.

5.2.2.5 Limitations and Assumptions

The DMRB Screening Method provides a test that is designed to establish whether a road project ought to be subject to a more ‘Detailed’ air quality assessment and is intended to give a reliable answer quickly. However, with reference to DMRB 11.3.1 Annex C, it does not take into account a number of factors that could affect concentrations. Essentially, if these are considered important, then a ‘Detailed’ approach may be required. The factors which would be considered relevant to this scheme include:

- the effect of cuttings/embankments; and
- local meteorological conditions, including prevailing wind direction.

The various route options are situated on embankments and in cuttings over the course of their length, and this can have an influence upon local air quality conditions at nearby receptors. Placing the road on an embankment can increase the distance between a roadside receptor and vehicles, thus allowing more time/distance for dispersion of pollutants, thus reducing concentrations, and giving a general beneficial effect. The same principle applies to some roads located in cuttings. Consequently, whilst the effect of embankments and cuttings has not been considered in the 'Simple' air quality assessment, it can be confidently assumed that any receptor in proximity would experience slightly improved local air quality conditions than those predicted using the Screening Method.

The Screening Method provides a test that is designed to establish whether a road project ought to be subjected to a more 'Detailed' air quality assessment (in which local meteorological conditions would be a consideration). However, pollutant concentrations estimated by this Screening Method are so conservative that it is not deemed necessary to consider local meteorological conditions.

The DMRB Screening Method 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}. However, the Screening method does not predict concentrations of $PM_{2.5}$ (though PM_{10} can be used as an indicator of estimated $PM_{2.5}$ levels).

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 Method 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 Defra, recent 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, 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. It enables Highways Agency (HA) scheme assessments (using the DMRB screening method) 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 HA of long-term monitored NO_2 concentrations based on monitoring data collected between 2006 and 2010. The outcome of the analysis by the HA 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 HA207/07 and with reference to Defra's LAQM.TG(09) guidance where applicable. However, the verified modelled NO_2 concentrations should be adjusted using a HA spreadsheet which has been developed to support scheme assessments.

The adjusted long-term NO_2 results should be reported in the environmental assessment for each receptor, alongside the corresponding result based on Defra's technical guidance. The results from both assessments should be compared to the Air Quality thresholds.

5.2.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. The following table outlines the responses from the Stage 2 consultation from an air quality perspective. It should be noted that any relevant responses which were received during the Stage 1 consultation, although not recorded in this Stage 2 consultation table, are considered/addressed within the appropriate technical section.

Table 5.2.3: Summary of formal consultation responses in relation to Air Quality

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Air and Environmental Quality Unit	09 Apr 2018	09 May 2018	Recommend consultation with NMDDC regarding potential air impact and for local air quality information. Provided links to NI air quality information and legislation, and recommended following DMRB assessment procedures.

5.2.4 Regulatory & Policy Framework

5.2.4.1 Legislation

The management of air quality in Northern Ireland is currently based on the requirements of European Union (EU) Air Quality Directives, and the UK Air Quality Strategy.

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.

In Northern Ireland, this Directive is currently transposed by the Air Quality Standards (Amendment) Regulations (Northern Ireland) 2017, which amended the Air Quality Standards Regulations (Northern Ireland) 2010. 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. These limit values are binding in Northern 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. It is the responsibility of the Department of Agriculture, Environment and Rural Affairs (DAERA) to inform the public about air quality in the region, particularly with regard to warning the public when information and alert thresholds are exceeded.

Of relevance to the scheme, the limit values (as detailed within Schedule 2 of the Regulations) for pollutants specific to the protection of human health are contained within Table 5.2.4.

Table 5.2.4: Relevant Air Quality Standards for the protection of human health

Pollutant	Averaging period	Value	Maximum Permitted Exceedances
Nitrogen Dioxide (NO_2)	Annual Mean	40µg/m^3	None
	Hourly Mean	200µg/m^3	18 times per year
Particulate Matter (PM_{10})	Annual Mean	40µg/m^3	None
	24-hour	50µg/m^3	35 times per year
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25µg/m^3	None

Source: Schedule 2 of the Air Quality Standards Regulations (Northern Ireland) 2010 [as amended]

DAERA 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. The critical levels for pollutants of relevance to the scheme are summarised in Table 5.2.5.

Table 5.2.5: Critical levels for the protection of vegetation specific to the assessment of road schemes

Pollutant	Critical Level	
	Concentration	Measured as
Oxides of Nitrogen (NO_x)	30µg/m^3	Annual mean

Source: Schedule 6 of the Air Quality Standards Regulations (Northern Ireland) 2010[as amended]

A list of other current Northern Ireland Air Quality legislation, which may be pertinent to the assessment of the route options, is detailed on the DAERA's Air Quality Northern Ireland webpage (http://www.airqualityni.co.uk).

5.2.4.2 Policy

Local Air Quality Management

Local Air Quality Management (LAQM) provides the framework under the Environment Order (NI) 2002 within which air quality is managed by the councils in Northern Ireland. LAQM requires councils to review and assess a range of air pollutants against the objectives set by the Air Quality Strategy, using a range of monitoring, modelling, observations and corresponding analyses. For locations where objectives are not expected to be met by the relevant target date, councils are required to declare an Air Quality Management Area (AQMA), and (along with relevant authorities), to develop an Action Plan addressing the problem.

Regional Development Strategy

In 2012, the then Department for Regional Development (now DfI) published the Regional Development Strategy 2035 (RDS). The document sets out the policies and strategies for Northern Ireland, and includes region-wide policies. Policy RG9 states:

"Reduce our carbon footprint and facilitate mitigation and adaptation to climate change whilst improving air quality.

***Reduce noise and air pollution from transport**. This will include the need to adapt the existing transport network to facilitate the modal shift away from the car. The car may be essential for some journeys but its social and economic value needs to be weighed against its impact on the environment. The way existing transport is used needs to be looked at to favour modes of transport that allow reduction of Northern Ireland's carbon footprint.*

***Protect Air Quality Management Areas**. In order to improve air quality for all citizens in Northern Ireland local authorities are responsible for reviewing the state of air quality in their district. To assist them with this process an Air Quality Strategy has been devised for the UK. This sets down standards and objectives for the air quality pollutants causing the problems and allows local authorities to review air quality in their area against these. Where local air quality fails to meet the required standard, the local authorities must declare an AQMA, covering the geographical area where a problem has been identified for the pollutant that exceeds its permitted standard. Development should be consistent with the AQMA action plans. NI departments also have a responsibility to ensure limit values, target values and alert thresholds for specified pollutants are not exceeded."*

5.2.5 Baseline Environmental Conditions & Constraints

5.2.5.1 Local Air Quality Management Areas

As noted previously, councils are required to review air quality and assess whether any locations within their jurisdiction are likely to exceed the Air Quality Strategy Objectives. If they identify areas of exceedance, then one or more AQMAs will need to be defined. Currently, NMDDC has declared two AQMAs within its jurisdiction, both of which are within Newry:

- Newry (Urban Centre) AQMA; and
- Newry Canal Street AQMA.

Newry (Urban Centre) AQMA

The Council first reviewed and assessed local air quality in 2006, and reached the decision to declare five AQMAs within Newry City as a result of NO_2 and PM_{10} concentrations. Following further review and assessment during the three-year period 2006 to 2008, the Council revoked all five AQMAs and replaced them with one larger AQMA (Newry (Urban Centre)) for NO_2 only. All former AQMAs remain revoked for PM_{10}.

As shown on Figure 5.2.9, the Newry (Urban Centre) AQMA incorporates the area originally covered by the five revoked AQMAs (Bridge Street, St Mary's Street, Canal Street, Water Street and A2 Kilmorey Street), as well as an additional area of exceedance in Sandy Street. In terms of coverage, the AQMA encompasses the majority of the City and in terms of source, road traffic is considered to be a principal contributor of NO_2.

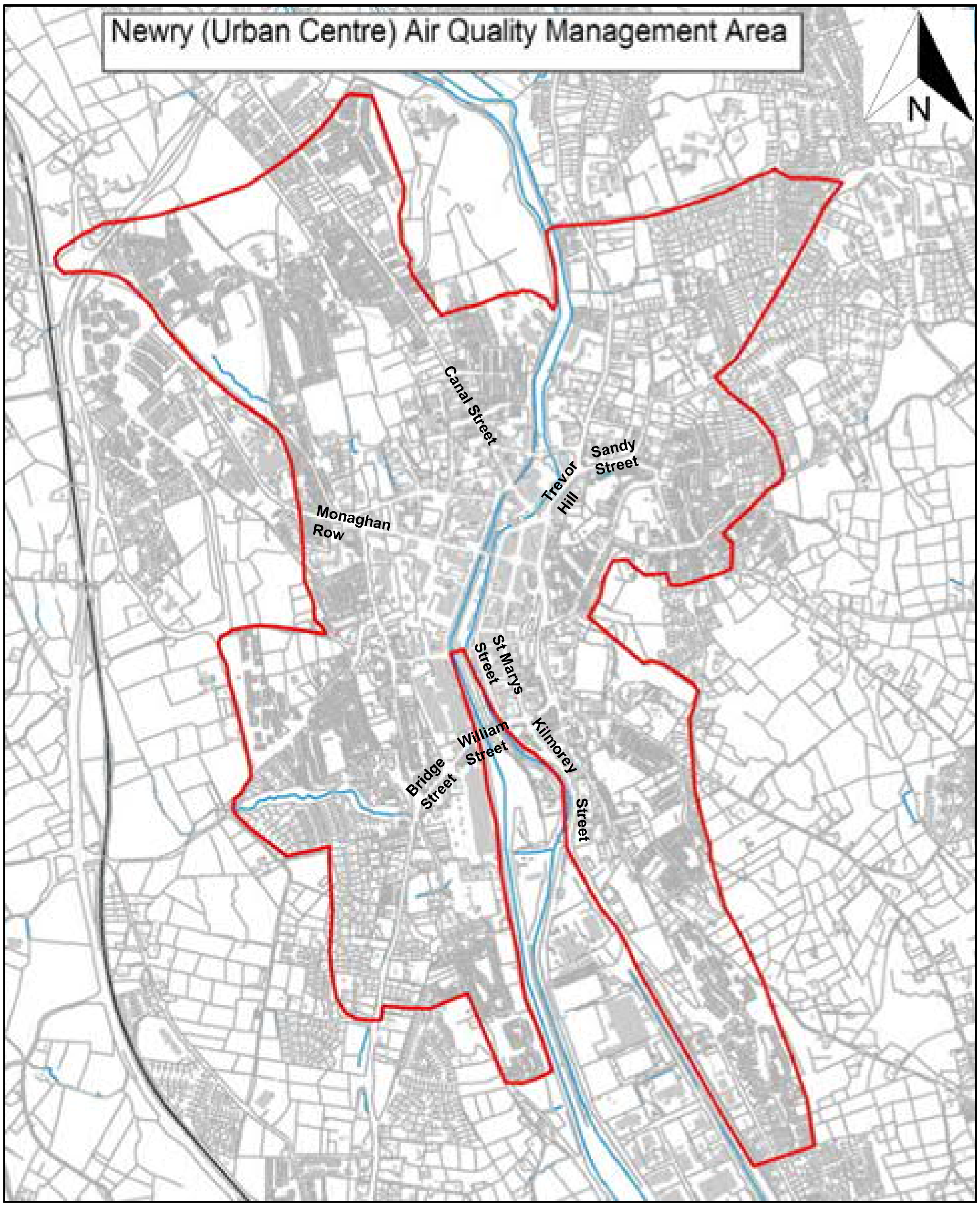


Figure 5.2.9 Newry (Urban Centre) AQMA

Source: http://aqma.defra.gov.uk/images/aqma_maps/Newry.jpg

Newry Canal Street AQMA

The Newry Canal Street AQMA (Figure 5.2.10) has been declared for Particulate Matter (PM_{10}) and incorporates part of Canal Street between its junction with Chequer Hill and Barrack Street to the north and the junction with New Street to the south, with adjacent land. It also falls entirely within the Newry Urban Centre AQMA.

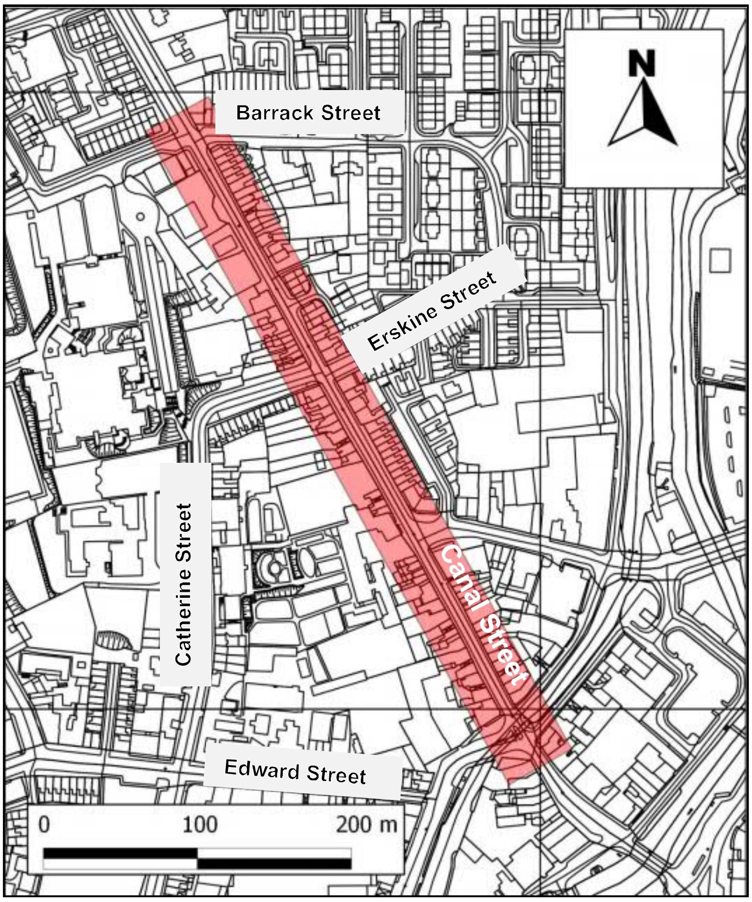


Figure 5.2.10 Canal Street AQMA

Source:http://www.airqualityni.co.uk/assets/documents/dcreports/Newry_and_Mourne_Canal_Street_FA_J1940_D2_130814.pdf

5.2.5.2 Monitoring

The Council currently operate one Automatic Air Quality Monitoring Station (AQMS) in Newry, which monitors NO_2 and PM_{10} levels, at Canal Street. Previously, the Council also operated Monitoring stations at both Trevor Hill and Monaghan Row (until April 2016); however these stations are no longer in use. The Automatic monitoring network measures air pollutants in near real-time to produce hourly average concentrations. The measurements are collected from the individual sites by dial-up modem. A range of simple statistics are routinely calculated by the database for the automatic monitoring data each night, including daily mean, maximum and minimum values for pollutants, and running 24-hour means for PM_{10}. NMDDC has produced a number of reports including Action Plans, Progress Reports and Screening Assessment Reports in relation to the potential and actual exceedances in the area.

The latest Screening report '*2015 Updating and Screening Assessment for Newry, Mourne and Down District Council in fulfilment of Environment (Northern Ireland) Order 2002 Local Air Quality Management*' (January 2016) confirmed that monitored NO_2 concentrations (both from the AQMS and diffusion tubes located within Newry City Centre) in 2014 were above the annual mean objective at Canal Street and Trevor Hill, for which there is an agreed Action Plan to address these exceedances. There was no exceedance of the hourly mean NO_2 objective. The PM_{10} daily mean objective was exceeded within Canal Street.

The most recent progress report, the 2017 Air Quality Progress Report, provides a review and assessment of new or existing potential sources of air quality pollutants and results of monitoring for the 2016 calendar year. This identified that nine of twenty-four diffusion tubes within Newry City Centre exceeded the annual mean objective for nitrogen dioxide (NO_2). However, there were no exceedances of annual mean, or daily mean objectives for PM_{10} during 2016.

Newry (Urban Centre) AQMA Action Plan (March 2010)

According to the 'Newry (Urban Centre) Air Quality Management Area Action Plan' (March 2010), with its location within the valley of a basin, Newry has been subject to episodes of poor air quality. This was first recognised in the 1960s at which time monitoring of levels of smoke and sulphur dioxide had already commenced. At that time, the principal source of this pollution was from coal-burning appliances.

The Council's air quality review process had identified road transport as a significant source of NO_2 within the Newry (Urban Centre) AQMA. Whilst the proposed Action Plan measures main focus is on reducing levels of NO_2 from road transport, there is also recognition that there are other sources of NO_2 within Newry City, including emissions from heating systems in residential properties and emissions from industrial processes where present. The Action Plan identified a number of measures to help lower levels of air quality pollution. These included: improvements to infrastructure, improvements to public transport, increased energy efficiency of homes and cleaner heating systems, and measures to encourage the modal shift from private car to public transport and cycling.

In terms of actual and proposed measures, Action 5 of the Action Plan makes specific reference to delivering a Newry Southern Relief Road and how it is expected to improve local air quality within the City. Action 23 of the Action Plan states that the Greater Newry Vision Partnership (made up of NMDDC, local business, economic, community and public sector leaders) will act as a facilitator to influence the speed of implementation of the actions required, as detailed in the Newry Vision published by the partnership in 2006; this includes provision of a Newry Southern Relief Road.

The Action Plan goes on to test impact scenarios when measures are implemented, focusing specifically on whether air quality objectives will be met within the declared AQMAs. A scenario tested included the effect of the reduction in HDVs within each area, based on a 50%, 75% and 90% reduction, of which the relief road was identified as the only tangible solution that could achieve such reductions.

The scenario testing noted that reductions in HDV movements along Water Street and A2 Kilmorey Street may be achievable through construction of a Newry Southern Relief Road. If this scheme is implemented, it is expected that a significant proportion of HDVs would be diverted to the Relief Road instead of passing through these particular streets. As HDVs contribute disproportionately to pollutant emissions, targeting these vehicle types can have significant results.

5.2.5.3 Study Area (Natural and Built Environment)

As noted previously, the City is located within a valley and is surrounded by the Mourne Mountains to the east, and the Ring of Gullion to the south-west. The Cooley Mountains lie to the south with a ridge extending northwards to Fathom Mountain.

Within the study area, there is a large variation of land types and uses, including: residential, agricultural, woodlands, scrub and commercial land. Consequently, the study area is intersected by a network of local roads and two major highway routes, namely the A1 connecting from Belfast heading south to the border with the Republic of Ireland (RoI) bypassing Newry to the west, and the A2 from Warrenpoint heading north to Newry.

5.2.5.4 Existing Road Network

Newry has historically been a large centre of population and commerce. It has a significant number of regionally-important roads which link it to the surrounding smaller regional towns as well as being connected to the strategic motorway/trunk road network via the A1 located in the western reaches of the study area. There are also a number of local roads which cross the study area, interconnecting with each other and the A1. The existing road network, indicating all major roads within the study area, is shown on Figure 5.1.1.

Within the study area, there are six sections of A-class road:

- A1/N1 Belfast-Dublin Corridor;
- A2 Warrenpoint Road;

- A2 Warrenpoint Road/Kilmorey Street north of Greenbank Roundabout;
- A28 William Street/Abbey Way;
- A2 Bridge Street/Dublin Bridge; and
- A2 Dublin Road.

There are two sections of B-class road:

- B79 Fathom Line/R173 in the RoI; and
- B79 Drumalane Road.

The various local unclassified roads include:

- U5284 Fathom Line/Albert Basin;
- C0219 Flagstaff Road;
- U5291 Ferryhill Road;
- U5285 Hillhead Road; and
- U5328 Barracric Road.

5.2.5.5 Property Counts & Sensitive Facilities

As part of the local air quality assessment, it is necessary to estimate the number of properties in 50m bands to 200m from the road centre for each road expected to be affected by each route option. The existing route through Newry passes through a dense urban area, and as expected, the number of properties within 200m of the route is relatively high, especially within 50m of the roadside, where air pollutants attributable to vehicular activity are most concentrated. Moreover, there are numerous sensitive facilities close to this existing route.

Some facilities are deemed particularly sensitive to changes in air quality, such as those used by the elderly, schools and hospitals, or outdoor communal facilities (Figure 5.2.8). Within 50m of the existing affected road network are;

- Drumalane House Care Home;
- St Colman's Park;
- Newry Market;
- St Mary's Church of Ireland;
- 1st Presbyterian Church(Non-Subscribing), Newry;
- Gateway Club;
- *Bunscoil an Iuir*;
- Orana Children & Family Centre;
- 1st Dromore Scout Group Scout Hall;
- Our Mother of Mercy Nursing Home;
- Health & Social Care Park;
- Convent of Mercy;
- St Mary's High School;
- St Mary's Church and Graveyard;
- Southern Regional College; and
- Funhouse.

In terms of outdoor facilities, there are a number of areas within 50m of the extensive existing road network, including (from north to south);

- Newry Bowling Green;
- Newry Tennis Club;
- Playing Fields at Drumalane Park;
- Pairc Esler;
- Newry Showgrounds & Training Pitch;
- Gerry Brown Park;
- Victoria Lock Picnic and Amenity Site; and
- Forest Service paths within Fathom Forest.

Again, this list is not exhaustive as other sensitive facilities are located within the city, and in proximity to the existing route.

5.2.5.6 Local Air Quality Assessment

With use of the 10 receptor site locations (Figure 5.2.7) and 'Base Year' traffic flow data (2017), local air quality pollutant concentrations have been calculated (Appendix B, Annex A) and summarised in Table 5.2.6.

Table 5.2.6: Local Air Quality Assessment for 'Base Year' (2017)

Receptor Number and Name		NO_2	PM_{10}	
		Annual Mean µg/m^3	Annual Mean µg/m^3	Days >50 µg/m^3
1	[redacted]	17.90	12.04	0
2	[redacted]	6.01	8.60	0
3	[redacted]	9.03	9.68	0
4	[redacted]	5.26	9.66	0
5	[redacted]	4.60	7.77	0
6	[redacted]	4.53	8.01	0
7	[redacted]	5.12	8.09	0
8	[redacted]	6.34	8.34	0
9	[redacted]	5.73	8.20	0
10	[redacted]	8.57	8.79	0
NAQS	Limit Value	40.0	40.0	35
	Compliance Year	2005	2004	2004

Under 'Base Year' (2017) conditions, all airborne contaminants screened at the various receptor locations fall well below the NAQS Limit Values for the protection of human health.

As expected of the receptor sites selected, the lowest pollutant concentrations experienced would be at those furthest from passing strategic traffic and relatively distant from the local road network, namely Receptors 6, 5, 7 and 4 ([redacted] and [redacted] respectively). 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.

Locations with the highest NO_2 and PM_{10} levels are those in closest proximity to the existing route through Newry City Centre, namely Receptor 1 ([redacted]), which experiences the highest levels of airborne pollutant concentrations of all the receptors under consideration. As mentioned previously, this property is located immediately adjacent to the strategic route and thus is exposed to comparatively high volumes of passing traffic, however still remains well within the NAQS limit values.

5.2.5.7 Designated Areas

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 global 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 level of 30 µg/m^3 (annual mean) forming the critical load for designated ecological sites. NO_x is composed of Nitric Oxide (NO) and its oxidation product Nitrogen Dioxide (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 and are expressed in deposition units of kg N ha^{-1} year^{-1}.

Designated sites with the potential to be affected at a local scale were identified within 200m of the existing and Approved Options, and assessed in accordance with the methodology set out in DMRB 11.3.1 Annex F. There are three sites designated for either their ecological or earth science interest within the study area. These are:

- Carrivemaclone ASSI;
- Carlingford Lough ASSI; and
- Fathom Upper ASSI.

The locations of these sites are shown on Figures 5.4.1 and 5.11.4.

As a site designated for its geological interest, Carrivemaclone ASSI does not require assessment from an air quality perspective, as the features would be unaffected by a change in air pollutant concentrations. With reference to the Air Pollution Information System (APIS) website (accessed April 2018), the habitat interest features within Carlingford Lough ASSI, namely Littoral Sediments associated with both Coastal Saltmarsh and Mudflats, are not sensitive to Nitrogen. As a result, no air quality assessment needs undertaken for Carlingford Lough ASSI.

Fathom Upper ASSI has designated ecological features which may be sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by local air pollutant concentrations on vegetation. This ASSI is shown on Figure 5.4.1.

The European Nature Information System (EUNIS) outlines the nitrogen deposition critical loads for protected habitats. In this case, the critical load for Low and Medium altitude hay meadows (E2.2) in relation to Fathom Upper is 20-30kg N ha^{-1} year^{-1} (Source: Air Pollution Information System (*APIS) Website, accessed April 2018*).

An exceedance of the critical load range could lead to a decrease in diversity, and an increase in tall grasses at the site. 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. However, the values summarised in Table 5.2.7 represent the calculated concentrations and rates at the closest point within the designated site to the existing route for ‘Base Year’ (2017) conditions.

Table 5.2.7: Annual Mean NO_X concentrations and Nitrogen Deposition rates at designated ecological sites for 'Base Year' (2017) within 200m of the existing route.

Designated Ecological Site	NO_x annual mean (µg/m^3)	Nitrogen Deposition (N)(kg N ha-^{1} year-^{1})
Fathom Upper ASSI	5.26	18.32

As shown in Table 5.2.7, the NO_x concentration and Nitrogen Deposition rates at Fathom Upper ASSI are currently below the critical load range of 20-30kg N ha^{-1} $year^{-1}$.

5.2.5.8 Regional Air Quality Assessment

The contribution of the existing road layout to the overall Regional air quality has been established for 'Base Year' (2017). This gives a comparator for future 'Do-Minimum' and 'Do-Something' scenarios in the assumed year of Opening (2023) and the Design Year (2037). Base year Regional air quality conditions are summarised in Table 5.2.8 and detailed in Appendix B, Annex B.

Table 5.2.8: Regional Air Quality assessment for 'Base Year' (2017)

Year	Network	Pollutant (Tonnes/yr)				
		CO	THC	NO_x	PM_{10}	C
2017	Existing	63.717	7.866	36.44	1.165	4961

5.2.6 Assessment of Environmental Impacts

5.2.6.1 Operation

The environmental effects (from an air quality perspective) of developing a relief road to the south of Newry are likely to be threefold;

- sensitive receptors adjacent to the relief road may experience increased exposure to airborne pollutants attributable to vehicular activity;
- sensitive receptors along the existing route between the A2 Warrenpoint Road and the A1, which passes through the southern fringe of Newry City Centre, may experience reduced exposure to airborne pollutants attributable to vehicular activity with the removal of some strategic through traffic; and
- sensitive receptors adjacent to roads intersecting with the relief road may experience some minor changes in exposure to airborne pollutants attributable to vehicular activity, depending on side-road realignment and traffic redistribution.

As the scheme would relieve some of the city centre congestion associated with the through movement of strategic traffic between the A1 and A2, a change in traffic volume in the order of 7-17% (route dependent) in the assumed year of scheme Opening (2023) may be experienced on parts of the existing route. Nevertheless, as Newry acts as a local hub, it is inevitable that traffic would continue to be attracted to the City Centre which would continue to contribute to congestion, especially at peak times. Therefore, whilst local air quality within the City would improve, the beneficial change may not be significant or perhaps enough to revoke any declared AQMA.

5.2.6.2 Sensitive Receptors

As noted previously, the existing route between the A2 and A1 through the southern fringe of Newry City Centre has a comparatively high number of sensitive receptors within 200m of the road (Figure 5.2.7), especially within the first 50m, where air pollutants attributable to vehicular activity are typically in their highest concentration.

In consideration of the potential for sensitive receptors to experience a change in local air quality near any affected roads, the number of high to low sensitivity receptors has been estimated. This has been achieved by providing a 200m offset from the centreline of an indicative alignment for each route option. A count of the receptors was then made within 50m bands up to 200m from the centreline. The receptor counts have been summarised in Table 5.2.9.

Table 5.2.9: Number of properties within 200m of each route option centreline (not adjusted for potential property loss)

Route Option	Road Centreline – 50m	50-100m	100-150m	150-200m	Total
Red Route	10	11	15	7	43
Yellow Route	15	10	14	9	48
Blue Route Option 1	18	8	30	51	107
Blue Route Option 2	16	11	29	52	108
Blue Route Option 3	16	11	29	52	108

Red Route
There would be approximately 43 receptors within 200m of the Red Route alignment, with approximately 10 of these located within the first 50m.

From east to west, these receptors are located on or in the vicinity of, the A2 Warrenpoint Road, Fathom Line, Flagstaff Road, Barracric Road, old Dublin Road and Ellisholding Junction. The vast majority of these are residential properties. There are no known community facilities within 200m of the indicative centreline.

Yellow Route

There would be approximately 48 receptors within 200m of the Yellow Route, with approximately 15 of these located within the first 50m.

From east to west, these receptors are located on or in the vicinity of, the Fathom Line, Flagstaff Road, Barracric Road, old Dublin Road and Ellisholding Junction. The vast majority of these are residential properties. Victoria Lock Picnic and Amenity area is the only community facility within 50m of the indicative centreline. There are no other known community facilities within 200m of the indicative centreline.

Blue Route Options

There would be approximately 107 receptors within 200m of Blue Route Option 1, with approximately 18 of these located within the first 50m. Blue Route Options 2 and 3 would have approximately 108 receptors within 200m, with 16 of these being within 50m of the indicative centreline.

From east to west, these receptors are located on, or in the vicinity of, the Old Warrenpoint Road, Warren Hill, Greenan Road, Greenwood Drive, Greenbank Industrial Estate, Fathom Line, Hillhead Road, Flagstaff Road, Barracric Road, old Dublin Road and Ellisholding Junction. There is a number of ‘low’ sensitivity receptors located within Greenbank Industrial Estate; however, the vast majority of are residential properties.

There would be only one community facility within the first 50m of the indicative centreline; Newry Mitchel’s GAA ground at Gerry Brown Park, Greenbank Industrial Estate. The Funhouse children’s play centre on Rampart Road would be within 150m. There are no other known community facilities within 200m.

Overall

In terms of sensitive receptors, the Red Route would have the fewest receptors within 200m, and is not in proximity to any known community facilities; it would therefore be the preferred option from this perspective. The next preferred would be the Yellow Route, again based on proximity to fewer residential properties or community facilities than the Blue Route options.

5.2.6.3 Local Air Quality Assessment

With the use of projected traffic data to the assumed year of scheme Opening (2023), Tables 5.2.10 and 5.2.11 summarise forecasted annual mean NO_2 and PM_{10} pollutant concentrations at the various receptor site locations for the ‘Do-Minimum’ and ‘Do-Something’ scenarios. Table 5.2.10 is based on the interim alternative long-term trend projections for NO_2, with the Defra technical guidance long-term trends reported in Appendix B, Annex C of this report. The results on which a judgement of significance is based are those from the IAN interim alternative assessment, as these forecast slightly higher NO_2 concentrations as a worst case scenario. This allows for the magnitude of change to be defined, to assist in the description of local air quality impacts at each receptor assessed. The IAN calculations and input / background data for this assessment are also contained within Appendix B, Annex C (IAN Background Data and Local IAN Assessment).

Table 5.2.10: Localised air quality assessment and Magnitude of Change in adjusted Annual Mean NO_2 concentrations for receptor locations in assumed Opening Year (2023)

Receptor Number and Name		Adjusted NO_2 Annual Mean µg/m^3 (IAN Assessment)					
		Do-Min	Do-Some				
			Red Route	Yellow Route	Blue Route Option 1	Blue Route Option 2	Blue Route Option 3
1	[redacted]	17.6	15.5	15.9	16.3	16.3	16.3
2	[redacted]	5.8	5.7	5.7	5.7	5.7	5.7
3	[redacted]	8.9	8.0	7.8	10.3	10.3	10.3
4	[redacted]	5.0	5.0	5.0	5.2	5.3	5.3
5	[redacted]	4.4	5.2	5.1	4.5	4.8	4.8
6	[redacted]	4.3	4.5	4.5	5.4	4.4	4.4
7	[redacted]	5.0	5.5	5.4	5.0	5.0	5.0
8	[redacted]	6.1	7.2	7.1	7.1	7.1	7.1
9	[redacted]	5.6	8.3	7.9	8.0	8.0	8.0
10	[redacted]	8.3	8.8	8.7	8.8	8.8	8.8
NAQS Limit Value					40.0		

As shown above, there is a variance in the impact on local air quality at each receptor, depending on the route option being assessed. An increase in value over the 'Do-Minimum' situation indicates an increase in estimated concentrations at that location, with a decrease in value subsequently indicating a reduction in pollutant concentrations at that location. In terms of the magnitude of change experienced at each of the receptors, the range is between No Change and Medium, as outlined in Table 5.2.1 (Magnitude of Impact for changes in Annual Mean NO_2 and PM_{10} concentrations at a receptor), when comparing the Do-Minimum and Do-Something scenarios.

[redacted] is the only receptor forecasted to experience a 'Small' to 'Medium' improvement in NO_2 concentrations with all options under consideration. The receptor at [redacted] would also experience an improvement with all route options, however the change would be 'Imperceptible' in all cases, as the decrease is <0.4 µg/m^3. The levels at these receptors are improving as a proportion of strategic traffic would be reassigned from links close to them, and effectively diverted onto the proposed Southern Relief Road, with a reduction in stop-start traffic around the junctions in the area. [redacted] (Receptor 3) would experience a 'Small' improvement with implementation of the Red or Yellow route options, but a 'Small' deterioration with any of the three Blue Route options under consideration. This is due to its proximity to the tie-in at-grade junction between the scheme and the existing A2 Warrenpoint Road.

As would be anticipated with the remaining receptors, those in proximity to a route option would experience an increase in pollutant concentrations. In particular, [redacted] (Receptor 9) would experience a 'Medium' magnitude of change with all route options.

Table 5.2.11: Localised air quality assessment and Magnitude of Change in adjusted Annual Mean PM_{10} concentrations for receptor locations in assumed Opening Year (2023)

Receptor Number and Name		Adjusted PM_{10} Annual Mean µg/m^3 (IAN Assessment)					
		Do-Min	Do-Some				
			Red Route	Yellow Route	Blue Route Option 1	Blue Route Option 2	Blue Route Option 3
1	[redacted]	11.71	11.28	11.36	11.45	11.45	11.45
2	[redacted]	8.33	8.32	8.33	8.32	8.32	8.32
3	[redacted]	9.42	9.28	9.24	9.66	9.66	9.66
4	[redacted]	8.20	8.20	8.20	8.22	8.22	8.23
5	[redacted]	7.77	7.88	7.86	7.78	7.82	7.82
6	[redacted]	7.76	7.78	7.78	7.90	7.77	7.77
7	[redacted]	7.85	7.92	7.91	7.85	7.85	7.85
8	[redacted]	8.09	8.24	8.21	8.20	8.20	8.20
9	[redacted]	7.96	8.36	8.30	8.32	8.32	8.32
10	[redacted]	8.53	8.57	8.55	8.57	8.57	8.57
NAQS Limit Value					40.0		

As with NO_2, there is a variance in the PM_{10} concentrations at each receptor, depending on the route option being assessed. The magnitude of change for PM_{10} would be classified as; No Change, Small (an increase or decrease of between 0.4 and 2 µg/m^3) or Imperceptible (an increase or decrease of <0.4µg/m^3) in all cases.

Again, as with NO_2, [redacted] is the only receptor forecasted to experience an improvement [reduction] in PM_{10} concentrations with all options under consideration, as a proportion of strategic traffic would be reduced in proximity to this community facility with scheme implementation. However, the improvement would be classified as 'Imperceptible' with every option, except the Red Route, which would create a 'Small' improvement. The Yellow Route would reduce PM_{10} concentrations at Receptors 1 and 3, and would result in No Change at Receptors 2 and 4. There would be an 'Imperceptible' impact at Receptors 5-9. Receptors 3-6 and 8-9 would all experience an imperceptible reduction in air quality (<0.4µg/m^3) with implementation of any of the Blue Route options. Receptor 7 would experience No Change with implementation of any of the Blue Route options.

5.2.6.4 Local Air Quality Management Areas

Implementation of any of the route options would likely have a positive effect on the two declared AQMAs within Newry City Centre. This is demonstrated in Tables 5.2.10 and 5.2.11, which shows a decrease in both NO_x and PM_{10} levels at [redacted] which lies within the boundary of Newry City AQMA. In terms of NO_x, the decrease is classified as 'Small', as it would be between 0.4 – 2µg/m^3, with the Red Route providing the greatest improvement over the existing situation. Similarly, with PM_{10} levels, although a decrease is predicted, the magnitude of change is likely to only be 'Imperceptible' with the Yellow Route and Blue Route options. Again, the Red Route would result in the greatest improvement, but demonstrating only a 'Small' magnitude of change. However, due to the level of improvements for either pollutant, it is unlikely that this effect would be sufficient to result in the AQMAs being revoked.

5.2.6.5 Designated Areas

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 surfaces of 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 both National and International 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}.

As noted previously, there is one designated ecological site within the study area, Fathom Upper ASSI (proximal to both the Red and Yellow Route options) containing designated features which may be sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by a change in local air quality (as shown on Figure 5.4.1).

Table 5.2.12: Annual mean NO_X concentrations and Nitrogen deposition rates & change in overall exposure at Fathom Upper ASSI

Designated Site Location	Nitrogen Oxides (NO_x) Annual Mean (µg/m^3)			Nitrogen Deposition (N) (kg N ha^{-1} year-^{1})		
	Do–Min	Do-Some (Red Route)	Do-Some (Yellow Route)	Do-Min	Do-Some (Red Route)	Do-Some (Yellow Route)
Fathom Upper ASSI	4.14	7.57	6.93	16.23	16.42	16.38
Change in Concentration /Deposition	-	+3.43	+2.79	-	+0.19	+0.15

In terms of impact upon the sensitive ecosystem at Fathom Upper ASSI, the Blue Route options would have no impact due to the distance from the protected site being over 200m. Therefore, the impact would essentially be the same as experienced with the Do-Minimum situation, as shown in Table 5.2.12 above, and the Blue Route options would therefore be preferred from an ecological perspective.

In terms of the impact resulting from implementation of either the Red or Yellow Routes, there would be an increase in both Oxides of Nitrogen and Nitrogen Deposition with both routes. However, the Red Route would result in slightly higher rates and exposure than the Yellow Route. As both routes are almost congruent in the vicinity of Fathom Upper ASSI, the difference in the rates can be attributed to the difference in traffic flows in the area, with the Red Route attracting a higher number of vehicles than the Yellow Route.

In terms of the likely impact upon sensitive ecosystems, the effect is unlikely to be significant from an air quality perspective.

5.2.6.6 Regional Air Quality Assessment

In terms of Regional air quality, both the ‘Do-Minimum’ and ‘Do-Something’ scenarios were assessed for the assumed year of Opening (2023) and Design Year (2037). The calculation of Design Year conditions is required as part of the Regional air quality ‘Simple’ assessment. However, the ‘Regional’ application of the DMRB screening spreadsheet does not permit year entries later than 2025. Consultation with the Air Quality Management (AQM) Resource Centre, at the University of the West of England (UWE), has indicated that there are currently no emission factors for periods beyond this date, as there is a high level of uncertainty in long-term predictions beyond this timescale. Therefore, under the advice of the AQM Resource Centre (UWE), the year 2025 should be used for predictions beyond this year, with recognition of the inherent uncertainty and limitations associated with long-term predictions.

The following tables (Table 5.2.13 & Table 5.2.14) are a summary of the net effect of the various route options in the assumed year of Opening (2023), and Design Year (2037) in comparison with the equivalent 'Do-Minimum' alternatives.

Table 5.2.13: Regional air quality assessment for existing and route option road network in assumed year of Opening (2023)

		CO	THC	NO_x	PM_{10}	C
2023	**Do-Minimum**	**68.695**	**8.466**	**37.296**	**1.205**	**4180**
	Red Route	75.372	9.242	44.918	1.439	6133
	% Change	**+9.7%**	**+9.2%**	**+20.4%**	**+19.4%**	**+46.7%**
	Yellow Route	82.855	10.167	49.405	1.571	6742
	% Change	**+20.6%**	**+20.1%**	**+32.5%**	**+30.4%**	**+61.3%**
	Blue Option 1	36.211	4.565	17.594	0.530	2503
	% Change	**-47.3%**	**-46.1%**	**-52.3%**	**-56.0%**	**-40.1%**
	Blue Option 2	36.013	4.540	17.472	0.526	2486
	% Change	**-47.6%**	**-46.4%**	**-53.2%**	**-56.3%**	**-40.5%**
	Blue Option 3	36.014	4.540	17.474	0.527	2487
	% Change	**-47.6%**	**-46.4%**	**-53.1%**	**-56.3%**	**40.5%**

Note: Positive value indicates an increase, and a Negative value indicates a decrease in exposure with route option implementation

The removal of a proportion of traffic from the City Centre would allow traffic to flow more freely both through the City and on the relief road itself, reducing pollutants caused by idling vehicles and congestion. However, as illustrated in the table above, only the Blue Route options would result in an improvement over the Do-Minimum situation in 2023. The Red and Yellow Route options are forecasted to cause an increase in regional pollutants.

Table 5.2.14: Regional air quality assessment for existing and route option road network in Design Year (2037)

Year	**Network**	**Pollutant (Tonnes/yr)**				
		CO	**THC**	**NO_x**	**PM_{10}**	**C**
2037	**Do-Minimum**	**76.503**	**9.418**	**40.844**	**1.320**	**5699**
	Red Route	83.206	10.203	49.102	1.572	6726
	% Change	**+8.8%**	**+8.3%**	**+20.2%**	**+19.1%**	**+18.0%**
	Yellow Route	92.348	11.333	54.260	1.725	7437
	% Change	**+20.1%**	**+20.3%**	**+32.8%**	**+30.7%**	**+30.5%**
	Blue Option 1	40.445	5.092	19.362	0.585	2768
	% Change	**-47.1%**	**-45.9%**	**-52.6%**	**-55.7%**	**-51.4%**
	Blue Option 2	40.228	5.065	19.227	0.581	2750
	% Change	**-47.4%**	**-46.2%**	**-52.9%**	**-56.0%**	**-51.7%**
	Blue Option 3	40.229	5.065	19.229	0.581	2750
	% Change	**-47.4%**	**-46.2%**	**-52.9%**	**-56.0%**	**-51.7%**

Note: Positive value indicates an increase, and a Negative value indicates a decrease in exposure with route option implementation

The comparison of the Do-Minimum situation in the assumed Year of Opening and the Design Year shows an increase in all assessed pollutants. Vehicle emissions across the vehicle fleet are predicted to improve (i.e. lower) due to technological advances, but the increase in predicted traffic flows accounts for the increase.

As with the Opening Year, the Design Year shows an improvement in Regional Air Quality, for each of the assessed pollutants with any of the Blue Route options, though a reduction in air quality with both the Red and Yellow Route options, with the Yellow Route showing the greatest increase in pollutant levels. Blue Route Option 2 shows marginally the greatest improvement over the predicted Do-Minimum situation in the Design Year, with between -46.2 and -56.0% forecasted reductions.

Both the Red and Yellow Route options would introduce traffic to an area currently devoid of strategic flows, resulting in vehicle-related pollutants being spread over a wider area than currently. The Yellow Route option is forecasted to increase NOx regionally by +32.8%.

5.2.6.7 Construction

Although the study area is both rural and urban in character, with the majority of the area being relatively sparsely developed, there would still be instances where properties and sensitive facilities would experience air quality impacts relating specifically to the construction phase. DMRB 11.3.3.1 states that studies have shown that at least half the people living within 50 metres of a construction site boundary are seriously bothered by construction nuisance in one form or another, but beyond 100m less than 20% of the people are seriously bothered.

At this stage, it is possible to give an approximate indication of the likely number of residential properties that would be disrupted during construction, as outlined in Table 5.2.15., and shown on Figures 5.2.11 - 5.2.15. The number of properties affected by each option varies due to that nature of the environment through which the various route options pass.

Table 5.2.15: Number of dust sensitive receptors within 200m of the earthworks of each route option

Option	Distance Band			
	0-50m	50-100m	100-200m	TOTAL
Red Route	16	10	23	49
Yellow Route	20	10	26	56
Blue Route Option 1	18	13	92	123
Blue Route Option 2	18	17	92	127
Blue Route Option 3	18	18	90	126

In terms of potential disruption to these properties from an air quality perspective, nuisance may be in the form of excessive dust, generated particularly during prolonged dry periods, site fires and operation of construction machinery, which can emit higher than normal levels of airborne contaminants. These impacts could have significant effects on nearby residents, and hence monitoring may be necessary during the construction period. Dust is typical on any project which involves movement of large quantities of material for earthwork and road construction, and can have several undesirable impacts:

- health and safety - airborne dust can irritate the eyes and respiratory system;
- road safety - reduced visibility if dust blows across roads; and
- nuisance - settling on washing, windows and ledges of surrounding property etc.

It is also worth noting that short-term environmental impacts such as reductions in air quality would be created along any planned diversion routes during the construction period. Again, it would be possible to incorporate mitigation measures into contract requirements, once a preferred route has been selected. In terms of sensitive properties or locations, such as schools or playing fields, it is anticipated at this stage that there would be only two sensitive locations, Gerry Brown Park (Newry Mitchells GAC ground), and the Newry Canal Greenway. With implementation of any of the Blue Route options, Gerry Brown Park would be lost at its current location, which is within 100m of the proposed earthworks of the Blue Options. The Greenway would not be directly affected, as it would be passed over at height. Consequently, the degree of disruption would be largely similar for all three Blue route options. Victoria Lock Picnic & Amenity area would be within 50m of the Yellow Route, and the Greenway would again be passed over at height with this option. The Greenway community facility would also be indirectly affected by the Red Route, which would pass over it at height.

5.2.7 Mitigation & Enhancement Measures

Based on the air quality assessment undertaken at this stage, it is evident that pollutant concentrations for any of the approved route options would remain within the National Air Quality Standards. It is considered unlikely at this stage that any specific mitigation for operational impacts would be required, as implementation of any of the route options has the potential to lead to improvements in air quality in the Newry urban area by relieving traffic congestion of any of the route options, particularly within the Newry (Urban Centre) and Canal Street AQMAs.

5.2.8 Residual Effects

5.2.8.1 Local Air Quality

From a Local air quality perspective, considering that estimated NO_2 and PM_{10} levels at each of the receptors assessed would be 'Well Below' the NAQS limit values with implementation of any of the route options, the significance of effect in all cases would be Negligible, irrespective of the absolute adverse or beneficial change in NO_2 and PM_{10} concentrations.

Two existing AQMAs would be indirectly affected with scheme implementation, as a result of removal of some strategic traffic from the city centre. However, the change would likely not be significant enough to result in the AQMAs being revoked.

5.2.8.2 Regional Air Quality

The Regional air quality assessment indicates that total emissions of CO, THC, NOx, PM_{10} and C are forecasted to decrease from the 'Do-Minimum' and Base Year (2017) scenarios, for both the assumed 'Opening Year' (2023) and 'Design Year' (2037) with implementation of any of the Blue Route options. These results can be attributed to the removal of a significant proportion of traffic from the city, which currently leads to congestion. The provision of the southern relief road would allow traffic to flow more freely both through the city, and on the new road, reducing pollutants produced by idling vehicles, particularly HGV traffic bound for Warrenpoint Port.

The Red and Yellow Route options however, would result in an increase in Regional emissions compared with a 'Do-Minimum' scenario, as these routes would disperse traffic further into a rural area currently devoid of strategic traffic.

Overall, with implementation of any of the Blue Route options, the significance of effect would be considered Slight Beneficial as an improvement would be experienced over the 'Do-Minimum' situation. However, as shown in Tables 5.2.13 and 5.2.14, the effect of implementation of the Red or Yellow routes on Regional air quality is likely to be a deterioration. Overall, the significance of effect would be considered Slight Adverse.

5.2.8.3 Construction

In terms of potential air quality impacts during the construction phase, as stated in Table 5.2.15, the number of properties with 200m of the earthworks associated with each route option varies between approximately 49 with the Red Route, and approximately 127 with Blue Route Option 2. There is potential for nuisance, and health and safety impacts associated with the generation of excessive dust during construction up to 200m from the construction boundary; however these impacts should be minimised with effective implementation of the Contractor's Dust Minimisation Plan.

The contribution of airborne contaminants from site vehicles and plant to local air quality would therefore be largely Negligible, and any effects transient.

5.2.9 Presentation of Key Issues

The key issues associated with the five route options from an air quality perspective are listed below.

- Implementation of any of the route options is forecasted to have a beneficial local effect by removing a proportion of traffic, (particularly HDV traffic from Warrenpoint Port) from Newry City, leading to less congestion and lower air quality pollution in the City Centre;
- Significantly more properties would experience an improvement in air quality than experience a deterioration, with implementation of the scheme in general;
- None of the local air quality receptor sites throughout the study area would exceed current or future UK National Air Quality Standards, either currently or under the ‘Do-Minimum’ or ‘Do-Something’ scenarios;
- There are two existing AQMAs within the study area, Newry (Urban Centre) AQMA, and Canal Street AQMA. Both would experience a benefit from the removal of a proportion of traffic from the city centre, but are not directly impacted by any of the route options;
- The Red Route would have the least number of sensitive receptors in proximity to its indicative alignment, and is likely to provide the most benefit to city centre air quality as it would attract the most traffic;
- The Blue Route options would have the highest number of receptors in proximity to their alignment;
- The Regional Air Quality assessment indicates a reduction in air quality with both the Red and Yellow Route options, though an improvement with any of the Blue Route options; and
- In terms of designated ecological sites, the Red and Yellow Route options would be least preferred, due to their relative positioning in proximity to Fathom Upper ASSI. However, the effect is unlikely to be significant.

On balance, from an air quality prospective, either the Red Route or Yellow Route would be the preferred option when collectively considering the impact on local and regional air quality, and designated sites.

5.3 Cultural Heritage

5.3.1 Introduction

This section is an assessment of the cultural heritage features within and in the vicinity of the various route options. The assessment identifies the archaeological remains, historic buildings and historic landscape. It aims to:

- assess the potential impacts that the route options may have on cultural heritage features and to determine whether any further assessment is required;
- ensure that the Cultural Heritage assessment is tailored to the characteristics of the scheme and carried out to the appropriate level of detail; and
- identify, describe and assess the environmental advantages, disadvantages and constraints associated with the five route options under consideration.

Within the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2 HA208/07, and for the purpose of this assessment, cultural heritage features are divided into three sub-topics: Archaeological Remains, Historic Buildings and Historic Landscapes.

- Archaeological Remains – *"the materials created or modified by past human activities that contribute to the study and understanding of past human societies and behaviour … Archaeology can include the study of a wide range of artefacts, field monuments, structures and landscape features, both visible and buried"*;
- Historic Buildings – *"architectural or designed or other structures with a significant historical value. These may include structures that have no aesthetic appeal, and the sub-topic includes, in addition to great houses, churches and vernacular buildings, some relatively modern structures, such as … military structures, industrial buildings, and sometimes other structures not usually thought of as 'buildings', such as milestones or bridges";*
- Historic Landscapes – *"defined by perceptions that emphasise the evidence of the past and its significance in shaping the present landscape. The definition encompasses all landscapes, including the countryside, townscapes and industrial landscapes as well as designed landscapes, such as gardens and parks"*.

5.3.2 Methodology

5.3.2.1 Data Sources

The NSRR scheme has the potential to adversely impact local historic environment sites (Figure 5.3.1). To identify the location of sites within or in the vicinity of the route options, a Historic Environment Division (HED) digital GIS dataset was downloaded from the Department for Communities' (DfC) web-page (April 2018):

- World Heritage Sites (no entries within study area);
- Monuments in State Care;
- Scheduled Monuments;
- Listed Buildings;
- Register of Parks, Gardens and Demesnes of Special Historic Interest;
- Archaeological Sites and Monuments on the Sites and Monuments Record of Northern Ireland;
- Areas of Significant Archaeological Interest;
- Battlefield sites;
- Industrial Heritage Record (IHR) sites; and
- Defence Heritage database.
- In addition, the following sources were searched:

- Historic Woodland recorded by the Woodland Trust;
- Buildings at Risk Register NI (no entries within study area);
- Council for British Archaeology Defence of Britain Project/ Defence Heritage Project (no entries within study area);
- Current Conservation Areas, Areas of Townscape or Village Character (ATC), Local Landscape Policy Areas (LLPAs) and Heritage Designations defined on Area Plans; and
- Areas of Outstanding Natural Beauty (AONB) management plans.

The Department of Agriculture, Environment and Rural Affairs (DAERA) Marine Historic Environment section was consulted to obtain information on shipwrecks, including historic losses for the Newry River and harbour area.

Cartographic sources consulted comprised historic mapping held by the Public Record Office Northern Ireland (PRONI), Ordnance Survey Northern Ireland (OSNI) mapping, including historic mapping (Figures 5.3.2-5.3.4), recent topographic mapping and aerial photography.

Information on Conservation Areas was obtained from the Department for Infrastructure's (DfI) Planning Portal.

The Newry Southern Relief Road Preliminary Options Report (Stage 1) (AECOM, 2017) section on Cultural Heritage was also reviewed.

This culminated in the preparation of a gazetteer of heritage assets (Appendix C, Annex A).

5.3.2.2 Study Area

The assessment of cultural heritage considers a study area that typically extends 250m from the scheme centre-line. However, sites up to 1km beyond the edge of the route option boundaries have been taken into consideration in order to consider the potential for impacts upon the setting of heritage assets. In addition, the potential for impacts on designated heritage assets outside the study area will also be considered during the preparation of any subsequent Environmental Statement.

5.3.2.3 Impact Assessment Methodology

The methods for assessing the potential effects of road schemes on cultural heritage are set out in the DMRB, Volume 11, Section 3, Part 2 (2007). Factors for assessing the value of archaeological, built heritage and the historic landscape are described in Table 5.3.1 below.

Table 5.3.1: Factors for assessing the value of archaeological assets

Very High	World Heritage Sites (including nominated sites); Assets of acknowledged international importance; Assets that can contribute significantly to acknowledged international research objectives.
High	Scheduled Monuments (including proposed sites); Undesignated assets of schedulable quality and importance; Assets that can contribute significantly to acknowledged national research agendas.
Medium	Designated or undesignated assets that contribute to regional research objectives.
Low	Designated and undesignated assets of local importance; Assets compromised by poor preservation and / or poor survival of contextual associations; Assets of limited value, but with potential to contribute to local research objectives.
Negligible	Assets with very little or no surviving archaeological interest.
Unknown	The importance of the resource has not been ascertained.

Source: DMRB Vol 11, Section 3, Pt 2 HA208 / 07, Table 5.1

With regards to built heritage, the importance of a building, structure, conservation area or village is judged on an individual basis. It is assessed in relation to architectural and historic importance, statutory and non-statutory designations, and contribution to local character. Useful factors to consider when assigning importance are:

- Architectural interest;

- Historic interest;
- Close historical associations;
- Group value;
- Age; and
- Rarity.

Table 5.3.2: Factors for assessing the value of historic buildings

Very High	Structures inscribed as of universal importance as World Heritage Sites; Other buildings of recognised international importance.
High	Scheduled Monuments with standing remains; Grade A and B+ Listed Buildings; State Care Monuments; Conservation Areas containing very important buildings; Undesignated structures of clear national importance.
Medium	Grade B (including B1 and B2) Listed Buildings; Historic (undesignated) buildings that can be shown to have exceptional qualities in their fabric or historical associations; Conservation Areas containing buildings that contribute significantly to its historic character; Historic Townscape or built-up areas with important historic integrity in their buildings, or built settings (e.g. including street furniture and other structures).
Low	Historic (undesignated) buildings of modest quality in their fabric or historical association and / or considered to be of local historic interest; Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (e.g. including street furniture and other structures); Buildings that appear on the Industrial Heritage Record; Buildings that have been de-listed but retain historic interest.
Negligible	Buildings of no architectural or historical note; buildings of an intrusive character.
Unknown	Buildings with unknown (i.e. inaccessible) potential for historic significance.

Source: DMRB Vol 11, Section 3, Pt 2 HA208 / 07, Table 6.1

Table 5.3.3: Factors for assessing the value of historic landscape character units

Very High	World Heritage Sites inscribed for their historic landscape qualities; Historic landscapes of international value, whether designated or not; Extremely well preserved historic landscapes with exceptional coherence, time-depth or other critical factor(s).
High	Designated historic landscapes of outstanding interest; Undesignated landscapes of outstanding interest; Undesignated landscapes of high quality and importance, and of demonstrable national value; Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	Designated special historic landscapes; Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value; Averagely well-preserved historic landscapes with average or reasonable coherence, time-depth or other critical factor(s).
Low	Robust undesignated historic landscapes; Historic landscapes with importance to local interest groups; Historic landscapes whose value is limited by poor preservation and / or poor survival of contextual associations.
Negligible	*Assets with very little or no significant historical interest.*

Source: DMRB Vol 11, Section 3, Pt 2 HA208 / 07, Table 7.1

Factors for assessing the magnitude of impacts for archaeological, built heritage and historic landscape assets are described in Table 5.3.4 to Table 5.3.6.

Table 5.3.4: Factors in the assessment of the magnitude of impacts for archaeological remains

Major	Change to key archaeological elements, such that the resource is totally altered; Comprehensive changes to setting.
Moderate	Change to many key archaeological elements, such that the resource is clearly modified; Considerable changes to setting that affect that character of the asset.
Minor	Change to key archaeological materials, such that the asset is slightly altered; Slight changes to setting.
Negligible	Very minor changes to archaeological materials, or setting.
No Change	No change.

Source: DMRB Vol 11, Section 3, Part 2 HA 208 / 07, Table 5.3

Impacts of the route options upon built heritage features are considered in terms of direct, indirect, and cumulative impacts. A direct impact is considered to constitute a direct physical impact upon a structure, such as damage or demolition, or an impact on the setting of the feature, such as the severance of an agricultural building from its rural setting. An indirect impact is taken to constitute a remote or complex impact, such as a change in amenity that would endanger the future maintenance and survival of a historic building.

Cumulative impacts may be caused by an interaction of different impacts to constitute a larger, more significant impact, such as increased visual intrusion and vibration, all occurring to a single building. Alternatively, a cumulative impact may result from other reasonably foreseeable future changes that may act in conjunction with those from the Scheme. Cumulative effects are judged with the understanding that the proposal is one of many past and present impacts to the cultural heritage in the area, and that the potential of other sites may be compromised by the proposals. The magnitude of impact has been assessed on the eight-point scale as detailed Table 5.3.5.

Table 5.3.5: Factors in the assessment of the magnitude of impacts for historic buildings

Major	Change to key historic building elements, such that the resource is totally altered; Comprehensive changes to setting.
Moderate	Change to many key historic building elements, such that the resource is significantly modified; Changes to the setting of an historic building, such that it is significantly modified.
Minor	Change to key historic building elements, such that the asset is slightly different; Change to the setting of an historic building, such that it is noticeably changed.
Negligible	Slight changes to historic buildings elements or setting that hardly affect it.
No Change	No change to fabric or setting.

Source: DMRB Vol 11, Section 3, Part 2 HA 208 / 07, Table 6.3

Table 5.3.6: Factors in the assessment of the magnitude of impacts for historic landscapes

Major	Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change or noise or change to sound quality; fundamental changes to use or access, resulting in total change to historic landscape character unit.
Moderate	Changes to many key historic landscape elements, parcels or components; visual change to many key aspects of the historic landscape; noticeable differences in noise or sound quality; considerable changes to use or access, resulting in moderate changes to historic landscape character.
Minor	Changes to few historic landscape elements, parcels or components; slight visual changes to few key aspects of historic landscape; limited changes to noise levels or sound quality; slight changes to use or access, resulting in limited changes to historic landscape character.
Negligible	Very minor changes to historic landscape elements, parcels or components, virtually unchanged visual effects; very slight changes in noise levels or sound quality; very slight changes to use or access, resulting in a very small change to historic landscape character.
No Change	No change to historic landscape elements, parcels or components; no visual or audible changes; no changes arising from amenity or community factors.

Source: DMRB Vol 11, Section 3, Part 2 HA 208 / 07, Table 7.3

5.3.2.4 Assessment of significance of effects: method

The magnitude of impact is judged in accordance with the guidance set out in Table 5.3.7. Categories with possible dual ratings are defined as a single score for clarity, based on professional judgement.

Table 5.3.7: Significance of Effects Matrix

Value / sensitivity						
	Very high	Neutral	Slight	Moderate / large	Large or very large	Very large
	High	Neutral	Slight	Moderate / slight	Moderate / large	Large / very large
	Medium	Neutral	Neutral / slight	Slight	Moderate	Moderate / large
	Low	Neutral	Neutral / slight	Neutral / slight	Slight	Slight / moderate
	Negligible	Neutral	Neutral	Neutral / slight	Neutral / slight	Slight
		No change	Negligible	Minor	Moderate	Major
		Magnitude of impact				

Source: DMRB Vol 11, Section 3, Pt 2 HA208 / 07, Table 5.4.

Table 5.3.8: Description of the Significance of Effects for Cultural Heritage

Rating	Comment
Large Beneficial (positive) effect	The proposals would: • provide potential, through removal, relocation or substantial mitigation of very damaging or discordant existing impacts (direct or indirect) on the heritage, for very significant or extensive restoration or enhancement of characteristic features or their setting; • make a major contribution to government policies for the protection or enhancement of the heritage; • remove or successfully mitigate existing visual intrusion, such that the integrity, understanding and sense of place of a highly valued area, a group of sites or features of national or regional significance is re-established.
Moderate Beneficial (positive) effect	The proposals would: • provide potential, through removal, relocation or mitigation of damaging or discordant existing impacts on the heritage, for significant restoration of characteristic features or their setting; • contribute to Regional or Local policies for the protection or enhancement of the heritage; • enhance existing historic landscape / townscape character through beneficial landscaping / mitigation and good design.
Slight Beneficial (positive) effect	The proposals: • are not in conflict with national, regional or local policies for the protection of the heritage; • restore or enhance the form, scale, pattern or sense of place of the heritage resource through good design and mitigation; • remove or mitigate visual intrusion (or other indirect impacts) into the context of locally or regionally significant heritage features, such that appreciation and understanding of them is improved.
Neutral effect	The proposals: • are not in conflict with, and do not contribute to policies for the protection or enhancement of the heritage; • maintain existing historic character in a landscape / townscape; • have no appreciable impacts, either positive or negative, on any known or potential heritage assets; • are a combination of slight positive and negative impacts, on locally significant aspects of the heritage;

	• do not result in severance or loss of integrity, context or understanding within a historic landscape.
Slight Adverse (negative) effect	The proposals would: • be in conflict with local policies for the protection of the local character of the heritage; • have a detrimental impact on the context of regionally or locally significant assets, such that their integrity is compromised and appreciation and understanding of them is diminished; • damage locally significant heritage features for which adequate mitigation can be specified; • not fit well with the form, scale, pattern and character of a historic landscape / townscape / area.
Moderate Adverse (negative) effect	The proposals would: • be out of scale with, or at odds with the scale, pattern or form of the heritage resource; • be intrusive in the setting (context), and will adversely affect the appreciation and understanding of the characteristic heritage resource; • be in conflict with local or regional policies for the protection of the heritage; • be damaging to nationally significant heritage assets, resulting in loss of features such that their integrity is compromised, but not destroyed, and adequate mitigation has been specified; • be a major direct impact on regionally or locally significant heritage, resulting in loss of features such that their integrity is substantially compromised, but adequate mitigation can be specified.
Large Adverse (negative) effect	The proposals would: • have a major direct impact on nationally significant heritage assets such that they are lost or their integrity is severely damaged; • have a moderate direct impact on, or compromise the wider setting of, multiple nationally or regionally significant heritage assets, such that the cumulative impact would seriously compromise the integrity of a related group or historic landscape / townscape; • have a major direct impact on regional heritage assets, such that their integrity is lost and no adequate mitigation can be specified; • be highly intrusive and would seriously damage the setting of the heritage resource, such that its context is seriously compromised and can no longer be appreciated or understood; • be in serious conflict with government policy for the protection of the heritage, as set out in PPS6; • be strongly at variance with the form, scale and pattern of a historic landscape / townscape.

Source: DfT 2014, Table 8

5.3.2.5 Scope of Assessment

The route options have been subject to an initial site appraisal at this stage. The aims of the initial site appraisal were to:

- check the condition of visible assets within the Study Area and record any that have not been previously noted;
- identify sites of palaeoenvironmental potential (e.g. dry valleys, stream valleys, upland bogs, lowlands, etc.); and
- inform decisions about further field survey techniques to be applied, if necessary.

Figure 5.3.1 illustrates known Archaeological Remains, Historic Buildings and Historic Landscapes within the study area. A statement describing the constraints associated with the various site types, with an indication of impact significance of the alignment of each route option on cultural heritage is also given.

5.3.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns or particular requirements during the assessment process. The following table outlines the responses from the consultation in relation to Cultural Heritage assets.

Table 5.3.9: Summary of formal consultation responses in relation to Cultural Heritage assets

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DfC - Historic Environment Division (HED) - Heritage Advice and Regulation Branch	27 March 2018	27 March 2018	Consultation meeting held at the request of DfI-Roads to provide HED Heritage Advice and Regulation Branch with a scheme update and to discuss the scheme in relation to the Newry Ship canal. HED stated that they would prefer a scheme that avoided the Newry canal and its associated Scheduled area. AECOM highlighted the issue of bridge pier locations. Siting bridge pier locations outwith the scheduled area will increase the bridge span and significantly increase costs, with a thicker, more visually-dominant bridge deck. HED noted that the scheduled area appeared quite wide at the indicative crossing point (beyond the canal and onto the shores of the Newry River) and there may be scope to develop a more pragmatic solution of keeping the piers away from the canal structure itself, though within the scheduled area to reduce bridge costs / public money expenditure. It was agreed that HED would send the Scheduling Papers associated with the Canal to AECOM for information, who will also check the digital dataset boundary relating to the scheduled area. It was also agreed that AECOM should explore the possibility of developing a pier location east of the Middlebank, although within the scheduled area. A follow-up on-site meeting on Middlebank is to be arranged following bridge design amendment. AECOM queried the requirement for an opening bridge over the canal. HED stated that its primary concern is the protection of the canal as a Scheduled Monument and that, the owners; (Newry, Mourne and Down District Council) should answer that question. HED confirmed that the forthcoming Stage 2 consultation letters should be issued to both Andrew Gault (Archaeological Heritage) and Brian McKervey (Historic Buildings / Architecture).
Inland Waterways Association of Ireland (IWAI)	10 Apr 2018	29 Apr 2018	IWAI consider that the preferred route should not impede access to Albert Basin for large vessels, irrespective of route choice. The clearance under any fixed bridge must be at least 37m. They noted the difficulty in this and suggested that there should be an opening span of at least the same width as the Victoria Lock. No route preference was indicated as long as the above criteria are met. They also provided detailed supporting documents.
DfC - Historic Environment Division (HED): Historic Monuments	9 Apr 2018	29 May 2018	Andrew Gault, Archaeological Heritage, HED: Historic Monuments (HED: HM) advised that the potential archaeological impacts of the proposed route options have been considered as requested. The principal historic monuments related issue concerning all options is how the road crosses the Newry Canal which is a statutorily protected historic monument scheduled for protection. AG is aware that discussions are ongoing with the HED Scheduling Team in relation to this. HED: HM consider the Blue Route Options as preferential in terms of overall archaeological impact. In particular, ST01-Blue Option 1 is the preferable version of the Blue Route. HED considers that the existing character of the locality of the Blue Route options would offer opportunities to minimise impacts upon the character of the setting of the canal and would be more appropriate here than the more rural southern options. It was noted that further detailed consideration of the design

	of the road bridge would be necessary to mitigate any potential adverse impacts upon the setting of the canal. Further details of the proposed construction methodology would be necessary to ensure any adverse physical impacts upon the scheduled area of the canal are avoided. HED would be happy to discuss this further as designs progress and also the scope of the archaeological section of the Environmental Statement as this develops. Any ES should include an archaeological mitigation strategy in line with DEM 156/15 Management of Archaeological Investigations on Major Road Improvement Schemes. It is also advised that any issues relating to the listed buildings in proximity to the Blue Route be discussed with HED: Historic Buildings (Jacqui Stokes).

5.3.4 Regulatory & Policy Framework

The following guidelines, legislation and planning policies provide the framework for the protection and conservation of cultural heritage assets in Northern Ireland.

5.3.4.1 Planning policy:

- Planning Service (1999) Development Control Advice Note 10;
- DOENI (1999/2011) Planning Policy Statement 6: Planning Archaeology and the Built Heritage;
- DRD (2010) Regional Development Strategy 2035;
- DOENI (2013) Planning Policy Statement 2: Natural Heritage;
- DOENI (2013) Banbridge/Newry and Mourne Area Plan 2015;
- DOENI (2014) Planning Policy Statement 23: Enabling Development for the Conservation of Significant Places;
- DOENI (2015) Strategic Planning Policy Statement for Northern Ireland: Planning for Sustainable Development; and
- Transport NI (2015) Management of Archaeological Investigations on Major Road Improvement Schemes (Director of Engineering Memorandum) DEM 156/15.

5.3.4.2 Legislative Context:

- Protection of Wrecks Act 1973;
- The Historic Churches (Northern Ireland) Order 1985;
- The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985;
- Planning (Northern Ireland) Order 1991;
- Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995;
- Treasure Act 1996;
- The Historic Monuments (Class Consents) Order (Northern Ireland) 2001; and
- Planning Act (Northern Ireland) 2011. http://www.legislation.gov.uk/nia/2011/25/contents

5.3.4.3 Archaeological Sites and Monuments

5.3.4.3.1 Scheduled and State Care Monuments

Archaeological sites and monuments may be in State Care or Scheduled for protection under Article 3 of the Historic Monuments and Archaeological Objects (NI) Order 1995. Once a site or monument has been scheduled, it benefits from statutory protection. Under Article 4, Scheduled Monument Consent (SMC) must be obtained prior to any works affecting scheduled monuments, including archaeological investigations.

State Care monuments are managed by the Department for Communities (DfC) - Historic Environment Division (HED) (formerly NIEA) under The Historic Monuments and Archaeological

Objects (Northern Ireland) Order 1995. The DfC - HED controls and manages works to monuments in their guardianship and prior permission to undertake works on or affecting State Care monuments must be obtained.

PPS 6 Policy BH 1 (The Preservation of Archaeological Remains of Regional Importance and their Settings) states that “The Department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in State Care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances.”

5.3.4.3.2 Archaeological Sites and Monuments

Archaeological sites identified in the Northern Ireland Sites and Monuments Record (NISMR) are defined as a site of archaeological interest in the Planning (General Development) Order (NI) 1993.

PPS 6 notes that Archaeological Sites and Monuments add meaning to our natural environment and are a limited, finite and non-renewable resource, in many cases highly fragile and vulnerable to damage and destruction. *“They can contain irreplaceable information about our past and the potential for an increase in future knowledge, which, once destroyed, cannot be replaced. They are part of our sense of place and are valuable both for their own sake and for their role in education, leisure and tourism” (PPS 6, 3.2). “In all cases the desirability of preserving an archaeological site or monument and its setting, whether scheduled or otherwise, is a material consideration in determining planning applications”* (PPS 6, 3.3).

According to PPS 6 Policy BH 2 (The Protection of Archaeological Remains of Local Importance and their Settings), *“Development proposals which would adversely affect archaeological sites or monuments which are of local importance or their settings will only be permitted where the Department considers the importance of the proposed development or other material considerations outweigh the value of the remains in question.”*

“On many occasions it will be possible to avoid conflicts with archaeological interests, particularly through seeking suitable alternative sites for development. However where it is decided that development may proceed this will be conditional on appropriate archaeological mitigation measures” (described in Policy BH 4).

According to PPS 6 Policy BH 3 (Archaeological Assessment and Evaluation), *“Where the impact of a development proposal on important archaeological remains is unclear, or the relative importance of such remains is uncertain, the Department will normally require developers to provide further information in the form of an archaeological assessment or an archaeological evaluation. Where such information is requested but not made available the Department will normally refuse planning permission.”*

PPS 6 Policy BH 4 (Archaeological Mitigation) notes that *“Where it is decided to grant planning permission for development which will affect sites known to contain archaeological remains, the Department will impose conditions to ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development, including where appropriate the completion of a licensed excavation and recording of remains before development commences.”* Mitigation may require design alterations to development schemes (PPS 6, 3.15) and *“The excavation recording of remains is regarded by the Department as a second best option to their physical preservation. The preservation in situ of important archaeological remains is … always to be preferred”* (PPS 6, 3.16).

The discovery of archaeological remains, which have not been previously known, may therefore represent a material change which can affect the nature of development which will be permitted (PPS 6, 3.20).

5.3.4.3.3 Areas of Significant Archaeological Interest

Development plans, where appropriate, designate Areas of Significant Archaeological Interest (ASAIs), and highlight areas of archaeological potential within the historic cores of towns and villages where it is likely that archaeological remains will be encountered in the course of continuing development and change (PPS 6, 2.1-2.7).

5.3.4.3.4 Shipwrecks and Marine Archaeology

There is one shipwreck in Northern Ireland, La Girona (off Lacada Point, County Antrim) which is protected under the Protection of Wrecks Act 1973. Although there are no Protected Wreck Sites within the study area, the Newry River contains a number of wrecks recorded by DAERA – Marine Historic Environment.

5.3.4.4 Built Heritage

Listed buildings are protected under the Planning (Northern Ireland) Order 1991. Article 42 of the Order places a statutory duty on the Historic Environment Division (HED) to compile a list of structures of special architectural and historical interest. The list is based on the results of two surveys; the First Survey began in the early 1970s and was completed in 1994, whilst the Second Survey was begun in 1997 and is still in progress.

Following designation, the agency has *"a special regard to the desirability of preserving a building or its setting or any features of special architectural or historic interest which it possesses"* (Article 45). The protection of structures designated under the Order is expanded on in PPS6. Paragraph 6.4 states that the agency *"will require full information to accompany all applications to enable assessment of the likely impact of proposals on the special architectural or historic interest of the building and its setting"*. Annex A to the report discusses Transport and Traffic Management. Paragraph A4 states that where new schemes are proposed, the Agency *"will identify and evaluate the significance of any remains or features of the built heritage including listed buildings, conservation areas and other historic sites"*. It requires that such issues are taken into account and that *"new routes, alterations and any other transport infrastructure should respect such features"* but notes that *"in each case a suitable balance needs to be struck between conservation, other environmental concerns, economics, safety and engineering feasibility"*. Annex C (revised March 2011) presents criteria for listing, set out below:

Grade A
Buildings of greatest importance to Northern Ireland, including both outstanding architectural set-pieces and the least altered examples of each representative style, period and type.

Grade B+
High quality buildings that because of exceptional features, interiors or environmental qualities are clearly above the general standard set by grade B1 buildings. Also buildings which might have merited Grade A status but for detracting features such as an incomplete design, lower quality additions or alterations.

Grade B1
Good examples of a particular period or style. A degree of alteration or imperfection of design may be acceptable. Generally B1 is chosen for buildings that qualify for listing by virtue of a relatively wide selection of attributes. Usually these will include interior features or where one or more features are of exceptional quality and/or interest.

Grade B2
Special buildings which meet the test of the legislation. A degree of alteration or imperfection of design may be acceptable. B2 is chosen for buildings that qualify for listing by virtue of only a few attributes. An example would be a building sited within a conservation area where the quality of its architectural appearance or interior raises it appreciably above the general standard of buildings within the conservation area.

Source: PPS 6 Annex C (2011)

5.3.4.5 Industrial Heritage

Industrial heritage features include the remains of corn, flax and beetling mills, cotton and linen mills and other manufacturing industries, and associated workers' accommodation. The historic pattern of roads, railways and canals and historic utilities networks also form an important part of the industrial heritage (PPS 6, 8.1-8.2). The Department is responsible for identifying and protecting buildings and other industrial heritage features; many important features are already subject to existing protection measures as archaeological sites or monuments, or as listed buildings (PPS 6, 8.3).

5.3.4.6 Historic Landscape

The register of parks, gardens and demesnes of special historic interest in Northern Ireland is maintained by the HED (PPS 6, 2.17). Conservation areas are designated following Article 50 of the Planning (NI) Order 1991 (PPS 6, 2.18-2.19).

The effect of proposed development on a park, garden or demesne, or its setting included in the register, is a material consideration in the determination of planning and / or listed building consent applications and appeals.

PPS 6 Policy BH 6 (The Protection of Parks, Gardens and Demesnes of Special Historic Interest) states that *"The Department will not normally permit development which would lead to the loss of, or cause harm to, the character, principal components or setting of parks, gardens and demesnes of special historic interest. Where planning permission is granted this will normally be conditional on the recording of any features of interest which will be lost before development commences."*

"Where a decision is taken to permit development which would result in the loss of any distinctive features of parks, gardens and demesnes, the Department will normally require developers to carry out recording, working to a brief prepared by the Department, so that knowledge of this part of our landscape heritage is not entirely lost" (PPS 6, 5.5).

Some sites and monuments located within or adjoining settlements may be designated as Local Landscape Policy Areas (LLPAs). Local Landscape Policy Areas comprise features and areas within and adjoining settlements considered to be of greatest amenity value, landscape quality or local significance and therefore worthy of protection from undesirable or damaging development. These LLPAs are identified in the process of Countryside Assessment and are designated and maintained through development plans (PPS 6, 2.23-2.24).

These environmental assets may include archaeological sites and monuments and their surroundings; listed and other locally important buildings and their surroundings; river banks and shore lines and associated public access; attractive vistas, localised hills and other areas of local amenity importance; areas of local nature conservation interest, including areas of woodland and important tree groups.

Trees can be protected through Tree Preservation Orders (TPO) under the Planning (Trees) Regulations (Northern Ireland) 2003 and the Planning (Amendment) (Northern Ireland) Order 2003. A TPO provides protection for trees considered to be of special value in terms of amenity, history or rarity. It makes it an offence to cut down, top, lop, uproot or wilfully damage or destroy a protected tree, or to permit these actions, without first seeking the Department's consent to do so.

5.3.4.7 Regional and Local Planning Policy

5.3.4.7.1 Banbridge/Newry and Mourne Area Plan 2015

The Banbridge/Newry and Mourne Area Plan (BNMAP) 2015 Strategic Plan Framework (DoE 2013) notes that a *"major thrust of this strategy is to promote more sustainable patterns of development based on … the sensible and sensitive use of the built heritage and the rural environment". Plan objectives include "conserving, sustaining and enhancing the area's environmental qualities, local distinctiveness and sites of environmental importance in terms of landscape character and diversity, wildlife and habitats, townscape and archaeology".*

The Strategic Plan Framework notes *"Evidence of past human activity within the Plan Area is illustrated by archaeological sites and monuments, vernacular and historic buildings, features and structures surviving from past industries, planned parkland landscapes and in the pattern of streets and buildings in our historic townscapes. There is also a particular maritime element in the local heritage of coastal areas. This heritage is finite and vulnerable and it is important that it be cherished and protected for future generations to enjoy as we do".*

Policy CVN 2 – Areas of Significant Archaeological Interest notes: *"Within designated Areas of Significant Archaeological Interest, planning permission will not be granted for proposals for large scale development, unless it can be demonstrated that there will be no significant impact on the character and appearance of this distinctive historic landscape".*

Strategic Northern Ireland Tourist Board plans in the area include *"The Saint Patrick and Christian Heritage Project, plans to capitalise on the strength of the Christian Heritage product by concentrating on Armagh and Downpatrick and linking them through a high quality touring trail that will include Newry City and Dromore. The Mournes Signature Project aims to take advantage of the potential designation of the area as a National Park and the tourism benefits it may bring".*

5.3.4.7.2 Regional Development Strategy 2035

The Regional Development Strategy 2035 (DRD, 2010) notes that *"The Region has a rich and diverse built heritage which contributes to our sense of place and history. It is a key tourism and recreational asset and sustainable management of the built heritage makes a valuable contribution to the environment, economy and society. The built heritage embraces many sites of local and international interest which once lost cannot be fully replaced.*

- *Identify, protect and conserve the built heritage, including archaeological sites and monuments and historic buildings. Northern Ireland's archaeological sites and monuments provide a tangible link to the distant past, as well as more modern remains. For example, the suite of historic monuments in State Care in the Region ranges from the earliest known dwelling-sites and burial monuments through to twentieth-century fortifications. New discoveries are made every year that contribute to our understanding of the past and its place in the future landscape. Continuing work to identify these built heritage assets, on land, along the coast and within coastal waters helps inform future decisions about development and land-use change.*
- *Identify, protect and conserve the character and built heritage assets within cities, towns and villages. Historic buildings and monuments are key elements of our historic townscape, Conservation Areas, key civic and publicly-accessible buildings, as well as everyday dwellings and shops. If these assets are recognised and managed they can make a positive contribution to regeneration. This will allow the maintenance of craft skills, and the development of a sense of place that can be respected by future development.*
- *Maintain the integrity of built heritage assets, including historic landscapes. Historic sites, buildings and landscapes do not exist in isolation. Their appropriate management and wider integration with their surroundings will help contribute to local character, and ensure that these assets continue to make a valuable contribution to our tourism economy."*

5.3.4.7.3 Areas of Outstanding Natural Beauty (AONBs)

South-west of Newry, within the area of the route options, is the Ring of Gullion AONB. The AONB Management Plan (NIEA, 2011) sets out objectives for the conservation and enhancement of the rich built, cultural and natural heritage of the AONB. Priorities include:

- Objective 2: Conserving the AONB's landscape heritage and encouraging new development to reflect locally distinctive character; and,
- Objective 6: Increasing public awareness and appreciation of the special landscape of the AONB through promotion, events & activities.

North-east of Warrenpoint is the Mourne AONB. The Mourne AONB Management Plan sets out what makes the area special and what the various interested parties see as important to maintaining and enhancing those qualities. The Landscape Conservation Action Plan (MMLP, 2010) contains further details regarding heritage aspects.

5.3.4.8 Standards and Guidance

- DMRB Volume 11, Section 3, Part 2: HA 208/07 – Cultural Heritage;
- DMRB Volume 10, Section 6, Part 1: HA 75/01 – Trunk Roads and Archaeological Mitigation;
- Transport NI (2015) Management of Archaeological Investigations on Major Road Improvement Schemes DEM 156/15;
- Department for Transport (2007) Assessing the Effect of Road Schemes on Historic Landscape Character HA49/06;
- Chartered Institute for Archaeologists, Code of Conduct and Standards (2014) and Guidance for Historic Environment Desk-based Assessment (2017); and

- Department for Communities (2018) Historic Environment Division Guidance on Setting and the Historic Environment.

5.3.5 Baseline Environmental Conditions & Constraints

5.3.5.1 Archaeological Sites and Monuments

Consultation with HED has indicated that the study area is located within an area of high archaeological potential, which contains many known archaeological sites and monuments dating from at least the Neolithic period, c.4500 BC.

Archaeological sites have been identified within the study areas, covering periods from the post-medieval to the 20th century. These comprise one Scheduled Historic monument, one State Care Monument, eight archaeological sites, 18 Industrial Heritage Record sites, and five shipwrecks (Figure 5.3.1).

There are no Areas of Significant Archaeological Interest (ASAIs) in the study area. The nearest is the Dorsey Earthworks and neighbouring lands, over 12km west of the immediate study area.

There are no designated Areas of Archaeological Potential within the immediate study area. The nearest is in Newry City approximately 1.25km north of the immediate study area.

5.3.5.1.1 High Value Archaeological Assets

There is one Scheduled Monument within the study area, the 18th/19th century Newry Canal Reach 1A (ARM/DOW029:500). The designated site is extensive, covering its substantial remains in County Down and County Armagh. The scheduled canal is also an Industrial Heritage Site (IHR172).

There is one monument in State Care within the study area; the late medieval Narrow Water Castle (DOW051:044), which protects the entrance to part of Carlingford Lough and is thought to have been built by the English in c.1560.

5.3.5.1.2 Medium Value Archaeological Assets

No medium value archaeological remains have been identified within the study area.

5.3.5.1.3 Low Value Archaeological Assets

Heritage assets recorded in the NI SMR identified as being of low value comprise:

- Late medieval (AD1150 – 1600) and post-medieval (1600 – 1901) sites:
  - A battle site at Fathom Lower, the general site of the ambush on the Elizabethan field army on the 14th October 1600 (ARM029:042).
  - The site of a former castle at Fathom Upper, demolished in 1730 during the construction of the first lock of the Newry Canal (ARM029:033).
- Uncertain date:
  - An “old fort” may be situated on a level terrace on the steep north-eastern flank of Fathom Mountain, commanding an extensive view over the Newry River below, but there are no visible remains (ARM029:025).
  - The study area incorporates the boundaries between the townlands of Cloghogue and Fathom Upper. The townland system of land division dates to before the Anglo-Norman invasion of Ireland during the late 12th century though the sub-division of land into townlands continued until the 19th century with some townlands altered in terms of size and shape until comparatively recently. The boundaries defining townlands can be over 800 years old and they survive in a variety of physical forms, such as natural or artificial features.
- Aerial imagery also shows a number of watercourses, drainage ditches and palaeochannels, particularly around Cloghogue.

Heritage assets recorded in the NI IHR identified as being of low value comprise:

- A series of undesignated elements of the scheduled Newry Canal, including a quay (00172:095:00), a lock (00172:039:00) and a Lock House (00172:113:00) in Lisdrumliska, a spill weir at Cloghogue (00172:096:00) and in Fathom Upper, Victoria Lock (00172:041:00), a quay (00172:093:00), a lock house (00172:042:00) and a pump house (00172:112:00);

- A group of IHR sites are associated with the GNR Main Line from Belfast to the border. These comprise a railway bridge at Cloghogue (00062:099:00, 00062:100:00), and two at Fathom Lower (00062:102:00, 00062:103:00);
- A group of IHR sites associated with the Newry and Greenore Railway west of the Newry Canal, at the foot of Fathom Mountain. These comprise a bridge at Cloghogue (00538:002:00) and at Fathom Upper (00538:006:00), a milepost at Cloghogue (00538:003:00) and at Fathom Upper (00538:007:00), and a signal post at Fathom Lower (00538:005:00); and
- The GNR Branch Line from Goraghwood to Warrenpoint (00478). The former line of this railway ran across areas where possible bridge crossings and tie-ins for each option are located.

5.3.5.1.4 Negligible Value Archaeological Assets

No negligible value archaeological assets have been identified within the study area.

5.3.5.1.5 Unknown Value Archaeological Assets

DAERA – Marine Historic Environment was consulted in May 2016 and indicated that although there are no designated wrecks within the study area, historic losses for the river and harbour area have been mapped. These largely comprise late 19th/early 20th century partial losses or strandings. The information has been collated from contemporary Commons Sessional Papers. Despite past dredging and development of the harbour and river areas, there is still the potential for unknown archaeological remains (e.g. vessels, artefacts etc.) to survive. DAERA - Marine Historic Environment highlight that, although the impacts of construction works will be relatively localised, should any impact occur it is likely to be of a long-term and irreversible nature. Wrecks noted within the immediate study area include:

- MRD 2616 British steam vessel (name unknown) partial loss in Newry River / harbour in June 1887;
- MRD 2672 Vessel (name unknown) partial loss in Newry River / harbour on 30.07.1897;
- MRD 2631 British vessel (name unknown) partial loss in Newry River / harbour on 30.06.1891;
- MRD 2655 British vessel (name unknown) partial loss in Newry River / harbour on 30.07.1894; and
- MRD 2705 British vessel (name unknown) partial loss in Newry River / harbour on 30.07.1903.

A review of Ordnance Survey historic mapping during the previous Stage 1 Scheme Assessment noted several areas of interest. An area of complex field boundaries was noted around Cloghogue. This area is close to the northern extent of the immediate study area and has been identified as CH-01. The area to the north of Fathom Mountain consists of marginal ground and there is the potential for well-preserved organic, waterlogged and palaeoenvironmental remains in the vicinity of watercourses, in marshy areas and in inter-drumlin fen hollows. As such, this area has been identified as CH-02. Historic mapping also shows the former Wellington Inn (CH-03), Cloghogue, north-east of the Ellisholding Junction adjacent to the Dublin Road. This asset would have been a coaching inn, providing accommodation for travellers between Belfast and Dublin. The inn was probably named after the Duke of Wellington; the famous military leader / politician of the time, but the building may be older and date to the 18th century.

5.3.5.2 Built Heritage

At this stage, a total of 14 built heritage assets have been identified within the study area, dating from the 18th to 20th century.

5.3.5.2.1 High Value Built Heritage Assets

Grade A listed buildings are ascribed a high value in the cultural heritage assessment. There is one Grade A listed building within the study area, Narrow Water Castle (HB16/11/019A).

There is one Grade B+ listed building within the study area, the early 20th century Church of the Sacred Heart, Dublin Road, Newry (HB16/29/017A).

5.3.5.2.2 Medium Value Built Heritage Assets

There are three B1 listed buildings in the study area:

- The early 18th century Fathom House, Fathom Lower (HB16/13/005). It is a well-proportioned, early 18th century symmetrical building, occupying a maturely planted site overlooking the Newry River and Canal. Along with its ruinous stable block and Belvedere Tower (a B2 graded structure), they form a pleasing and important architectural group;
- The early 18th century Former Servant's Accommodation to Narrow Water Castle, Narrow Water (HB16/11/019B); and
- Gates and walling at the Church of the Sacred Heart, Dublin Road, Newry. These date to the early 20th century (HB16/29/017C).

There are five B2 listed buildings in the study area:

- The Belvedere Tower, an 18th century building associated with Fathom Park, Fathom Lower (HB16/13/029). The Belvedere Tower is a three-stage octagonal tower with bowed stairwell. The Tower is now roofless with the remains of a crenelated parapet and the walls are of random rubble and cut stone;
- At Narrow Water Castle, the early 19th century Former Gardener's House (HB16/11/020);
- At Narrow Water Castle, the 19th century Stable Yard (HB16/11/021);
- At Narrow Water Demesne, the 19th century Entrance Screen (HB16/11/018); and
- At Narrow Water Demesne, the 19th century gates (HB16/11/018).

5.3.5.2.3 Low Value Built Heritage Assets

There are four low value built heritage assets in the study area. These are noted on the Historic Buildings Record as “Record Only”. These assets are:

- Belvedere Tower, an 18th century building associated with Ashton House, Fathom Lower (HB16/13/028). The Belvedere Tower is an octagonal tower with felted roof, central cast-iron lantern and boxed timber eaves. The building has been repaired in concrete blockwork;
- The late 18th century Ashton House, Fathom Lower (HB16/13/009). It is a pleasantly situated and much altered late 18th century Georgian house with impressive entrance door case and original door. It has undergone internal refurbishment and retains few features of interest;
- Victoria Locks, Fathom Road, Newry (HB16/13/069). This is the largest single lock chamber in Northern Ireland. Its size reflects the importance of maritime trade to Newry and it also has associations with Sir John Rennie. This site is part of the Scheduled Newry Ship Canal and is an Industrial Heritage feature (00172:041:00); and
- Mid-19th century bridge, Barracric Road, Fathom Lower (HB16/13/013). Road bridge carrying the road over the double track Belfast-Dublin railway. Erected in 1851, this bridge has historical associations with Sir John McNeill and William Dargan ('father' of Irish railways). It is also an Industrial Heritage feature (00062:100:00).

5.3.5.3 Historic Landscape

The study area is principally located on the west bank of the Newry River, within the Newry Valley and Upper Bann Regional Landscape Character Assessment (NIRLCA) area and the Newry Basin Northern Ireland Landscape Character Assessment (NILCA) area. Impacts upon these areas are considered in Section 5.5 (Landscape & Visual Effects). Heritage aspects of these landscapes are noted below.

West of the river, the immediate study area is principally located within the eastern extent of the Ring of Gullion AONB. The Mourne AONB extends north-west of Warrenpoint, up the east bank of the Newry River. Impacts upon these areas are considered in Section 5.5, (Landscape & Visual Effects). Summarised excerpts regarding heritage aspects of these areas are noted below.

5.3.5.3.1 High Value Historic Landscapes

There are no High Value Historic Landscapes within the immediate study area.

5.3.5.3.2 Medium Value Historic Landscapes

Narrow Water Castle demesne is on the Register of Parks, Gardens and Demesnes of Special Historic Interest. It is located in the south-eastern fringe of the study area. The present house was built during 1831-37 to the designs of Thomas Duff of Newry (listed HB 16/11/19). It replaced an earlier house, known as Mount Hall (the name of the occupants), of which a wing survives. A map of 1800 shows this house with garden, grove and shrubbery, orchard, pasture, woods, and parkland trees. It is thought that Sir Joseph Paxton made plans for the surroundings of the new house. The Italian Garden has grass terraces, balustrading, cut stone steps and urns. Horizontal ground was once filled with flower beds, remembered in photographs but now grassed. Early 19th century photographs also show the wild garden in the Pleasure Grounds to the north-west of the house, said to have been created by Thomas Smith of Newry. This is no longer maintained. Articles in garden journals at the end of the 19th century mention the garden, and remarkable trees are noted in Trees of Great Britain and Ireland of 1909 and 1910. A folly summer house survives on high ground in woodland. There are extensive plantations of trees. The parkland trees are few and far between. The walled garden is not cultivated and the glasshouses have gone.

5.3.5.3.3 Low Value Historic Landscapes

The Newry Valley contains areas of historic woodland. Six of these are located within the study area including:

- Ancient woodland (WT896) and long-established woodland (WT940 & WT943) at Fathom Lower;
- An extensive area of long-established woodland (planted mixed) at Fathom Upper (Fathom Forest) along the west bank of the Newry River (WT895) and ancient woodland at Fathom Lower (WT896); and
- Areas of long-established woodland (planted mixed) (WT907) at Narrow Water, with an extensive strip of long-established woodland (planted mixed) along the east bank of the Newry River.

A group of four tree rings, recorded as designed landscape features in the SMR, are located in Fathom Lower (ARM029:020, ARM029:021, ARM029:022, ARM029:023). In the Feasibility Study (Scott Wilson, 2008), these features were interpreted as a linear group of four defensive sconces dating to the Nine Years' War (1595-1603). However, they have subsequently been subject to archaeological investigation and there is no archaeological evidence that they were used for defence, being interpreted as 'tree rings' dateable to the late 18th or early 19th century (Walsh, 2014).

The immediate study area crosses the boundaries between the townlands of Cloghogue and Fathom Upper. Depending on preservation and provenance, these boundaries may be over 800 years old.

5.3.5.3.4 Regional Landscape Character Assessment

According to the Northern Ireland Regional Landscape Character Assessment, the study area is located within the Newry Valley and Upper Bann Regional Landscape Character Assessment (NIRLCA) area. *"The Newry Valley and Upper Bann form a lowland area between the uplands of the Mourne Mountains to the east and Slieve Gullion to the west. The lowland forms a link between Lough Neagh and Carlingford Lough which has long served as a strategic route … Slieve Gullion and the South Armagh hills (RLCA 24) rise to the west, and to the east the Mourne Mountains and Slieve Croob (RLCA 25) rise sharply out of the drumlins and form a frame around the Newry and Ballyroney basins … The lower Newry River and the ship canal are characterised as the Newry Estuary Seascape Character Area (SCA 21). Drumlins dominate the area, carrying improved pastures, generally of good condition although rougher on higher ground towards the edges of the hills. There are maintained hedges and tree lines that give this area a sense of intactness and form a network of field boundaries overlying the pattern of drumlins."* (NIRLCA, 2016).

Relevant cultural influences are described as follows:

- "Newry traces its origins to St Patrick, and his monastery was refounded as a Cistercian house in the 12th century when Normans took over the area. The town was developed from the 16th century after the suppression of the monastery, and the coming of the canal and port in the 18th century brought prosperity and growth to the town, seen in the many fine Victorian buildings. It acquired city status in 2002.
- Narrow Water Castle is a well-known 16th-century tower house and bawn near Warrenpoint at the point where the Newry River meets Carlingford Lough. There has been a keep on the site

since 1212 and was originally built by Hugh de Lacy, first Earl of Ulster, to prevent river-borne attacks on Newry.

- The Newry Ship Canal, opened for traffic in 1742, was the first summit level canal in the British Isles and was built to link the Tyrone coalfields (via Lough Neagh and the River Bann) to the Irish Sea at Carlingford Lough near Newry.
- Albert Basin canal harbour within Newry was an important port for emigrant vessels sailing from Warrenpoint, with passengers fleeing the hardships of the Great Irish Famine.
- The towpath of the Newry Ship Canal has become part of a long distance footpath and also part of the National Cycle Network. The section from Newry to sea locks on the Omeath Road, has hosted the World Coarse Angling Championships." (NIRLCA, 2016).

Cultural services include:

- "Archaeological heritage: Heritage of raths and crannogs; castles including Narrow Water and Newry; later country houses and demesne landscapes; 18th century Newry Canal and Ship Canal and wider industrial heritage.
- Spiritual and religious values: Association of Newry with St Patrick and early Christian monastery site." (NIRLCA, 2016).

5.3.5.3.5 Landscape Character Assessment

The study area is located within the Northern Ireland Landscape Character Assessment area LCA 69 Newry Basin. It is described as *"a large scale rolling drumlin landscape situated between the Ring of Gullion and the Mourne Mountains … To the south of Newry, the Newry River flows in a dramatic, steep sided narrow valley. The Newry Basin is a very diverse area; with a rich heritage of historic landscapes and archaeological sites … Narrow Water Castle is an important historic landmark at the entrance to the Newry River". "The most sensitive landscapes are the attractive river valleys, loughs and marshes … and the many archaeological sites (raths, mottes, standing stones) which are concentrated on the fringes of the area."* (NILCA, 2006).

5.3.5.3.6 Areas of Outstanding Natural Beauty

The Ring of Gullion AONB Management Plan (NIEA) notes that *"The Ring of Gullion is a unique geological landform, unparalleled elsewhere in the British Isles. The ring of low, rugged hills forms a 'rampart' around the heather-clad Slieve Gullion Mountain. Rich semi-wild habitats of heath, bog and woodland contrast with the neatly patterned fields and ladder farms. Slieve Gullion's mysterious reputation arises from its associations with legends and the wider area's rich archaeological heritage." "People have lived in the Ring of Gullion for over 6000 years. The area is rich in historic monuments dating from Neolithic times to the Plantation, including burial sites, raths, ecclesiastical sites and the early 17th century fortification at Moyry. Many of the sites have been well studied and their significance understood. Others such as the Dorsey earthworks, thought to be both a gateway and defensive boundary to Ulster, may still have secrets to reveal. The area has been important for communications and travel through the ages and the AONB is traversed by both the modern and newly-upgraded A1 and the Slige Midluachra, the ancient road from Drogheda to Dunseverick*.

Built developments in the countryside that impact on the quality of the landscape include … the widening and realignment of the A1 through the AONB and further through more localised programmes of road and junction improvement and realignment … The works to the A1 road present an opportunity to promote the AONB through signage. It is important however to ensure that the existing advertising hoardings and intrusive signage associated with the border crossing, which detract from the visual quality of the surrounding landscape, do not transfer to the new road. There is no indication that the final roadside treatment of the new A1 road has been designed to reflect the traditional character of the Ring of Gullion AONB however, some important mitigation works have been carried out including investigation of archaeological and wetland sites during the process of route choice and development …" (NIEA, 2011).

North-west of Warrenpoint is the Mourne AONB; a sliver extends west of Warrenpoint up the east bank of the Newry River, including Narrow Water Wood. *"The mountains, countryside, coast and settlements of Mourne comprise a diverse resource of immense importance in respect of their landscape, wildlife, built and cultural heritage. The Mourne Mountains contain a number of important pre-Christian sites including ancient burial or sacred places marked with cairns, many on the summits. A significant number of chambered graves or dolmens can be found in the foothills surrounding the*

Mournes and are said by some archaeologists to indicate the ancient significance of the mountains as a sacred site. On the lower slopes of the Western Mournes, there are Raths, also known as Ringforts Cashels which used stone walls instead of earthen banks also exist … The Mourne Mountains have long held an important place in Irish folklore. The original name of Slieve Donard, Slieve Slainge, was taken after the son of Partholon, a great leader of Irish mythology who was buried in the Great Cairn on the summit of the mountain" (MMLP, 2010).

5.3.5.4 Historic Cartographic Evidence

Historic Cartographic sources relating to the study area were examined at the Public Record Office of Northern Ireland. These sources ranged in date from the late 16th century to the 20th century. Most of the pre-20th century mapping reviewed was drawn at a large scale with little detail shown within the study area. In addition to this, the topography within the study area consists of higher ground with dense tree plantations and the mapping representations of this tend to be quite general with the only features of note the roads to Dublin and Carlingford.

Prominent features are depicted on mapping pre-dating the construction of the canal lock which shows the castle (ARM029:033) at this location in Fathom Lower. In particular, the map of the east of Ireland from Dublin to Carrickfergus (PRONI T2125/5/2A) shows the area in 1580 and depicts the castle as a tower house, similar to Narrow Water Keep (DOW051:044) which is also clearly marked to the southeast. No other structures are marked within the study area.

Early 19th century mapping shows the planned upgrading of the Newry Canal, including Rennie's plan from 1820 for the new entrance lock near Doyle's Hole (PRONI T1515/17B). This shows the old lock and jetty at Fathom Lower prior to their removal by the construction of the Victoria Locks. No details are shown of the area to the west where the Yellow Route is located.

It is only with the Ordnance Survey mapping during the 1830s that detailed depictions of the study area become available. The 1st Edition Ordnance Survey map shows the layout of the study area in 1835 (Figure 5.3.2). To the north-west, the old line of the river is marked, showing that the current line of the river had been diverted. An embankment is marked on the east side of the river where the Blue Route bridge crossing will run, suggesting that this area is reclaimed land. Gentleman's residences are shown at Ashton (HB16/13/009) and Fathom Park (HB16/13/005). The Belvedere Tower (HB16/13/029) associated with Fathom Park is shown, but the corresponding Belvedere Tower at Ashton is not shown. Apart from these, the area is sparsely inhabited with the majority of dwellings located along the Flagstaff Road. The topography is shown as mountainous with areas of wet, marginal terrain (CH-02), with major features being the roads to Dublin and Carlingford and the canal. The Wellington Inn (CH-03) is shown as set within a rectangular area to the immediate east of the Dublin Road. The tree rings (ARM029:020, 021 & 022) are shown but not identified. There is no indication of what property these landscape features are associated with. No development is shown at the locations of the bridge crossings on the County Down side of the Newry River.

By the 2nd Edition Ordnance Survey (1861), the study area had seen significant industrial development with the three railway lines now extant (Figure 12.3.3). In particular, the Newry to Greenore railway line ran adjacent to the Fathom Line Road. Associated railway features include the bridge (00538:006:00) and milepost (00538:007:00).

To the west, the Belfast to Dublin railway line now cuts across the study area. The bridge (HB16/13/013) carrying the Barracric Road over the railway line is now extant, while there are no visible traces of the Wellington Inn (CH-03) or its associated structures. To the east, the line of the Newry to Warrenpoint railway line is now extant. It follows the line of the river bank but is mostly set within the intertidal area, actually running between Narrow Water Keep and the river bank. No specific features associated with this railway line are marked.

Field systems are shown on this map edition. Those in the immediate study area have straight boundaries which do not curve as if respecting or avoiding physical features such as upstanding archaeological features, although the complex system of field boundaries (CH-01) are apparent around Cloghogue. The tree rings (ARM029:020 - 023) are distinctly visible as circular features in contrast to the surrounding rectangular field systems. Marginal ground is still marked at the location of CH-02.

The 3rd Edition Ordnance Survey map sheet shows the layout of the area at the start of the 20th century (Figure 5.3.4). The study area is still sparsely inhabited with the Gentleman's residences of

Ashton and Fathom overlooking the canal and river while the complex field system (CH-01) is still apparent to the west. The east side of the river, where the Blue Route bridge would cross is still defined by embankments with the Warrenpoint Railway line bounding it to the north. Fathom Mountain is well defined and the field systems are shown to respect the steep terrain with fields becoming smaller upslope. The terrain is visibly marginal in places including at CH-02 with dense planting in others. The tree rings (ARM029:020 - 023) are still visible, though less distinct in the landscape.

The railway lines still formed major features in the study area. No associated features are marked on these maps at the bridge crossings associated with the Red and Yellow Route options, either on the south or north banks of the river. The bridge (00538:006:00) carrying the road over the railway at Victoria Lock is marked but not identified. Narrow Water Demesne is well defined and the dense planting associated with the demesne continuing north-west.

5.3.5.5 Aerial Photographic Evidence

Aerial photographic evidence held by the Ordnance Survey Northern Ireland was examined, including the following:

- R24 TER 254 F5682 (1st April 1982);
- R19 TER 249 F4335 (1st September 1983); and
- R24 TER 254 F5673 (1st April 1984).

These aerial photographs were all colour orthophotography which showed the study area in good definition. The study area was still largely rural with pasture fields to the east towards the river and canal while marginal ground, including CH-02 and Fathom Mountain, occupy the west, with dense mature planting to the south. The complex field system (CH-01) has been larger subsumed into larger land units. Ashton House and Fathom House are clearly visible. The Belvedere at Ashton House was visible as a circular stone structure, though the Belvedere at Fathom House was not visible in the dense vegetation of Benson’s Glen. The tree rings were completely subsumed by surrounding vegetation.

The former Carlingford railway line closed in 1951 and the line of this feature was barely visible in the landscape on the aerial photographs. Similarly, the Warrenpoint railway line to the east had also gone out of use and there were no signs of it along the riverside, especially at the locations where the bridges associated with the Red and Yellow Route options would cross. The northern extent, where the Blue Route Option bridge would cross, was now heavily developed as an industrial park with the line of the former railway line now under dual carriageway.

There were no signs of cropmarks within fields that could signify below-ground remains of archaeological features, buildings or field systems.

5.3.5.6 Initial Site Appraisal

An initial site appraisal was carried out, (where accessible), along each route option to verify the results of the desk-based study and to assess the routes for previously unrecorded heritage assets which could be impacted, should the scheme proceed. Designated Cultural Heritage assets within 1km of the boundaries of each route were also examined to assess potential impact upon their settings. Plates associated with this site appraisal can be found in Appendix C.

The area remains largely as depicted on the aerial photographic evidence with industrial units / residential areas to the north and east; and rural areas to the west (Plate 5.3.1). The topography of the river valley consists of steep ground extending upwards on each side of the river, especially with Fathom Mountain. This has impeded development and large areas remain densely forested on both sides of the river. Similarly, the local road network remains quite sparse.

Ashton House (HB16/13/009) is still extant, as is its Belvedere (HB16/13/028). The Belvedere is clearly visible from the east bank of the river (Plate 5.3.2), as is Fathom House (Plate 5.3.3). The Belvedere associated with Fathom House is located in the densely wooded Benson’s Glen (WT940) which screens this asset on all sides (Plate 5.3.4). The majority of the ground to the north-west is agricultural and used as pasture. The quality of this pasture decreases closer to the slopes of Fathom Mountain with marginal ground apparent (Plate 5.3.5). This ground has the potential for palaeoenvironmental remains (CH-02).

Barracric Road provides access between Flagstaff Road and the old Dublin Road skirting around the north slopes of Fathom Mountain. The road still utilises the bridge to cross the Belfast – Dublin railway before joining the Dublin Road (Plate 5.3.6). Wellington Inn (CH-03) was formerly located at the junction of these roads but there are no longer any visible signs of this building.

The Newry Canal is still extant with the most striking aspect the Victoria Lock (00172:041:00) which has been developed into a visitor attraction (Plate 5.3.7). Similarly, the canal bank has been recently developed into a Greenway. The line of the adjacent former railway line to Greenore has been largely subsumed by vegetation and there are few visible traces. An abutment associated with the former bridge (00538:006:00) at Victoria Lock is one visible feature (Plate 5.3.8). There are no signs of the former railway to Warrenpoint on the east bank of the river (Plate 5.3.9).

Designated assets within the study area include the Newry Ship Canal (DOW/ARM 029:500) (Plate 5.3.10). The Church of the Sacred Heart, Dublin Road, Newry (HB16/29/017A) (Plate 5.3.11) and Narrow Water Castle (HB16/11/019A) (Plate 5.3.12) are both listed buildings. Initial assessment suggests that there would be limited or no views between these assets and the route options (Plates 5.3.13 – 5.3.16). However, this should be subject to a thorough assessment once a final route option has been selected.

5.3.6 Assessment of Environmental Impacts

5.3.6.1 Potential Impacts by Route Option

Due to the inherent limited design information available for each route option at this early stage, it is not possible to accurately determine the impacts that the ultimate scheme would have on archaeological remains. In addition, specific route options may impact on buried and currently unknown archaeological remains, or other heritage assets that have not yet been identified or recorded in HED datasets.

Depending on the final route and bridge design, there is the potential for construction of the scheme to physically impact the Newry Ship Canal, a Scheduled Monument. Dependent on the design, it is possible that elements such as bridge piers, abutments or narrowing of the channel may result in physical impacts to this monument. Scheduled Monument Consent (SMC) is required for any works which might physically impact a Scheduled Monument.

The route options discussed below are all considered on the basis that any new bridge structure would over-fly the Scheduled Monument and there would be no direct physical impact upon it. This, however, may change and would be clarified as the design is developed.

Depending on the final route and bridge design, there is the potential for adverse effects on the setting of historic buildings, archaeological sites and historic landscapes located along the scheme during construction, due to activities such as topsoil stripping, bulk earthworks operations, erection of new highways structures, piling, or excavation.

For these reasons, in the following sections, a broad assessment of likely impacts is provided, assuming a worst-case scenario. A gazetteer of heritage assets and assessment of potential impacts per route option is given in Appendix C.

5.3.6.1.1 Red Route

The Red Route has the potential to physically affect nine assets of low value, fives assets of unknown value and affect the settings of three assets of high value and four assets of low value. The magnitude of effect is considered to be **Major Adverse** resulting in a significance of effect of **Large Adverse** for this option.

The nine assets of low value that the route option may impact upon are the battle site of 1600 (ARM029:042) and four tree ring sites in Fathom Lower (ARM029:020; ARM029:021; ARM029:022; ARM029:023). It may also impact upon the former lines of the Industrial Heritage Record GNR Branch Line from Goraghwood to Warrenpoint (00478), the Newry and Greenore Railway (00538), the long-established woodland of historic value at Fathom Upper (WT895), whilst also crossing the boundaries between the townland of Cloghogue with Fathom Upper.

The five assets of unknown value that the Red Route may impact upon are areas of palaeoenvironmental potential (CH-02) and the possible site of the former Wellington Inn (CH-03) while the river crossing associated with this route could impact upon the following recorded shipwrecks: MRD 2631, MRD 2655 and MRD 2705.

The Red Route also has the potential to impact upon the setting of a range of heritage assets, including:

- The Scheduled Newry Ship Canal (ARM/DOW029:500). Although it is not expected at this stage that the canal itself would be physically affected by the bridge structure, the setting of this high value site would be affected, including the Victoria Locks (HB16/13/069) which are classed as a Record Only Historic Building;
- The B+ listed Church of the Sacred Heart, Drumalane (HB16/29/017A), the associated B1 listed gates and walling (HB16/29/017C) and its non-designated Parochial House (HB16/29/017B). Based on HED records, Cloghogue Church is an important basilica plan 20th century church in a Hiberno-Romanesque style, an architectural landmark set on a prominent elevated site. The gates, piers and walls provide a plain entrance into the church complex, which is in a mature landscape. They provide an attractive setting for the church. The gates are finished in a similar style and materials to the rest of the buildings in the group, and remain intact and in good condition. The church may be buffered from the alignment of the Red Route by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line. However, the historic setting of this high value site may be adversely affected as the Red Route would be visible to the south;
- The high value B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- The low value undated enclosure or 'fort' in Fathom Lower (ARM029:025); and
- The low value three areas of historic woodland in Fathom Lower, comprising ancient woodland (WT896) and long-established woodland (WT940 & WT907).

5.3.6.1.2 Yellow Route

The Yellow Route has the potential to physically affect 12 assets of low value, four assets of unknown value and affect the settings of three assets of high value and four assets of low value. The magnitude of effect is considered to be **Major Adverse** resulting in a significance of effect of **Large Adverse** for this option.

It may impact upon the following low value assets: the former lines of the Industrial Heritage Record GNR Branch Line from Goraghwood to Warrenpoint (00478) and the Newry and Greenore Railway (00538), the battle site of 1600 (ARM029:042), the four tree ring sites in Fathom Lower (ARM029:020; ARM029:021; ARM029:022; ARM029:023), as well as on the extensive areas of historic woodland at Fathom, including ancient woodland (WT896) and long-established woodland (WT895, WT943 & WT940). It also crosses the boundaries between the townland of Cloghogue with Fathom Upper.

This route may impact upon unknown value assets in the form of the areas of palaeoenvironmental potential (CH-02) and the possible site of the former Wellington Inn (CH-03) while the river crossing associated with this route option could impact upon the following recorded shipwrecks: MRD 2616 and MRD 2672.

The Yellow Route also has the potential to impact upon the setting of a range of heritage assets comprising:

- The Scheduled Newry Ship Canal (ARM/DOW029:500). Although the canal would be not directly physically affected by the new bridge, its setting of this high value asset would be affected including the Victoria Locks (HB16/13/069) which are classed as a Record Only Historic Building;
- The B+ listed Church of the Sacred Heart, Drumalane (HB16/29/017A), the associated B1 listed gates and walling (HB16/29/017C) and its non-designated Parochial House (HB16/29/017B). Based on HED records, Cloghogue Church is an important basilica plan 20th century church in a Hiberno-Romanesque style, an architectural landmark set on a prominent elevated site. The gates, piers and walls provide a plain entrance into the church complex, which is in a mature landscape. They provide an attractive setting for the church. The gates are finished in a similar style and materials to the rest of the buildings in the group, and remain intact and in good condition. The church may be buffered from the alignment of the Yellow Route by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line.

However, the historic setting of this high value asset may be adversely affected as the Yellow Route would be visible to the south;

- The high value B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- The low value undated enclosure or 'fort' in Fathom Lower (ARM029:025); and
- The low value historic long-established woodland at Narrow Water (WT904; WT905; WT906; WT907).

5.3.6.1.3 Blue Route Option 1

Blue Route Option 1 has the potential to physically affect five assets of low value, three assets of unknown value and affect the settings of three assets of high value and four assets of low value. The magnitude of effect is considered to be **Major Adverse** resulting in a significance of effect of **Large Adverse** for this option.

Blue Route Option 1 may physically impact upon the following low value assets: Record Only Belvedere Tower (HB16/13/009), Fathom Lower and the former lines of the Industrial Heritage Record GNR Branch Line from Goraghwood to Warrenpoint (00478), the Newry and Greenore Railway (00538) and the boundary between the townlands of Cloghogue and Fathom Lower and would sever the long-established woodland of Fathom Lower (WT940) in Benson's Glen.

This route option may also impact upon the unknown value assets: a possible area of complex field boundaries (CH-01), areas of palaeoenvironmental potential (CH-02), the possible site of a 19th century building, Wellington Inn (CH-03) located adjacent to the old Dublin Road and previously unrecorded archaeological features and deposits within greenfield areas.

Blue Route Option 1 also has the potential to impact upon the setting of a range of heritage assets, including:

- The Scheduled Newry Canal (ARM/DOW029:500; IHR 172). Although it is not expected at this stage that the canal itself would be directly physically affected by the bridge structure, the setting of the high value site would be affected. The impact on the setting of the canal would probably be limited, as the area where the corridor crosses is in a more urbanised area where the setting of the canal has already been compromised especially by modern industrial development.
- The B+ listed Church of the Sacred Heart, Drumalane (Cloghogue Church) (HB16/29/017A), the associated B1 listed gates and walling (HB16/29/017C) and its non-designated Parochial House (HB16/29/017B). Based on HED records, the church is an important basilica plan 20th century church in a Hiberno-Romanesque style, an architectural landmark set on a prominent elevated site. The gates, piers and walls provide a plain entrance into the church complex, which is set in a mature landscape. The gates are finished in a similar style and materials to the rest of the buildings in the group, and remain intact and in good condition. The church may be screened from the alignment of Blue Route Option 1 by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line. However, the setting of this high value asset may be adversely affected by the proximity of Blue Route Option 1 which would be visible to the south of the church.
- The high value B1 listed Fathom House (HB16/13/005) and B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- The low value Record Only Ashton House (HB16/13/028); the Industrial Heritage Record railway bridge on the GNR Main Line (00062:102:00) which is also a Recorded Only Historic Building (HB16/13/013) and long-established woodland in Fathom Lower (WT943).

5.3.6.1.4 Blue Route Option 2

Blue Route Option 2 has the potential to physically affect four assets of low value, three assets of unknown value and affect the settings of three assets of high value and four assets of low value. The magnitude of effect is considered to be **Major Adverse** resulting in a significance of effect of **Large Adverse** for this option.

Blue Route Option 2 may physically impact upon the following low value assets: Record Only Belvedere Tower (HB16/13/009), Fathom Lower and the former lines of the Industrial Heritage Record GNR Branch Line from Goraghwood to Warrenpoint (00478) and the Newry and Greenore Railway

(00538), the boundary between the townlands of Cloghogue and Fathom Lower and fragment the west extent of the long established woodland of Benson's Glen (WT940).

This route option may also impact upon the unknown value assets: a possible area of complex field boundaries (CH-01), areas of palaeoenvironmental potential (CH-02), the possible site of a 19th century building, Wellington Inn (CH-03) located adjacent to the old Dublin Road and previously unrecorded archaeological features and deposits within greenfield areas.

Blue Route Option 2 also has the potential to impact upon the setting of a range of heritage assets, including:

- The Scheduled Newry Ship Canal (ARM/DOW029:500; IHR 172). Although it is not expected at this stage that the canal itself would be directly physically affected by the bridge structure, the setting of the high value site would be affected. The impact on the setting of the canal would probably be limited, as the area where the corridor crosses is in a more urbanised area where the setting of the canal has already been compromised especially by modern industrial development.
- The B+ listed Church of the Sacred Heart, Drumalane (Cloghogue Church) (HB16/29/017A), the associated B1 listed gates and walling (HB16/29/017C) and its non-designated Parochial House (HB16/29/017B). Based on HED records, the church is an important basilica plan 20th century church in a Hiberno-Romanesque style, an architectural landmark set on a prominent elevated site. The gates, piers and walls provide a plain entrance into the church complex, which is set in a mature landscape. The gates are finished in a similar style and materials to the rest of the buildings in the group, and remain intact and in good condition. The church may be screened from the alignment of Blue Route Option 2 by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line. However, the setting of this high value asset may be adversely affected by the proximity of Blue Route Option 2 which would be visible to the south of the church.
- The high value B1 listed Fathom House (HB16/13/005) and B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- The low value Record Only Ashton House (HB16/13/028); the Industrial Heritage Record railway bridge on the GNR Main Line (00062:102:00) which is also a Recorded Only Historic Building (HB16/13/013) and long-established woodland in Fathom Lower (WT940, WT943).

5.3.6.1.5 Blue Route Option 3

Blue Route Option 3 has the potential to physically affect five assets of low value, three assets of unknown value and affect the settings of three assets of high value and four assets of low value. The magnitude of effect is considered to be **Major Adverse** resulting in a significance of effect of **Large Adverse** for this option.

Blue Route Option 3 may physically impact upon the following low value assets: Record Only Belvedere Tower (HB16/13/009), Fathom Lower and the former lines of the Industrial Heritage Record GNR Branch Line from Goraghwood to Warrenpoint (00478) and the Newry and Greenore Railway (00538), the boundary between the townlands of Cloghogue and Fathom Lower and fragment the west extent of the long established woodland of Benson's Glen (WT940).

This route option may also impact upon the unknown value assets: a possible area of complex field boundaries (CH-01), areas of palaeoenvironmental potential (CH-02), the possible site of a 19th century building, Wellington Inn (CH-03) located adjacent to the old Dublin Road and previously unrecorded archaeological features and deposits within greenfield areas.

Blue Route Option 3 also has the potential to impact upon the setting of a range of heritage assets, including:

- The Scheduled Newry Ship Canal (ARM/DOW029:500; IHR 172). Although it is not expected at this stage that the canal itself would be directly physically affected by the bridge structure, the setting of the high value site would be affected. The impact on the setting of the canal would probably be limited, as the area where the corridor crosses is in a more urbanised area where the setting of the canal has already been compromised especially by modern industrial development.

- The B+ listed Church of the Sacred Heart, Drumalane (Cloghogue Church) (HB16/29/017A), the associated B1 listed gates and walling (HB16/29/017C) and its non-designated Parochial House (HB16/29/017B). Based on HED records, the church is an important basilica plan 20th century church in a Hiberno-Romanesque style, an architectural landmark set on a prominent elevated site. The gates, piers and walls provide a plain entrance into the church complex, which is set in a mature landscape. The gates are finished in a similar style and materials to the rest of the buildings in the group, and remain intact and in good condition. The church may be screened from the alignment of Blue Route Option 3 by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line. However, the setting of this high value asset may be adversely affected by the proximity of Blue Route Option 3 which would be visible to the south of the church.
- The high value B1 listed Fathom House (HB16/13/005) and B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- The low value Record Only Ashton House (HB16/13/028); the Industrial Heritage Record railway bridge on the GNR Main Line (00062:102:00) which is also a Recorded Only Historic Building (HB16/13/013) and long-established woodland in Fathom Lower (WT940, WT943).

5.3.6.2 Potential Impacts during Construction

Construction of the scheme with any of the five route options under consideration has the potential to affect heritage assets in the following ways:

- Partial or total removal of heritage assets during ground investigations, site clearance and road construction;
- Impact of landscaping, spoil disposal and planting on the setting of heritage assets, and damage caused to archaeological deposits caused by planting or earthwork bunds;
- Compaction of archaeological deposits due to construction traffic movement or materials storage; damage through rutting of superficial deposits from construction traffic;
- Vibration and changes in air quality, causing damage to historic monuments during construction;
- Changes in groundwater levels leading to the desiccation of previously waterlogged archaeological deposits, damage caused by changes to hydrology and chemical alteration, or changes in silt deposition regimes;
- Effects on the setting of heritage assets, including visual and noise intrusion and changes in traffic levels; and
- Severance causing dereliction or neglect of historic monuments or reduction of group value and adverse impacts on amenity as a result of construction works.

5.3.6.3 Potential Impacts during Operation

The operation of the scheme with any of the five route options under consideration has the potential to result in impacts on the setting of heritage assets. In the majority of cases, these would be long-term in nature. These impacts would commence during construction of the scheme and continue during operation; however, the degree of impact may vary between phases. Such impacts can include:

- Changes to the surroundings of heritage assets or the general character of their setting;
- Changes to access or the viability of heritage assets; and,
- Cumulative impacts on historic landscape elements as a result of operational maintenance through alteration of historic landscape elements.
- Operation of the scheme has the potential to result in impacts on the setting of heritage assets located along the route, including the Scheduled Newry Ship Canal, due to the presence of the new road configuration, noise and visual intrusion, resulting from the movement of vehicles, lighting, potential acoustic barriers and signage.

There is also the potential for beneficial impacts on the setting of historic buildings and area designations (e.g. Newry Conservation Area), due to reductions in traffic levels on the road network in the surrounding area, which has the potential to result in beneficial impacts on heritage assets at some distance from the scheme.

5.3.7 Mitigation & Enhancement Measures

5.3.7.1 Potential Mitigation Measures for Impacts during Construction

Potential mitigation measures for effects on heritage assets include:

- Detailed design of development proposals to avoid or reduce impacts on heritage assets;
- Installation of physical protection or screening measures, or temporary removal of assets for reinstatement following the completion of construction works;
- Archaeological investigations in advance of, or during, construction;
- Historic building recording and historic landscape recording in advance of construction to provide a permanent documentary record of assets in their current form and condition; and
- Dissemination of the results of all surveys in an appropriate format and supporting archive.

5.3.7.2 Potential Mitigation Measures for Impacts during Operation

It is anticipated that adverse impacts on the setting of heritage assets resulting from the operation of the scheme can be mitigated through detailed design. This may include measures such as consideration of the horizontal or vertical alignment of the scheme to reduce its visual prominence, careful siting of lighting or signage, the possible use of acoustic fencing or maintenance of access routes to historic buildings to maintain their viability. Further mitigation can be provided through the use of landscape mitigation measures such as bunds, planting or materials to soften the impact of highway structures. These measures can help to reduce the visual prominence of the scheme and aid its integration with the surrounding landscape.

5.3.8 Presentation of Key Issues

The key issues associated with the five route options from a Cultural Heritage perspective have been outlined below:

- All route options may result in setting impacts upon the Newry Canal, a scheduled historic monument and industrial heritage site.
- Industrial Heritage Record sites include the former line of the railway to Greenore, parts of which could be impacted by all five route options.
- The Blue Route options may physically impact upon the Belvedere Tower associated with Ashton House.
- The Blue Route Option 1 would physically impact upon the historic woodland of Benson's Glen causing severance.
- The Blue Route options would physically impact upon the boundary between the townlands of Cloghogue and Fathom Lower.
- Remains impacted by the Red and Yellow Routes comprise a battle site and four 18th or 19th century tree rings. There is also the possibility that shipwrecks in the Newry River could be impacted by the proposed crossings associated with all five route options.
- There is the potential for well-preserved organic, waterlogged and/or palaeoenvironmental remains in the vicinity of watercourses and in marshy areas.
- It is not anticipated that any listed buildings would be physically impacted. However, Cloghogue Church and its walls and gates are located to the north-west of all five route options; and Fathom House and its associated Belvedere Tower are also close to the line of each route option. There is potential for an adverse impact on their setting both visually and in terms of noise.
- All route options have potential to result in beneficial impacts on the setting of heritage assets, due to reductions in traffic levels on the road network in the surrounding area, particularly within Newry itself.
- There is potential for route signage design to highlight local landscape and heritage assets, e.g. include signage to AONBs (all route options) and for the scheme to underline the 'gateway' aspect of the border crossing (Yellow Route).

This section of the report has identified that there are several heritage assets which could potentially be adversely affected by the scheme, for example through loss or damage during construction, or through adverse effects upon their setting. Given this, none of the five route options can be classed as preferential from a Cultural Heritage perspective. However, the Blue Route options (1-3) would require a smaller land take, resulting in a reduced risk of affecting previously unrecorded remains. In addition, they are anticipated to affect slightly fewer known heritage assets than the Yellow or Red routes.

The Red route has the possibility of impacting upon the tree rings and the 1600 battle site, the former railway line to Greenore, historic woodland on both sides of the river, upon the boundaries between the townland of Cloghogue with Fathom Lower while its associated crossing could impact upon shipwrecks in the river. It could also impact upon the settings of the Newry Ship Canal especially the Victoria Lock, the bridge carrying the Barracric Road over the railway line to Dublin, Fathom House and its associated Belvedere Tower.

The Yellow Route has the possibility of impacting upon the tree rings and the 1600 battle site, the former railway line to Greenore, historic woodland on both sides of the river, upon the boundaries between the townland of Cloghogue with Fathom Lower while its associated crossing could impact upon shipwrecks in the river. It could also impact upon the settings of the Newry Ship Canal, especially the Victoria Lock, the setting of Fathom House and its associated Belvedere Tower.

Blue Route Option 1 has the possibility of impacting upon historic woodland, the Belvedere Tower associated with Ashton House as well as the former line of the railway to Greenore and the townland boundary between Cloghogue and Fathom Lower while its associated crossing could impact upon shipwrecks in the river. It could also impact upon the settings of the scheduled Newry Ship Canal, the bridge carrying the Barracric Road over the railway line to Dublin, Fathom House and its associated Belvedere Tower, the listed church at Cloghogue and historic woodland.

Blue Route Option 2 has the possibility of impacting upon historic woodland, the Belvedere Tower associated with Ashton House as well as the former line of the railway to Greenore and the townland boundary between Cloghogue and Fathom Lower while its associated crossing could impact upon shipwrecks in the river. It could also impact upon the settings of the scheduled Newry Ship Canal, the bridge carrying the Barracric Road over the railway line to Dublin, Fathom House and its associated Belvedere Tower and the listed church at Cloghogue.

Blue Route Option 3 has the possibility of impacting upon historic woodland, the Belvedere Tower associated with Ashton House as well as the former line of the railway to Greenore and the townland boundary between Cloghogue and Fathom Lower while its associated crossing could impact upon shipwrecks in the river. It could also impact upon the settings of the scheduled Newry Ship Canal, the bridge carrying the Barracric Road over the railway line to Dublin, Fathom House and its associated Belvedere Tower and the listed church at Cloghogue.

The height of the new bridge structure could also have impacts on heritage assets beyond the five route options assessed, dependent on its siting and design restrictions imposed by the existing topography. Careful design would be required to minimise height and its impact on the setting of heritage assets in the wider area. A low-level crossing would be preferred, in order to minimise impacts to setting.

However, any crossing could effectively impede maritime traffic along the Newry River to and from the Albert Basin. Consultation has indicated that clearance under any fixed bridge structure should be at least 37m while any opening span should be, at least, the same width as the Victoria Lock. Such a bridge could form an iconic structure that links in to the existing historic landscape and transport networks in a sympathetic way forming a tourism asset of the future.

The options for mitigation would include designing the scheme to avoid or reduce impacts upon heritage assets and enable the preservation in situ of archaeological assets. Archaeological, built heritage and historic landscape recording undertaken in advance of construction would help to mitigate potential effects on heritage assets. Careful design choices and landscaping may help to mitigate the effects upon the settings of historic buildings and other heritage assets.

To inform the preparation of the ‘Detailed’ assessment for cultural heritage, further work will be undertaken, including site walkover inspections, archaeological fieldwork (where feasible, applicable and required), field assessment of the setting of heritage assets, and specialist input into the detailed design of the scheme. The final ‘Detailed’ assessment of potential impacts on heritage assets will be presented in a cultural heritage chapter of the Environmental Statement in due course.

On balance, from a Cultural Heritage perspective, Blue Route Option 2 or 3 would be preferred as they are comparatively shorter and avoid areas of long-established or ancient woodland. The Yellow Route is the longest and thus most likely to impact on yet unknown archaeology, rendering it least preferred.

5.4 Ecology & Nature Conservation

5.4.1 Introduction

Ecology can be defined as '*the scientific study of living organisms and their relationship with each other and their environment*' whilst nature conservation is concerned with '*maintaining a viable population of the country's characteristic fauna and flora and the communities which they comprise*'.

This section of the report examines the main ecological and nature conservation aspects associated with each of the five approved route options under consideration; the environmental protection which exists within the area; and, the potential impact of the route options on ecology and nature conservation interests.

5.4.2 Methodology

This assessment has been based on current best practice guidelines and relevant legislation, in accordance with the requirements of DMRB Volume 11, Section 3, Part 4 (11.3.4) (Ecology and Nature Conservation) and largely incorporates many of the principles detailed within The Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater and Coastal (CIEEM, 2016).

The objective of DMRB Volume 11 (Section 3, Part 4) in relation to nature conservation is concerned with maintaining a viable population of the country's characteristic fauna and flora and the communities they comprise. This objective can be achieved as follows:

- the maintenance of the diversity and character of the countryside, including its wildlife communities and important geological and physical features; and
- the maintenance of viable populations of wildlife species, throughout their traditional ranges, and the improvement of the status of rare and vulnerable species.

The requirement for a Stage 2 assessment is "*to undertake sufficient assessment to identify the nature conservation factors, and the significance of effects upon them, to be taken into consideration by the Design Organisation in developing and refining the route options*".

In accordance with the requirements of DMRB 11.3.4.7 (Stages of Ecological Assessment), the steps taken included:

- Review and update of information relevant to the scheme options collated in the Stage 1 assessment;
- Consultation with Northern Ireland Environment Agency (NIEA) – Natural Environment Division to confirm that the details on the location and nature of any designated sites within the study area have not changed or new sites designated since Stage 1, and to collate information on any further surveys that have been undertaken since that time; and
- Where the Stage 1 assessment and subsequent verification indicate that there is no evidence that any nature conservation interest will be significantly affected by a route option, confirm with NIEA - Natural Environment Division that further work is not required.

Baseline information has been compiled by detailed desktop assessment, collating information from a number of sources. Information regarding species and habitat status, key environmental designations of relevance to the area was gained through consulting the relevant web-based tools, viewers and datasets, including a review of Northern Ireland Habitat Action Plans; Northern Ireland Species Action Plans; and the UK Biodiversity Action Plan [BAP].

More specifically, the Northern Ireland Environment Agency and the Woodland Trust Inventory of Ancient and Long-Established Woodland websites were also reviewed. Sites deemed of relevance were those within 2km of the study area for statutory designated sites, and within 500m for non-statutory sites and features. The National Museums and Galleries of Northern Ireland, and Northern Ireland Environment Agency website was consulted, as a means of providing baseline information relating to protected species, where they have occurred within proximity to the five approved route options.

Experienced ecologists carried out site walkover surveys at a number of key locations throughout the study area, especially where the route options pass close to or through ecological designations or sensitive habitats. These surveys focused on known sensitive habitat features such as long-established woodland and grassland habitats associated with Sites of Local Nature Conservation Importance (SLNCI) and other significant habitat features, such as woodlands and open mosaic habitat. A full Phase 1 habitat survey of the approved route options has not been carried out, however the habitat descriptions below and drawings give an overview of the general habitats present and knowledge of the area to date. Anecdotal evidence of protected species and habitats suitable for protected species were recorded, although no specific detailed surveys were carried out at this stage. Additionally, where the presence of invasive plant species such as Japanese knotweed *Fallopia japonica* was identified, these were also noted. Walkover surveys of key areas were carried out during spring/summer 2017 and spring 2018.

5.4.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. Table 5.4.1 outlines the responses from the consultation in relation to ecology and nature conservation interests.

Table 5.4.1: Consultations in relation to ecology and nature conservation interests

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Birdwatch Ireland	09 Apr 2018 09 May 2018 30 May 2018	-	Did not respond to the consultation.
DAERA – Marine and Fisheries Division	09 Apr 2018 09 May 2018	17 May 2018	Have concerns with the proposal for a bridge over the Newry River particularly the Yellow Route option which is very close to Narrow Water - especially given the current discussions around the possible designation of Narrow Water as a SWPA. There were previous problems and issues with the Narrow Water Bridge that progressed to the stage where a Marine Licence was issued but construction never went ahead due to funding issues. There were problems with access for fishing vessels raised by DARD Fisheries colleagues at the time. The Yellow and Red Routes are within close proximity to the Newry Canal and the Newry River which are designated and are hydrologically connected to national, European and international designated sites. Namely, Carlingford Lough ASSI, which is declared under the Environment Order (Northern Ireland) 2002, Carlingford Lough MCZ which is designated under the Marine Act (Northern Ireland) 2013, Carlingford Lough SPA and Carlingford Marine pSPA which are designated under the EC Birds Directive (79/409/EEC on the conservation of wild birds) and, Carlingford Lough Ramsar Site which is designated under the Ramsar Convention. Recent advice, relating to SACs which have seals as a site selection feature, recommends the following ranges should be used when screening for either Harbour or Grey Seals, all SACs within 135km of the project should be screened for Grey Seals (*Halichoerus grypus*) and all SACs within 50km should be screened for Harbour Seals (*Phoca vitulina*).
DAERA – Natural Environment Division	09 Apr 2018 09 May 2018	17 May 2018	Blue Route options 2 & 3 present the fewest concerns, whereas the Red and Yellow Routes present serious concerns. Significant concerns and is likely to have objections in relation to some of the options proposed. Some

			options encroach on some designated sites while all options are approximately 10km upstream of Carlingford Lough Special Protection Area (SPA). Blue Route options 1, 2 & 3 have 3 natural heritage sites of interest: Ring of Gullion Area of Outstanding Natural Beauty (AONB), Carlingford Lough Area of Special Scientific Interest (ASSI), Fathom Lower Woods and Grasslands Site of Local Nature Conservation Importance (SLNCI) – includes long established woodland. The Yellow and Red Routes have 6 natural heritage sites of interest: Ring of Gullion and Mourne AONBs, Carlingford Lough ASSI – crossing of ASSI habitat, Fathom Lower Woods and Grasslands SLNCI –includes long established woodland, Narrow Water Forest SLNCI – includes long established woodland, Fathom Forest – long established woodland, Fathom Upper ASSI – adjacent to this option and may encroach or indirectly impact upon ASSI.
DAERA – Forest Service	09 Apr 2018	22 May 2018	Based on application of Forest Service policy for woodland removal, they have no objection to any route option. Forest Service note that woodland removal increases from the Blue Route Options (7.3 hectares) to the Red Route (37.3 hectares) to the Yellow Route (82.0 hectares). The loss of long-established woodland shown on the Blue, Red and Yellow Routes follows a similar trend with the greatest loss occurring on the Yellow Route and the least loss on the Blue Routes. Forest Service preference is for options that reduce woodland removal.
Irish Whooper Swan Study Group	09 Apr 2018	9 May 2018	No issues with whooper swans in relation to the scheme.
NMDDC Biodiversity Officer	09 Apr 2018	26 Apr 2018	Confirmed that all routes, apart from the Blue routes cross into the ASSI leading into Carlingford Lough.
Northern Ireland Bat Group	09 Apr 2018 09 May 2018 30 May 2018	07 Jun 2018	Pending/holding letter.
Northern Ireland Badger Group	09 Apr 2018	09 May 2018	No comment to make.
RSPB Northern Ireland	09 Apr 2018	02 May 2018	Preferred selection is the Blue Route (1, 2 or 3) as this route avoids any designated sites of nature conservation importance, namely the Carlingford Lough Area of Special Scientific Interest (ASSI) and thus is less likely to impact on this site. Subject to further environmental assessment, this route may involve the least impact on biodiversity. The Red and Yellow Route options both lie within the Carlingford Lough ASSI and as such represent an increased potential for impact on the site. Impacts may be direct e.g. loss of habitat due to construction, or indirect e.g. if there are impacts on water flow. Carlingford Lough ASSI contains internationally important populations of wintering wildfowl including pale-bellied brent geese, great crested grebes, redshank and oystercatchers.
The National	09 Apr 2018	15 May 2018	No comment to make regarding ecology and nature

Trust			conservation.
Ulster Wildlife	09 Apr 2018 09 May 2018 30 May 2018	-	Did not respond to the consultation.
Woodland Trust	09 Apr 2018	09 May 2018	Strongly object to the Red Route, Yellow Route and Blue Route Option 1 given their impact on the ancient and long-established woodlands along these. Loss, fragmentation or damage to the woodlands highlighted above would generate further concerns given the presence of some protected priority species such as the Red Squirrel and Pine Marten. The Woodland Trust considers the level of loss and damage to such a scarce resource wholly unacceptable and in contravention to the Strategic Planning Policy Statement, given the biodiversity value associated with such sites. The Trust requests that alternative proposals which will not result in the loss and damage of ancient or long-established woodland are sought.

5.4.4 Regulatory & Policy Framework

This section deals with the main policies and legislation relating to the flora and fauna contained within the study area.

Two key pieces of European nature conservation legislation are the Birds Directive (2009/147/EC) and the Habitats Directive (92/43/EEC). The former concerns the general protection of birds and designation of Special Protection Areas (SPA) for Annex 1 species.

The Habitats Directive concerns the protection of certain animals and plants (European Protected Species) and habitats, for which Special Areas of Conservation (SAC) must be designated. These Directives are implemented by national legislation and transposed into Northern Ireland laws as outlined below.

Several international conventions are implemented by European Directives and in turn by national legislation. The Bern Convention (1979) is implemented by The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended), which protects habitats listed in the Habitats Directive Annex 1, such as bog, and species listed in Annex IV (a), such as bats and otter, through their inclusion in Schedule 2 to the Conservation Regulations. This makes it an offence to intentionally kill, injure, or take an animal, or to damage, destroy or obstruct access to its resting place.

The Wildlife (Northern Ireland) Order 1985 (as amended) also implements the requirements of the European Directives and the Bonn Convention of 1979. Wild birds are protected and special penalties are available for offences related to birds listed in Schedule 1 and other animals (e.g. newts, badger and fish) through their inclusion in Schedule 5 to the Order. This makes it an offence to intentionally kill, injure, or take an animal, or to damage, destroy or obstruct access to its resting place. The legislative requirements associated with these protected habitats and species, and the implications of these for the route options are considered below.

Under the Wildlife and Natural Environment (Northern Ireland) Act 2011 (WANE), public bodies including local planning authorities have a duty to conserve biodiversity during the course of their duties.

Planning Policy Statement (PPS) 2 Natural Heritage (2013) states the Department's planning policy for nature conservation for the whole of Northern Ireland. It is strongly guided by Government policy. It helps to protect designated areas and advises on the treatment of nature conservation issues in development plans. In addition, it outlines the criteria that planning authorities employ when processing planning applications which might affect nature conservation interests, and to which developers should have regard when preparing proposals. This newly revised version outlines the importance that is now placed on Northern Ireland Priority Species and Habitats within the planning process.

5.4.4.1 Habitats

Biodiversity Action Plan (BAP) Priority Habitats for conservation are identified at national UK level (UK BAP) and at Regional level (NI BAP). Northern Ireland Priority Habitats are of principal importance for conserving biodiversity within the geographical area of reference. Where possible, such habitats must be protected from adverse impacts and where impacts are unavoidable, provision of sufficient compensatory habitat is advocated by planning policy.

Non-Priority Habitats (outside of protected sites) are generally common and widespread habitats. Such habitats are not subject to specific policy or legislative protection, but often have intrinsic value or form part of habitat networks supporting species and facilitating their dispersal. In some cases, areas of non-priority habitat can be important 'functional land', supporting species within neighbouring protected sites, or may buffer protected sites from nearby changes in land use or development.

5.4.4.2 Otter

The Otter is protected under The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007. Under the provisions of the Regulations, it is a criminal offence to intentionally kill, take or injure an Otter; intentionally disturb an Otter in its place of shelter; or intentionally damage, destroy or obstruct access to a place of shelter. The EC Habitats Directive implemented through the above Regulations, makes provision to protect both Otters and their habitat.

5.4.4.3 Bats

All bat species which occur in Northern Ireland are protected under The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007. Under the provisions of the Regulations, it is a criminal offence to intentionally or deliberately kill, injure or capture (take) a bat; deliberately disturb a bat (whether in a roost or not); or damage, destroy or obstruct access to a bat roost. For the purposes of bat protection, a bat roost is defined as 'any structure or place, which is used for shelter or protection', regardless of whether it is in use or not.

5.4.4.4 Red squirrel

The red squirrel is protected by its inclusion within Schedule 5 to the Wildlife (Northern Ireland) Order 1985, under which it is an offence to intentionally kill, take, injure or disturb any red squirrel, damage, destroy, or obstruct access to any structure or place used by a red squirrel for shelter or protection. The red squirrel also has a Northern Ireland Species Action Plan and a UK [BAP].

5.4.4.5 Nationally protected species

A number of species including badger, pine marten, holly-blue butterfly, common lizard, and smooth newt are nationally protected through Schedule 5 to the Wildlife (Northern Ireland) Order 1985 (as amended). Under this legislation it is an offence to (or attempt to) kill, take, injure or disturb such a species or its place of shelter, or damage, destroy or obstruct access to any structure or place which the species uses for shelter or protection.

Nesting birds are also protected by the Wildlife Order whereby it is illegal to intentionally or recklessly kill, injure or take any wild bird, damage or destroy or otherwise interfere with the nest of any wild bird, or take or destroy an egg of any wild bird. Therefore, during the breeding season (considered to be March to August inclusive) it is an offence to remove or destroy a bird's nest.

5.4.4.6 Invasive non-native Plant Species

The Wildlife (Northern Ireland) Order 1985 (as amended) makes it an offence to cause Japanese knotweed *Fallopia japonica*, Giant hogweed *Heracleum mantegazzianum* and Indian (Himalayan) balsam *Impatiens glandulifera*, amongst other species listed in Schedule 9 Part II, to grow in the wild. Excavated soil containing tissue from any of these species should be disposed of in a manner to comply with the Order.

5.4.5 Baseline Environmental Conditions & Constraints

5.4.5.1 Designated Ecological Sites of International/National/Local Importance

With reference to NIEA – Natural Environment Division digital data sets of designated ecological sites, it is evident that there are several international and national sites within the study area, such as Special Areas of Conservation (SAC), Ramsar Sites, and Areas of Special Scientific Interest (ASSI). There are no Special Protection Areas (SPA), within the immediate study area. The closest is

Carlingford Lough SPA located approximately 10km south-east of the study area at Killowen Point (Figure 5.4.1).

These sites have been designated for a variety of features of ecological and nature conservation interest, including grassland, fen, mesotrophic lough, invertebrate assemblage, woodland, intertidal mud/sand, sea bird, wader and waterfowl assemblages. Within Northern Ireland, the sites include Derryleckagh SAC, ASSI & proposed Ramsar Site, Carlingford Lough ASSI, Fathom Upper ASSI, Greenan ASSI, Greenan Lough ASSI and Clermont & Anglesey ASSI (Figure 5.4.1).

Due to the study area's proximity to the border with the Republic of Ireland, there are also several notable nationally and internationally designated sites located south-east of the study area, near Narrow Water. With reference to the digital dataset website of the National Parks & Wildlife Service (NPWS), these sites include Carlingford Shore SAC, Carlingford Mountain SAC & proposed Natural Heritage Area (pNHA) and Carlingford Lough (pNHA) (Figure 5.4.1). The closest of these is Carlingford Shore SAC.

Focussing on the study area, there are two nationally protected sites within it or adjacent to it. Covering a total area of 1105ha, Carlingford Lough was designated an ASSI in 1997 by reason of its flora, fauna and earth science interest. The limestones of Carlingford Lough were deposited in a shallow sea basin during the Carboniferous period approximately 340 million years ago. They contain numerous fossils, such as brachiopods and solitary corals. Moraines and deposited sediments provide evidence of the movement of ice sheets and glaciers. The site supports a range of unusual and rich littoral communities, including sheltered sands, muddy sands, muds and boulder shores. It exhibits a good natural transition from lower shore communities, through upper shore saltmarsh to fen vegetation. Mill Bay (near the mouth of the lough) supports the largest intact block of saltmarsh in Northern Ireland. Internationally important numbers of wildfowl and waders overwinter on the site, including pale-bellied brent geese, great crested grebe, shelduck, scaup, redshank and oystercatcher. Carlingford Lough is also important for terns, especially breeding Roseate terns (at one time it held 4.3% of the European Community population).

The study area covers the fringe of the ASSI in its upstream extent and includes the narrow channel of the Newry River and associated deep mud banks. With reference to NIEA's 'Carlingford Lough - Views About Management' document, the mudflats are an important habitat for wildlife, supporting a wide variety of marine invertebrates that represent an important food source for many fish and bird species. They also support beds of seagrass and a rich algal and sponge assemblage which are sensitive to habitat disturbance and water and sediment quality.

Carlingford Lough is also recognised as being an Important Bird Area (IBA), covering c. 4,660ha straddling the border between Northern Ireland (Ref: UK274) and the Republic of Ireland (Ref: IE122). It is an important site for wintering waterfowl, including light-bellied brent geese and scaup. Other waterfowl which winter in numbers of national importance are great crested grebe, cormorant and ringed plovers. However, only approximately 172ha of the IBA is currently underpinned by international designation (i.e. Carlingford Lough SPA).

With reference to the Countryside Assessment (Vol. 2) Technical Supplement of the Banbridge / Newry & Mourne Area Plan 2015, there are three designated Sites of Local Nature Conservation Importance (SLNCI) within the study area. These include Narrow Water Forest, Fathom Lower Woods & Grasslands, and Cloghogue SLNCI (Figure 5.4.2). A fourth SLNCI (Dublin Road) is located within the study area, but is designated for its earth science (geological) interest and thus not considered here.

Narrow Water Forest SLNCI is a narrow strip of Beech Woodland between the A2 Warrenpoint Road and a dense coniferous plantation. It is likely to be a Plantation on Ancient Woodland (PAWS) with an even age stand of beech *Fagus sylvatica* trees and minimal understorey vegetation. The ground flora is exceptional for its dense carpet of bluebells *Hyacinthoides non-scripta* and other spring wildflowers such as wood-sorrel *Oxalis acetosella*, and wood anemone *Anemone nemorosa*. The site merits its notification due to the diverse ground flora associated with the woodland.

Fathom Lower Woods & Grasslands SLNCI, located on the lower slopes of Fathom Mountain, represents an extensive area of mosaic habitat with mature woodland, regenerating scrub and pockets of species-rich grassland. The SLNCI itself is split into three distinct parcels; the location of each is presented in Figures 5.4.4 – 5.4.7. The scrub is at different stages of development with blackthorn and hawthorn *Crataegus monogyna* frequent, giving way to scattered trees of young ash *Fraxinus excelsior*, hazel *Corylus avellana* and rowan *Sorbus aucuparia*. The site contains Long-established and Ancient Woodland.

The grassland is rich with both wet and dry areas. Notable species within the cattle-grazed sward include: common twayblade *Listera ovata*, wild angelica *Angelica sylvestris*, eyebright *Euphrasia sp.* and fairy flax *Linum catharticum*.

Cloghogue SLNCI is unmanaged rank grassland that has pockets of species-richness scattered throughout the sward. There is some bracken encroachment, but the size of the site combined with the assemblage of plants found, such as burnet-saxifrage *Pimpinella saxifraga* and devil's-bit scabious *Succisa pratensis*, make it an important semi-natural area.

5.4.5.2 Non-Designated Ecological Sites

There are a number of non-designated areas, which are of ecological or nature conservation interest within the study area, in particular the wooded area on the lower slopes of Fathom Mountain which has not been designated as part of the Fathom Lower Woods & Grassland SLNCI complex.

Other open habitats contribute to the overall species diversity and habitat complexity of the study area. These include numerous semi-improved grassland fields with traditional stones walls, abandoned fields with encroaching bracken and scrub. There are also features with a more upland element such as the heath/scrub/bracken mosaic associated with Fathom Mountain.

5.4.5.3 Ancient and Long-established Woodland

With reference to the Woodland Trust's Woodland Inventory digital database, there are a number of woodlands within the study area identified as being of significant conservation value, largely based on age, rarity and biodiversity (Figure 5.4.3). The database provides a comprehensive record of information on the extent and location of Ancient and Long-established Woodland to facilitate future protection and restore and enhance existing Ancient/Long-established Woodland and its biodiversity. Identified by way of archive research and field survey, Ancient Woodland is defined as being continuously wooded since at least 1600 AD (i.e. at least 400 years old) and Long-established Woodland defined as those which have been continuously present since the First Edition 6" to the Mile OS maps were produced in 1830-44 (i.e. at least 180 years old), but which cannot be proven to be Ancient. 'Possibly' Ancient Woodland is an area which would appear to have been continuously wooded since the First Edition 6" to the Mile OS map, where archive evidence of woodland continuity between 1600 and 1830 is strong, or the site supports more plants associated with Ancient Woodland than the threshold for the original size of the wood shown on the most recent 1:10,000 OS map.

These woodlands are additionally split into two categories:

- **Ancient Semi-Natural Woodland (ASNW)** - Composed of native tree species that have not obviously been planted.
- **Planted Ancient Woodland (PAWS)** - Comprising Ancient Woodland where the native species have been partially or wholly replaced with a non-native species (usually conifers but also includes beech and sweet chestnut). These woodlands typically have a plantation structure, with even-aged crops of one or two species planted for commercial purposes.

A baseline on-site survey of the Long-established Woodland within the study area was carried out in spring and summer 2017, with certain areas revisited in spring 2018. The woodland parcels as outlined in the Woodland Trust's Woodland Inventory were visited (Figure 5.4.3).

5.4.5.4 Phase 1 Habitats

5.4.5.4.1 Broadleaved Semi-natural Woodland (A1.1.1)

Undesignated woodland occurs throughout the study area and often forms a buffer and important connectivity between protected sites. In many cases, characteristic ground flora is indistinguishable from adjoining Ancient/Long-established Woodland and is therefore species-rich. Beech and ash are the dominant species with occasional oak *Quercus sp.* and birch *Betula sp.* Sycamore *Acer pseudoplatanus* is abundant and regenerating. Understorey vegetation is also diverse with hazel, hawthorn and holly *Ilex aquifolium* frequent. Isolated woodland patches also occur on the upper slopes of Fathom Mountain with a more upland element, such as rowan *Sorbus aucuparia* and birch.

5.4.5.4.2 Conifer Plantation A1.2.2 and Mixed Plantation (A1.3.2)

Extensive conifer plantations occur on the slopes of Fathom Mountain, extending down to the B79 Fathom Line. Similarly, conifer plantations occur down to the A2 Warrenpoint Road on the eastern flank of the Newry River. Species include Douglas fir *Pseudotsuga menziesii*; Norway spruce *Picea abies*; pine species *Pinus sp.* and European larch *Larix decidua*. Often, broadleaved species have been planted alongside or in some cases interspersed within the conifer element. Predominantly, beech has been planted but other species, such as sweet chestnut *Castanea sativa* and oak, self-seeded ash and birch; also occur within gaps and forest edges. Within the dense conifer plantations, ground flora is often limited to shade-tolerant ferns and mosses but where light penetrates the often dense canopy above, ground flora can be relatively diverse with species such as bluebell *Hyacinthoides non-scripta*, bilberry *Vaccinium myrtillus*, lesser celandine *Ficaria verna*, greater wood-rush *Luzula sylvatica*, wood anemone Anemone nemorosa and wood sorrel *Oxalis acetosella* often frequent.

5.4.5.4.3 (Scrub A2)

Scrub, both continuous and scattered, is abundant across the study area and is encroaching on large areas that were previously farmed on the slopes of Fathom Mountain. Woodland parcels in general have an apron of scrub at their edges leading into the surrounding habitat. Many of the small traditional fields on steep slopes have been abandoned, allowing species such as gorse *Ulex europaeus*, hawthorn and blackthorn *Prunus spinosa* to take over. The habitat is also often associated with bracken and is also developing across the more upland habitats on the slopes of Fathom Mountain. This habitat forms part of the continuous cover and connectivity associated with the woodland habitat and forms important habitat corridors between woodland parcels.

5.4.5.4.4 Improved Grassland (B4)

The majority of grassland fields within the study area have been significantly altered through agricultural intensification. This may include drainage, addition of fertiliser, and often re-seeding with grass species of commercial value. Diversity in these fields is therefore limited to productive grass species and associated weeds. Perennial rye grass Lolium perenne is usually dominant with other grasses including bentgrass *Agrostis sp*. and meadow foxtail *Alopecurus pratensis*. Creeping buttercup *Ranunculus repens* and white clover *Trifolium repens* are also frequent throughout.

5.4.5.4.5 Marsh/Marshy grassland (B5)

Marshy grassland is limited to the flatter areas between the Flagstaff Road and old Dublin Road. This dip in topography has allowed for the wetter conditions to dominate despite drainage ditches. Grasses represent the more waterlogged conditions with tussocks of soft rush *Juncus effusus* extensive and dominant in some areas.

5.4.5.4.6 Semi Improved Grassland (B2.2) and Species-Poor Semi-improved Grassland (B6)

Due to the challenging farming conditions on the steep slopes of Fathom Mountain, agricultural intensification has been limited in some areas. Traditional small fields with low intensity grazing still remain is several locations, delimited by either dry stone walls or gappy hawthorn hedges. The most diverse of these areas are within designated SLNCIs and ASSI as discussed above. Species-poor semi-improved grassland is a transition habitat between improved and semi-improved areas and is abundant throughout the study area.

5.4.5.4.7 Bracken (C1.1)

Similar to scrub, dense stands of bracken have developed on abandoned fields and on the slopes of Fathom Mountain. Bracken can be indicative of previous management, such as burning and thrives in upland habitats where grazing pressure has been reduced. Bracken is dominant in many small parcels where grazing has been discontinued due to access issues from woodland density and topography.

5.4.5.4.8 Dry Heathland/Acid Grassland Mosaic (D5)

This habitat has likely developed from degraded blanket bog habitat which was previously cut for turf. The remaining thin peaty soils and bare rock support a mosaic of heathland species such bilberry *Vaccinium myrtillus*, common heather *Calluna vulgaris* and bell heather *Erica cinerea*. Patches of acid grassland with sweet vernal grass *Anthoxanthum odoratum* and creeping bent *Agrostis stolonifera* are present where grazing has been intense and scrub and bracken have significantly encroached where grazing has declined.

5.4.5.4.9 Open Water (G2)

The Newry Canal is designated as a Cyprinid waterbody, suitable for sustaining and supporting Cyprinid (coarse) species. Species include roach, roach/bream hybrids, skimmer bream, pike, perch, brown trout and eels. However, it is only designated Cyprinid upstream from a point approximately 90m south of Lock No. 2 (Reilly's Lock) adjacent to Win Business Park, north of the city centre. Nevertheless, consultation with Loughs Agency has confirmed that within the study area the canal is still a significant coarse fishery, worthy of protection.

5.4.5.4.10 Running Water (G1)

There is one significant watercourse within the study area, that of the Newry River. The river flows through Newry in a general south-easterly direction and into Carlingford Lough. Although the Newry River is for the most part designated as a Salmonid watercourse under the EC Freshwater Fish Directive (78/659/EEC) (revoked since December 2013), it is not designated where the river is tidal. Salmonid rivers support good stocks of salmon and trout, and are considered important game angling rivers, based on their chemical and biological quality. They are also regarded as a migratory route for spawning trout and salmon.

Several small streams descend the slopes of Fathom Mountain. None of these streams would have significant fisheries potential due to their small size but provide linear feature for wildlife to traverse the landscape. Notably, a small stream within the Long-established woodland of the central parcel of Lower Fathom Wood & Grasslands SLNCI (within Benson's Glen, whose location is presented in Figures 5.4.4 – 5.4.7) provides an excellent example of a riffle and pool system, and is considered likely to provide excellent foraging opportunities for bats and aquatic invertebrates.

5.4.5.4.11 Species-poor Hedgerows (J2.3.2)

Article 10 of the Habitats Directive, transposed by Regulation 32 of the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995, requires Member States to endeavour to encourage the management of features of the landscape that are of major importance for wildlife and biodiversity. Features such as river banks, tree lines and hedgerows, provide linear and continuous habitat which function as stepping-stones or wildlife corridors, essential for the migration, dispersal and genetic exchange of wildlife.

Additionally, all hedgerows in Northern Ireland are a Priority Habitat due to their significant biodiversity value which relates not only to the specific plant species within the hedgerow, but to their wider value for foraging, shelter, and commuting habitat for large numbers of species. Hedgerows may require conservation action as they are susceptible to impacts from development. Outwith the aforementioned rivers and streams, hedgerows and dry stone walls are the dominant linear features present across the study area. Hedgerows are dominated by hawthorn, often on species-rich earthbanks. Relict hedgerows are also features within the woodland parcels which have been subsumed into adjacent woodland and extend as scrub into the small field parcel structure now dominated by bracken. Many hedgerows are intact and represent effective field boundaries, however conversely the integrity of these linear features are retained only by the presence of an associated post & wire fence.

In keeping with the general landscape, drystone walls are a common feature, often associated with overgrown hedgerows. Dry stone walls are also associated with a plant assemblage synonymous with the upland habitats with bilberry, ling heather and other ericoids present. Some ferns and pennywort *Umbilicus rupestris* are locally frequent, emerging from crevices.

5.4.5.4.12 Mud, Brackish Lagoons and Scattered Saltmarsh Plants (H2.4)

The upstream extent of Carlingford Lough ASSI includes the very narrow channel of the Newry River and associated deep mud banks. Here, localised but frequent beds of dwarf eelgrass *Zostera noltii* cover the intertidal mudflats. Saltmarsh vegetation also occurs on the edge of the mudflats along the foreshore with scattered sea rush *Juncus maritimus*, common saltmarsh-grass *Puccinellia maritima* and common cord-grass *Spartina anglica*.

5.4.5.5 Invasive species

Invasive species listed on Schedule 9 Part II of The Wildlife Northern Ireland Order 1985 (as amended) were identified in several locations within the study area. This includes several stands of Japanese knotweed within Fathom Lower Woods & Grassland SLNCI and Giant hogweed *Heracleum* *mantegazzianum* in Narrow Water Forest SLNCI associated with Clady Quarries. A full site walkover has not been carried out to date and further areas of invasive species are likely to occur.

5.4.5.6 Protected Fauna

5.4.5.6.1 Otter

Otter are likely to occur frequently in the study area in association with water, particularly along the Newry Canal and the Newry River. The small streams that descend the slopes of Fathom Mountain may also provide dispersal and exploration habitat for otter. Otter will also likely have holts and lay-up sites within the wider study area.

5.4.5.6.2 Bats

Bats can roost in buildings, bridges and mature trees with suitable cracks and crevices, and will use woodland edges and streams and water-body shorelines as foraging habitat. There is an abundance of both roosting and foraging habitat within the immediate study area and it is therefore likely that various bat species occur within a number of sites including woodland interiors, woodland margins, along watercourses, pastures and along hedgerows.

Houses, commercial properties or farm buildings could potentially provide suitable roosting features for bats.

The Long-established Woodland associated with the northern and central sections of Fathom Lower Woods & Grassland SLNCI were noted in particular to contain an abundance of mature broadleaved trees with potential roosting features. Other non-designated scattered trees throughout the study area also have the potential to have potential roost features. Following site visits to the SLNCI woodland sites, they were recorded as having High suitability for roosting bats (Collins, 2016), due to the presence of mature trees with suitable holes and cracks, particularly beech, oak, ash and sycamore.

A number of woodland sites were found in the wider study area to possess a diverse structure, which can be considered favourable in terms of foraging sites for woodland species such as the brown long-eared bat *Plecotus auritus* and the greatest area of edge habitat including treelines and hedgerows. The woodlands within the study area were assessed as having High suitability for foraging and commuting bats (Collins, 2016). Conifer plantations provide sub-optimal habitat for foraging bats, with reduced habitat heterogeneity and species diversity. Although of reduced suitability for bats (Collins, 2016) this habitat still provides important connectivity in the landscape and is still assessed as being of Moderate suitability.

The Newry Canal with its riparian vegetation and still slow-flowing water, has a high suitability for foraging and commuting bats, especially Daubenton bats *Myotis daubentonii* which specialises in such aquatic habitat.

5.4.5.6.3 Red squirrel

Red squirrels were observed during ecological walkover surveys in both the conifer plantation and broadleaved habitat in Long-established Woodland areas of Fathom Lower Woods & Grasslands SLNCI. Red squirrels are at risk from invasion of the non-native grey squirrels and are often excluded in areas of broadleaved woodland. The presence of red squirrels throughout the Fathom Woodlands would indicate that grey squirrels have not significantly impacted this population. This population of red squirrel would therefore be of importance as a potential stronghold for the population regionally. Any direct loss or fragmentation of all woodland habitat and hedgerows could significantly impact this population, which depends on continuous forest and mature hedgerows to traverse the landscape.

5.4.5.6.4 Pine marten

No direct evidence of pine marten was recorded in the study area; however no systematic survey of any protected species was carried out at this stage. Pine marten are known to occur in adjacent areas such as Slieve Gullion and the Mourne Mountains, and therefore their presence within the study area is likely with excellent habitat available. Pine marten use den sites within mature trees.

5.4.5.6.5 Badger

Badger were recorded within the study area with several setts located in the middle section of Fathom Lower Woods & Grasslands SLNCI (Benson’s Glen), and snuffle holes and droppings attributed to badger recorded during walkovers. No specific badger surveys have been carried out across the study area at this stage but badger and their setts are likely to occur throughout the area. Badger will make use of all terrestrial habitat types across the study area.

5.4.5.6.6 Breeding birds

The study area contains a range of woodland and farmland birds and foraging habitat for breeding terns on the mudflats of the Newry River.

5.4.5.6.7 Wintering birds

Carlingford Lough ASSI including the mudflats either side of the Newry River are designated for internationally important populations of wintering birds such as light-bellied brent geese which forage in the area during winter. Significant numbers of great crested grebe, shelduck, scaup, red-breasted merganser, oystercatcher, dunlin and redshank also occur and are important in an all-Ireland context.

5.4.5.6.8 Common lizard

No specific common lizard surveys have been carried out to date and no common lizard were identified during site visits, however significant open habitat with suitable vegetation, rocky outcrops and semi-improved grassland with stone walls occur around Fathom Mountain. Common lizard are known to occur in Armagh with a stronghold in the nearby Mourne Mountains (Co. Down) and records also from adjacent Co. Louth.

5.4.5.6.9 Smooth newt

There is limited suitable breeding habitat for smooth newt in the immediate study area. An area of marshy grassland is present adjacent to by the Barracric Road. This area may hold suitable wetland habitat for newts, however no surveys have been carried out to date.

5.4.5.6.10 Holly Blue butterfly

No specific butterfly surveys were carried out at this stage and no observations were made during site visits. Holly blue require woodland, hedgerows or gardens with abundant holly and ivy (and other secondary species such as snowberry *Symphorocarpus alba*). This habitat is common in the area and holly blue are likely to occur within the study area.

5.4.6 Assessment of Environmental Impacts

5.4.6.1 Red Route

Carlingford Shore SAC in the Republic of Ireland is approximately 3.5km south-east of the southern portion of the Red Route. Carlingford Lough SPA in Northern Ireland would be approximately 17km south-east of this route. As these are two Natura 2000 sites within the wider study area, consultation with DAERA - NED has indicated that a Habitats Regulations Assessment under the terms of the Habitats Directive (92/43/EEC) should be (and has been) undertaken to test the likely significance of the scheme on these sites.

A bridge approximately 420m long (the longest of all the options) would traverse the Carlingford Lough ASSI and would require approximately nine pier structures within the river estuary habitat with several others either side of the Flagstaff Road to make the entire span. The degree of impact on the river and its associated designation would depend on the bridge design, in terms of the frequency, diameter and shape (profile) of the bridge piers. Whilst every effort would be made to minimise the impact on the aquatic systems by sensitive placement of the piers, there remains the risk of a pollution incident affecting the river, either during construction or during long-term operation/maintenance of the scheme. The bridging point would also likely affect the adjacent habitats, including the riparian corridor on the canal and intertidal river bank habitat causing fragmentation. The wetland habitat of the canal, in association with the strip of vegetation, forms a linear feature through the landscape which may be important for foraging and commuting riparian wildlife such as otters. Impacts on hydrology and the movement and disturbance to breeding and wintering birds would require further assessment. Piers would be required through the estuarine habitat causing direct habitat loss and fragmen4ation to mudflats, shoreline and saltmarsh habitats which are important for wintering and resident shore birds. Construction and operational noise could cause significant disturbance to birds using this habitat.

Fathom Upper ASSI is located to the west of the Red Route (c. 200m), however it is not expected that there would be any direct impact on the site, being several hundred metres west of the likely construction footprint. Habitat connectivity between this site and Fathom Lower Woods & Grasslands SLNCI would however be fragmented, reducing the ability for wildlife to move across the landscape.

The Red Route would have major direct impacts on several SLNCIs. The most southern and largest section of Fathom Lower Woods & Grasslands SLNCI would be completely severed by the route alignment and would be traversed over its entire length of approximately 1km leading to significant habitat loss and habitat fragmentation. The central section of the SLNCI (Benson's Glen) may be indirectly impacted as it would be within 30m of the construction footprint. Connectivity would be reduced between the southern section and the central and northern sections of this SLNCI. Narrow Water Forest SLNCI, east of the A2 Warrenpoint Road, would also be directly impacted by the route alignment. This would consist of a new roundabout junction on the A2 road which would encroach into the SLNCI Woodland habitat by several metres.

The woodland habitats within the SLNCI are of particular importance as they are considered to be Ancient Semi-natural Woodland (ASNW) and dominated by native broadleaved species. The long-established Woodland further south and across the Newry River are considered to be Planted Ancient Woodland (PAWS) dominated by planted conifers but also some planted beech and other broadleaved species. Whilst not being of such high ecological value as ASNW, PAWS typically contain remnants of semi-natural species where shading has been less intense and can be prioritised for restoration. The route would traverse directly through the Ancient Woodland associated with the southern section of this SLNCI and then continue south through the Long-established Woodland in Fathom Forest for approximately 1km. This would lead to irreplaceable loss of Long-established Woodland habitat. These habitats would be split in two by the route, fragmenting the extensive area of mixed woodland. The surrounding buffer of undesignated woodland would be impacted, leaving the remaining woodland habitat more exposed to disturbance. Additionally, the almost unbroken connection of undesignated woodland between the three sections of the SLNCI and Ancient and Long-established Woodland to the south would be completely lost, leading to significant habitat fragmentation. A wide range of woodland wildlife would be directly and indirectly impacted by the loss of woodland, particularly forest species such as brown long-eared bats and red squirrels, but also for birds, badgers and potentially pine marten. Significant fragmentation would prevent movement of species across the landscape.

The Red Route would also directly impact Long-established Woodland associated with Narrow Water Forest SLNCI where the route would tie into the A2 Warrenpoint Road with a new junction arrangement. The impact on woodland at this location could be relatively minor if the junction arrangement is limited to an at-grade roundabout.

This route would also traverse agricultural land with numerous hedgerows. As Priority Habitat and important wildlife corridors, hedgerow loss would be detrimental, causing habitat fragmentation for local wildlife. The agricultural areas on the steep slopes of Fathom Mountain are often relatively species-rich due to agricultural abandonment and/or low intensity management with low agricultural inputs. Encroachment of bracken and scrub habitat adds to the habitat diversity and supports greater habitat connectivity. This would therefore cause direct habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Protected species such as badger, bats and breeding birds depend on these habitats and would be affected by habitat loss and fragmentation along this route.

5.4.6.2 Yellow Route

Carlingford Shore SAC in the Republic of Ireland is approximately 0.5km south-east of the Yellow Route. Carlingford Lough SPA in Northern Ireland (at its closest point) would be approximately 14km south-east of this route. As these are two Natura 2000 sites within the wider study area, consultation with DAERA - NED has indicated that a Habitats Regulations Assessment under the terms of the Habitats Directive (92/43/EEC) should be (and has been) undertaken to test the likely significance of the scheme on these sites.

A bridge approximately 285m long would traverse the Carlingford Lough ASSI and would likely require four pier structures within the river estuary habitat with several others either side of the Flagstaff Road to make the entire span. The degree of impact on the river and its associated designation would depend on the bridge design, in terms of the frequency, diameter and shape (profile) of the bridge piers. Impacts on hydrology and the movement and disturbance to breeding and wintering birds would require further assessment. Piers would be required through the estuarine habitat causing direct habitat loss and fragmentation to mudflats, shoreline and saltmarsh habitats which are important for wintering and resident shore birds. Construction and operational noise could cause significant disturbance to birds using this habitat.

Fathom Upper ASSI is located to the west of the Red and Yellow Routes, however it is not expected that there would be any direct impact on the site, being c. 200m and 150m west respectively of the likely construction footprint. Habitat connectivity between this site and Fathom Lower Woods & Grasslands SLNCI would however be fragmented, reducing the ability for wildlife to move across the landscape.

The Yellow Route would directly impact on the most southern and largest section of Fathom Lower Woods & Grasslands SLNCI. A large proportion of the woodland would be completely lost to the route alignment as it traverses over its entire length of approximately 1km. This would result in significant habitat loss and habitat fragmentation. The central section (known locally as Benson’s Glen) would also be impacted as it occurs along the route but may not be directly impacted as the construction footprint is likely to pass slightly south of this section. Connectivity would be reduced between the southern section and the central and northern sections of this SLNCI. Narrow Water Forest SLNCI, east of the A2 Warrenpoint Road, would also be directly impacted by the route alignment where a new roundabout junction on the A2 road would encroach into the SLNCI woodland habitat.

The woodland habitats within the SLNCI are of particular importance as they are considered to be Ancient Semi-natural Woodland (ASNW) and Long-established Woodland. They are therefore dominated by native broadleaved species. The Long-established Woodland further south and on the eastern bank of the Newry River is considered to be Planted Ancient Woodland (PAWS). These areas are dominated by planted conifers but also some planted beech and other broadleaved species. Whilst not being of such high ecological value as ASNW, PAWS typically contain remnants of semi-natural species where shading has been less intense and can be prioritised for restoration. The Yellow Route would also cause direct impact to the central section of Long-established Woodland associated with Fathom Lower Woods and Grassland SLNCI. This route then turns south towards the southern section of this SLNCI, directly impacting this entire section of Ancient Woodland within this section. It then continues south traversing through Long-established Woodland in Fathom Forest for approximately 2.5km. This would lead to irreplaceable loss of Long-established Woodland habitat. These habitats would be split in two by the route, fragmenting the extensive area of mixed woodland. The surrounding buffer of undesignated woodland would be impacted, leaving the remaining woodland habitat more exposed to disturbance. Additionally, the almost unbroken connection of undesignated woodland between the three sections of the SLNCI and Ancient and Long-established Woodland to the south would be complete lost, leading to significant habitat fragmentation. The bridging point for the Yellow Route would cause direct habitat loss to the lagoon, woodlands and scrub habitat at Rough Island. The construction of bridge piers within the Newry River would impact mudflats, shoreline and saltmarsh, leading to direct loss and fragmentation of these coastal habitats.

This route would also traverse agricultural land with numerous hedgerows. As Priority Habitat and important wildlife corridors, hedgerow loss would be detrimental, causing habitat fragmentation for local wildlife. The agricultural areas on the steep slopes of Fathom Mountain are often relatively species-rich due to agricultural abandonment and/or low intensity management with low agricultural inputs. Encroachment of bracken and scrub habitat adds to the habitat diversity and supports greater habitat connectivity. This would therefore cause direct habitat loss, but also fragmentation/severance of a valuable wildlife corridor. A wide range of woodland wildlife would be directly and indirectly impacted by the loss of woodland, particularly forest species such as brown long-eared bats and red squirrels, but also for birds, badgers and potentially pine marten. Significant fragmentation would prevent movement of species across the landscape.

5.4.6.3 Blue Route Option 1

Blue Route Option 1 would not directly affect Carlingford Lough ASSI, as it would cross the river/canal approximately 0.5km north of the ASSI site boundary. Option 1 would cross the Newry River and canal requiring several bridge piers within the wider channel. Whilst every effort would be made to minimise the impact on the aquatic systems by sensitive placement of the piers, there remains the risk of a pollution incident affecting the river, either during construction or during long-term operation/maintenance of the scheme. The bridging point would also likely affect the scrub habitat, riparian corridor on the canal and intertidal river bank habitat causing fragmentation. The wetland habitat of the canal, in association with the strip of vegetation, forms a linear feature through the landscape which may be important for foraging and commuting riparian wildlife such as otters.

The northern-most and central parcels of the Fathom Lower Woods & Grassland SLNCI complex would be directly affected by Blue Route Option 1 as part of the route would require landtake from the SLNCI in both areas. The woodland habitats within the SLNCI are of particular importance as they are considered to be Long-established Woodland and dominated by native broadleaved species.

Blue Route Option 1 would have a major impact on the woodland habitat as it would traverse directly through the Long-established Woodland and adjoining undesignated woodland within the central section of Fathom Lower Woods and Grassland SLNCI (Benson's Glen). This would lead to irreplaceable loss of Long-established Woodland habitat. Additionally, this would fragment this SLNCI by splitting the northern section from the central and southern section. A wide range of woodland wildlife would be directly and indirectly impacted by the loss of woodland, particularly for forest species such as brown long-eared bats and red squirrels, but also birds, badgers and potentially pine marten. Significant fragmentation would prevent movement of species across the landscape.

The route alignment has been designed to avoid the Long-established Woodland section within the most northern section of Fathom Lower Woods and Grassland SLNCI. However, in reality the cut and fill, likely slope stabilisation works and general changes in hydrology, disturbance and other affects such as erosion and deposition of dust would cause significant adverse impact on the remaining woodland. The surrounding buffer of undesignated woodland would be lost leaving the remaining woodland habitat more exposed to disturbance. Additionally, the almost unbroken connection of undesignated woodland to the central and southern sections of the SLNCI and Ancient and Long-established Woodland to the south would be completely lost, leading to significant habitat loss and fragmentation.

This route option would pass within 140m of Cloghogue SLNCI north of the Ellisholding Junction, but would not directly impact upon it.

This route would largely traverse agricultural land with numerous hedgerows. As Priority Habitat and important wildlife corridors, hedgerow loss would be detrimental, causing habitat fragmentation for local wildlife. The agricultural areas on the steep slopes of Fathom Mountain are often relatively species-rich due to agricultural abandonment and/or low intensity management with low agricultural inputs. Encroachment of bracken and scrub habitat adds to the habitat diversity and supports greater habitat connectivity. Protected species such as badgers, bats and breeding birds depend on these habitats and would be affected by habitat loss and fragmentation along this route.

5.4.6.4 Blue Route Option 2 and 3

Blue Route Options 2 and 3 would not directly affect Carlingford Lough ASSI, as they would cross the river/canal approximately 0.5km north of the designated site boundary. Both route options would cross the Newry River and canal requiring several bridge piers within the wider channel. Whilst every effort would be made to minimise the impact on the aquatic systems by sensitive placement of the piers, there remains the risk of a pollution incident affecting the river, either during construction or during long-term operation/maintenance of the scheme. The wetland habitat of the canal, in association with the strip of scrub vegetation and intertidal river bank habitat, forms a linear feature through the landscape which may be important for foraging and commuting riparian wildlife such as otters. The bridge crossing point is likely to have a detrimental impact, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor.

Whilst the route options would not traverse Fathom Lower Woods & Grassland SLNCI, the options pass in close proximity to the SLNCI parcels (within10m of the site boundary). The northern-most and central parcels of the Fathom Lower Woods & Grassland SLNCI complex would be indirectly affected by Blue Route Options 2 & 3 as they would pass so close and would cut through some of the undesignated woodland fringe habitat. The woodland habitats within the SLNCI are of particular importance as they are considered to be Long-established Woodland and dominated by native broadleaved species. The route alignment has been designed to avoid the Long-established Woodland section within all sections of Fathom Lower Woods & Grassland SLNCI. In reality, the cut and fill, likely slope stabilisation works and general changes in hydrology, disturbance and other affects such as erosion and deposition of dust would cause adverse impact on the remaining woodland. The surrounding buffer of undesignated woodland would be lost from both sites leaving the remaining woodland habitat more exposed to disturbance. Additionally, the almost unbroken connection of undesignated woodland /hedgerows between the three sections of the SLNCI and to Ancient and Long-established Woodland to the south would be completely lost leading to habitat fragmentation. A wide range of woodland wildlife would be directly and indirectly impacted by the loss of woodland, particularly forest species such as brown long-eared bats and red squirrels, but also for birds, badger and potentially pine marten. Significant fragmentation would prevent movement of species across the landscape.

The routes would largely traverse agricultural land with numerous hedgerows. As Priority Habitat and important wildlife corridors, hedgerow loss would be detrimental, causing habitat fragmentation for local wildlife. The agricultural areas on the steep slopes of Fathom Mountain are often relatively species-rich due to agricultural abandonment and/or low intensity management with low agricultural inputs. Encroachment of bracken and scrub habitat adds to the habitat diversity and supports greater habitat connectivity. Protected species such as badgers, bats and breeding birds depend on these habitats and would be affected by habitat loss and fragmentation along these two route options.

5.4.7 Mitigation & Enhancement Measures

5.4.7.1 Principles of mitigation

The principles of mitigation applied here, in order of priority, are as follows:

- Avoid adverse impacts on habitats or species;
- Minimise adverse impacts through input into the scheme design.

If this is not possible, then:

- Minimise the scale and magnitude of the impact;
- Compensate for the impact through provision of replacements/alternatives.

Generally, seek to:

- Maximise opportunities for biodiversity enhancement.

A number of general principles should be adopted.

It is recommended that an experienced ecologist be commissioned to conduct a detailed field survey, as part of the Stage 3 Environmental Assessment. Following a detailed desktop assessment, the results will need to be verified by a preliminary walkover survey, to ensure that no undocumented sites or features of nature conservation importance are overlooked. This process should include an extended Phase 1 habitat survey with a full suite of ecological surveys for protected species. This should include all relevant protected species. Where necessary more detailed habitat survey may be required particularly where protected species or habitats are likely to occur.

5.4.7.2 Designated Ecological sites

Consultation with DAERA - Natural Environment Division has indicated that a Habitats Regulations Assessment under the terms of the Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) should be undertaken to test the likely significance of potential impacts from the various routes on Carlingford Shore SAC and Carlingford Lough SPA. A shadow HRA has been carried out alongside this Stage 2 Assessment to establish if any specific mitigation measures are necessary to protect these European sites (SAC and SPA) from adverse impacts affecting the integrity of the sites from the scheme.

As mentioned previously, it is not feasible to speculate on the degree of impact on Carlingford Lough ASSI until a more detailed design stage, as it is dependent not only on route alignment, but on bridge design (in terms of frequency, diameter and shape [profile] of bridge piers); this would determine the degree of mitigation required. It is possible that scour protection for bridge piers may be required to minimise sediment movements within the ASSI intertidal area, however again this would only be determined at a more detailed design stage by sediment modelling. Blue Route Options 1, 2 & 3 would avoid the ASSI and would therefore have minimal impact on nationally designated sites and the wintering and breeding birds associated with them.

As a minimum requirement and in line with best practice, extensive pollution mitigation measures, to prevent contaminated water from road drainage entering the watercourses would be required as part of the drainage design. Sustainable Drainage features would be required to provide filtration and attenuation, preventing untreated surface water from carriageways discharging directly into adjacent watercourses.

5.4.7.3 Non-designated ecological sites

5.4.7.3.1 Woodland

Long-established and Ancient Woodland are an irreplaceable resource of great importance for their wildlife, soils, cultural value, history and contribution to landscape. It is a scarce resource, as it only occupies 0.08% of the total land cover of Northern Ireland. Veteran trees often found within this habitat can be hundreds of years old, provide habitat for many different species and are a part of our landscape and cultural heritage. Ancient Woodland includes both Ancient Semi-natural Woodland and Plantations on Ancient Woodland Sites. Although there is obvious variation in habitat quality across areas of Ancient and Long-established Woodland, all areas should be treated similarly as they all retain soil characteristic and remnant species assemblages which are irreplaceable through mitigation. Plantations on Ancient/Long-established Woodland sites form large areas of the woodlands affected by Red and Yellow Routes. These conifer plantations should not be undervalued as they typically retain characteristic soils and ground flora, which make them particularly suitable for restoration, with native species.

The irreplaceable nature of Ancient Woodland and veteran trees means that loss or damage cannot simply be rectified by mitigation and compensation measures. Therefore, Ancient Woodland loss should only be carried out as a last resort and only after it has been judged that the wider benefits of a proposed development clearly outweigh the loss or damage of Ancient Woodland.

Blue Route Option 1 has direct impacts on Long-established Woodland habitat. It is not possible to replace or recreate this habitat type and therefore significant mitigation would be required to compensate for this loss. Significant restoration of PAWS sites through, reducing dense conifer stands and planting of native broadleaved species could provide some compensation. Translocation of woodland soils and retention of mature/veteran trees as deadwood habitat could also help to retain long-established woodland biota within restored or compensation habitat areas. Habitat translocation should however only be viewed as a measure of last resort in partial compensation for damage to Ancient Woodland. Extensive additional native planting would also be required to restore and improve connectivity between the remaining habitat areas.

Blue Route Options 2 and 3 are largely similar in regard to their impact on woodland. The route alignment have been designed to largely avoid direct impacts on Long-established Woodland however the route would be directly adjacent to this habitat and would impact on undesignated broadleaved woodland which forms a vital buffer and connectivity to the Ancient and Long-established Woodland to the south. Protection and retention of as much woodland habitat as far as construction design would allow would provide the best protection for the remaining designated woodland areas. Augmentation of buffer planting with native broadleaved species would mitigate for the loss of buffer habitat and planting to improve and restore connectivity between remaining habitat areas would be required. Restoration of PAWS could also be considered to provide a net gain in terms of habitat restoration.

The Red and Yellow Routes would have direct impacts on Ancient and Long-established Woodland habitat. It is not possible to replace or recreate this habitat type and therefore significant mitigation would be required to compensate for this loss. Significant restoration of PAWS sites through, reducing dense conifer stands and planting of native broadleaved species could provide suitable compensation. Translocation of woodland soils and retention of mature/veteran trees as deadwood habitat could also help to retain Long-established Woodland biota within restored or compensation habitat areas. Habitat translocation should however only be viewed as a measure of last resort in partial compensation for damage to Ancient Woodland. Extensive additional native planting would also be required to restore and improve connectivity between the remaining habitat areas. Overall, the Yellow Route would impact the greatest area of Long-established Woodland and would therefore require the greatest area of restoration and compensation.

5.4.7.3.2 Linear features (hedgerows, treelines and bankside vegetation)

The treelines and mature hedgerows which occur across the study area have added importance as connectivity between the Long-established Woodland blocks. Their importance for movement of woodland species such as red squirrel should be prioritised.

Where possible, all hedgerow, treelines and linear vegetation should be retained. Where these features are to be removed, vegetation should be cleared outside the bird breeding season, considered to be from March to August inclusive. New hedgerows should be planted ‘like-for-like’ to replace lost sections; this process should attempt to result in no net loss or preferably a net gain in hedgerow length across the scheme.

5.4.7.3.3 Other habitats (scrub, grassland, heathland)
Suitable planting of scrub habitat to replace lost areas would provide suitable replacement for species such as nesting birds. Maintaining or replacing species-rich grassland would provide habitat for wildflowers and associated wildlife. Where possible, this should provide connectivity between existing grassland areas such as the SLNCI and ASSI habitats.

5.4.7.3.4 Rivers
All route alignments would require interception and attenuation of surface runoff prior to discharge to the canal/river/streams. Such a solution would be the construction of SUDS for both construction and operation stages.

The tidal reach of the Newry River is a migratory route for salmon and sea trout and must be protected from pollution, both during construction or long-term operation and maintenance of the road.

The Newry Ship Canal and Newry River are of interest to various bodies including the Loughs Agency and Ulster Angling Federation Ltd. They stress the need to protect the waterway from contamination during and after the construction phase of the scheme, and that adequate measures, such as pollution traps, should be put in place to protect fisheries interests.

Several small streams would be directly impacted by all route options. Sections may require realigning to accommodate the preferred alignment and culverts may also be required. All culverts should be, as a minimum, large box culverts to allow continued passage of wildlife along river corridors. Any realigned steams should be fully restored with suitable instream features and bankside vegetation. Due to the steep precipitous slope, these watercourses would be susceptible to erosion; suitable silt traps and erosion control features should be incorporated into the design to maintain these features long-term.

5.4.7.3.5 Protected Fauna
All route options would cause significant fragmentation of habitat and would prevent the movement of wildlife through the landscape. Significant mitigation is required to provide suitable crossing points for wildlife to maintain connectivity.

5.4.7.3.6 Otter
Surveys would be required to assess the extent of otter use along the preferred route, once selected. If holt and lay-up locations are directly impacted by the preferred route, these would require licenced exclusion, closure and replacement with artificial replacement features. Otters require unobstructed watercourse and dry passage at culvert points. Although the majority of otter activity is expected to be in the Newry Canal and Newry River, it is likely that otters also frequent the smaller streams which traverse the routes. Suitable crossing points should therefore be maintained to provide continued access for otters. This must be in conjunction with appropriate mammal fencing to prevent otters from crossing the road at unsafe locations. Additionally, water quality must be maintained at all stages of construction to prevent adverse effects on foraging habitat and fish from pollution and sedimentation. Blue Route Options 1, 2 and 3 would require mitigation on a number of small streams (approximately 2-3) the most significant of which flows through the central block of Fathom Lower Woods & Grassland SLNCI (Benson’s Glen). The Red Route will affect significantly more stream habitat and would also have a greater impact on the Newry Canal and River. Similarly, the Yellow Route would have the greatest impact on small streams. The Yellow Route would however avoid the Newry Canal but would affect potential otter habitat at its crossing point through Rough Island.

5.4.7.3.7 Bats
Bat roosts are likely to occur along the route options. Roost locations are likely to occur within mature broadleaved trees with suitable cavities and also in buildings affected by the preferred route once selected. Extensive activity surveys would be required and depending upon the number of trees with potential roost features and buildings to be removed, emergence re-entry surveys would be required. Licenced exclusion of bats would be required from roosts directly affect by the preferred route. The provision of bat boxes as roosts would help mitigate the loss of natural sites. Suitable hibernacula

would also be required if hibernating sites were lost. Significant habitat creation and restoration, such as broadleaf woodlands, hedgerows and wetland areas, would compensate for the loss of traditional foraging sites and bat flight lines. Novel solutions to maintain connectivity for bats across the scheme with overpass/underpass that would provide bats with safe crossing points would be required.

5.4.7.3.8 Red squirrel

Pre-construction surveys of the preferred route must be undertaken to identify all drey tree locations prior to felling. Where possible, these trees must be retained however where direct impacts are unavoidable, a licence to destroy dreys must be obtained. Such activities must be undertaken from September to December only, in order to minimise stress to red squirrels during this sensitive period.

In woodland areas that are to be removed, phased tree clearance would be required to avoid both the felling of ‘drey trees’ and disturbance to red squirrels. This would avoid direct squirrel mortality from construction works and minimise the risk of stress-induced mortality from increased levels of disturbance associated with the construction phase. All tree clearance works would be undertaken outside the red squirrel breeding seasons (January to September).

The preferred route (once selected) would require extensive habitat creation and restoration to mitigate the loss and fragmentation of remaining habitat for red squirrels. The severance of hedgerow and treelines should be compensated by aiming to improve the quality of the hedgerow links in the area. Gapping-up of any defunct existing hedgerows on the western side of the routes could be undertaken to improve the cover and foraging habitat for red squirrels, as well as connectivity between woodland areas. Any tree and hedgerow planting proposals should utilise species favoured by red squirrel. For example, a good mix of conifer and broadleaved species should be used including Scot’s Pine *Pinus sylvestris*, Norway spruce *Picea abies*, rowan *Sorbus aucuparia*, ash *Fraxinus excelsior,* yew, *Taxus baccata* and hawthorn. Planting of large masted tree species such as oak, hazel and beech should be minimised, as these provide better food sources for grey squirrels, giving them a competitive advantage over the native red squirrels.

The construction of green bridges or aerial ropeways may be required to enable red squirrels to continue crossing between habitats areas. This would prevent fragmentation and isolation of this red squirrel population, which is likely connected to other populations in the Ring of Gullion and Mourne Mountains. The crossing points would also reduce the potential for traffic collisions once the scheme is in operation. These structures must be connected to remaining habitat corridors and must be associated with extensive planting of appropriate species.

5.4.7.3.9 Pine marten

Detailed survey of the preferred route to assess the presence and extent of pine marten in the area is required. If pine marten occur in the area, any preferred route is likely to significantly impact pine martens. Crucially, all route options would cause direct habitat loss, habitat fragmentation and increase the likelihood for traffic collision. Where den sites are identified, they should be protected and avoided during construction. If direct impact to dens is unavoidable, disturbance activities must be completed under licence. Replacement artificial den sites must be installed to provide alternative accommodation. Extensive habitat creation and restoration would be required to retain connectivity across the landscape (particularly to other populations in the Mourne Mountains/Ring of Gullion areas) and to provide sufficient foraging areas to support the remaining pine marten population. Suitable underpasses/overpasses to provide safe passage for pine martens may be required to maintain connectivity in the landscape and to prevent traffic collisions.

5.4.7.3.10 Badger

Detailed surveys of the preferred route to assess the presence and extent of badgers’ presence in the area would be required. Badger evidence including several setts has been identified across the route options and therefore all options would potentially negatively impact badgers. Where direct impacts on setts are identified, licensed closure would be required. Where appropriate, artificial badger sett creation may be required to provide alternative accommodation. Extensive habitat creation and restoration to compensate for loss and fragmentation would also be required; this should include woodland and hedgerow planting but also the retention of open grassland areas for foraging. Suitable crossing points with associated fencing would be required to provide safe passage for badger across the road corridor.

5.4.7.3.11 Breeding birds

A breeding bird survey of the area would be required for the preferred route to fully assess the importance for breeding birds. All site clearance works must be programmed to avoid the breeding season, considered to be March to August inclusive.

Extensive habitat creation and restoration to compensate for loss and fragmentation would also be required; this should include woodland and hedgerow planting but also the retention of open grassland areas for foraging.

The provision of species-specific nest boxes would mitigate the loss of natural nesting sites, until the new habitats mature.

5.4.7.3.12 Wintering birds

Wintering bird surveys may be required for the preferred route at the specific bridge crossing location where they occur in relation to the Carlingford Lough ASSI, dependant on the final bridge pier design. The impact of works within the Carlingford Lough estuary area should be examined and if necessary minimised (September to April) during the wintering bird season to reduce disturbance to feeding birds such as pale-bellied brent geese.

5.4.7.3.13 Lizard and smooth newt

If identified on the site during the next stage, through recommended survey work, habitat creation and translocation may be required. Underpasses may also be required to maintain connectivity.

5.4.7.3.14 Holly Blue

If habitat or holly blue surveys at the next stage identifies suitable habitat or live specimens, within the study area, habitat creation and restoration to compensate for loss and fragmentation may be required. Planting of broadleaved woodland and hedgerows with an abundance of holly would maintain suitable habitat for holly blue butterfly.

5.4.8 Presentation of Key Issues

The key issues associated with the five route options from an ecology & nature conservation perspective are listed below:

- There are several designated sites of national/international ecological importance within or close to the study area. A Habitats Regulations Assessment has been prepared in parallel with this report to assess likely significant effects of the routes on the European sites.
- The Red and Yellow Routes would traverse the Newry River, part of Carlingford Lough ASSI and would have pier structures within the ASSI boundary. Suitable pollution control and surface water runoff attenuation would be required for all route options. Disturbance and fragmentation of foraging habitat for breeding/wintering birds would also be an issue with Red and Yellow Routes;
- The Blue Route crossing is situated much further away from the designations and so would be likely to have minimum impact on them.
- There are several SLNCIs within the study area. The Yellow and Red Routes would have the greatest impact on this Fathom Lower Woods & Grasslands SLNCI, with the Blue Route Option 1 directly affecting only a substantial swathe of the middle SLNCI parcel. All routes would cause significant indirect disturbance and fragmentation to this SLNCI, with the Yellow and Red routes having the greatest overall impact. Additionally, Yellow and Red Routes would impact small sections of Narrow Water Forest SLNCI where new roundabout junctions are proposed. Blue Route Options 2 & 3 would avoid direct impacts on this SLNCI and therefore have least impact on this site;
- Red Route would cause direct loss of 2ha of Ancient Woodland and traverse through a large area (77ha) of Long-established Woodland for approximately 1km. The Yellow Route would similarly directly affect the 2ha of Ancient Woodland and would traverse a length of approximately 2.5km of Long-established Woodland. Additionally, the Yellow and Red routes would impact on Long-established Woodland where new roundabouts are proposed on the A2 Warrenpoint Road.

- Blue Route Options 2 & 3 would avoid direct impacts on Long-established Woodland areas and therefore have the lowest impact on these sites. Blue Route Option 1 would directly impact a small but significant section of long-established woodland (Benson’s Glen).
- All route options would cause significant indirect impacts on Ancient/Long-established Woodland by causing loss and fragmentation of adjoining undesignated woodlands and treelines which provide connectivity between various sites. The Yellow Route would cause the greatest amount of fragmentation and loss of undesignated woodland due to its greater overall footprint on the landscape. The Red Route would cause similar fragmentation and loss of undesignated habitat but overall would be lower due to the smaller footprint of this route. Blue Route Options 1- 3 would have the smallest indirect impact with lower levels of fragmentation and loss of undesignated habitat.
- No designated Salmonid or Cyprinid waterbodies would be directly affected by the routes; however, the intertidal section of the Newry River forms part of the migration corridor for Salmonid fish species and pollution control as described above would be required. Bridge piers associated with the Red and Yellow Routes would be unlikely to significantly impact fish passage;
- Wildlife such as red squirrel, pine marten, badger, bats and other woodland species such as birds and invertebrates are likely to be directly impacted through loss of resting places and breeding habitat. Direct loss of foraging habitat would also be significant and fragmentation would also prevent movement of these species through the landscape. The Yellow Route would have the greatest impact with the Red Route to a lesser extent, and Blue Route Options 1- 3 having the least impact. Innovative solutions to maintain connectivity should be considered such as wildlife over/underpasses and wildlife bridge/gantry structures to maintain connectivity for arboreal species such as red squirrel if fragmentation is an issue.
- All route options may require significant compensation for forest loss and significant planting to provide alternative connectivity in the landscape for woodland species. All route options with direct impacts on Ancient/Long-established Woodland (Blue Route Option 1, Red Route and Yellow Route) would require appropriate and proportional compensation and mitigation, with possible translocation, restoration of PAWS and significant compensation planting all forming part of an extensive mitigation package.
- The preferred route, from an ecological perspective, would be Blue Route Option 2 or 3 as they both avoid designated sites and Long-established and Ancient Woodland parcels. Blue Route Option 1 would be the third preferred route as it follows a largely similar alignment to Option 2 & 3 but would cause direct impact to a Long-established Woodland and two areas of the Lower Fathom Mountains and Grassland SLNCI, severing a linear parcel of woodland in Benson’s Glen.
- The Red and Yellow Routes would be least preferred as they cross Carlingford Lough ASSI and would cause significant direct loss and fragmentation of Ancient and Long-established Woodland. The Yellow Route would have the greatest impact overall and would be the least preferred from an ecological perspective.

5.5 Landscape & Visual Effects

5.5.1 Introduction

The Highways Agency Interim Advice Note (IAN) 135/10 'Landscape and Visual Effects Assessment' recognises that Landscape is an important resource that contributes to regional identity and sense of place, and is of value to future generations.

This section examines the landscape types within the study area, the potential effects of the Blue, Red and Yellow routes on these landscape types, and the potential effect on views that people currently experience.

The principal objective of the Landscape and Visual Impact Assessment at this Approved Options stage is to undertake sufficient assessment to identify the landscape and visual factors, and the significance of effects upon them, in order to develop and select a preferred route.

5.5.2 Methodology

5.5.2.1 Approach

The methodology adopted for this assessment is based upon guidance contained within the Highways Agency Interim Advice Note (IAN) 135/10 'Landscape and Visual Effects Assessment', published in November 2010. This IAN provides instructions on the assessment of landscape and visual effects of highway projects and supersedes guidance outlined in DMRB 11.3.5 'Landscape Effects'. It is however not part of DMRB.

The IAN promotes consistency in the approach to landscape assessment of highway projects, including the effects on landscape character and on views from sensitive visual receptors. Defined as a consequential process, the assessment methodology for landscape and visual effects, detailed within the IAN, has been used to inform this assessment.

The assessment has also been supported by using guidance from the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) 'Guidelines for Landscape and Visual Impact Assessment' (2013), 3rd Edition; hereafter referred to as the GLVIA. These publications form the standard reference for undertaking landscape character and visual assessments in Northern Ireland. However, the Landscape & Visual Impact Assessment (LVIA) is based on the GLVIA (2nd Edition) as this edition of the document is referenced within IAN 135/10.

For the purposes of assessment, a clear distinction is drawn between landscape and visual effects, as defined in the GLVIA:

"Landscape Effect – *Change in the elements, characteristics, character and qualities of the landscape as a result of development. These effects can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction)*."

"Visual Effect – *Change in the appearance of the landscape as a result of development. This can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction)*."

It should be noted that this section refers to landscape and visual 'effects' rather than 'impacts. This is in line with current GLVIA guidelines.

The assessment of landscape and visual effects includes the following steps:

- conducting a landscape assessment of the areas which would be affected by the approved route options;
- consultation with statutory bodies to ensure no new landscapes have been designated since the Stage 1 assessment;
- further site survey; and
- indication of areas where properties are likely to experience various levels of visual change. It is important to note that this assessment is proportionate and only indicative at this stage and that

further on-site survey work looking specifically at visual effects on properties will take place at Stage 3, following the selection of a preferred route.

A statement is provided classifying the type and quality of the landscape within the area, and giving a description of the route options, with an assessment of the significance of effects on the landscape of each route. A statement on the estimated visual effects of each route option is also given.

The Stage 1 Assessment considered 5 broad route corridors located between the A1 (Ellisholding Junction and Cloghogue Junction) descending into and crossing the Newry River valley and connecting to the A2 Warrenpoint Road. This Stage 2 assessment considers 3 main route options (Red, Yellow & Blue) with 3 sub-options for the Blue Route (Blue Route Options 1-3).

The baseline landscape and visual conditions of the study area were assessed through desktop studies, previous knowledge of the site and site surveys.

5.5.2.2 Landscape Effects

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 will identify the interaction between these components and the proposed 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.

The staged process for undertaking a landscape effects assessment (as outlined within Annex 1 of IAN 135/10) is detailed below:

- define the study area;
- collect and collate information on the landscape;
- assess the character and value of the landscape through consultation and desk study;
- carry out site survey to assess landscape character and condition and augment the desk study;
- assess the magnitude of effects, or degree of change, caused by the project;
- assess the sensitivity of the landscape to accommodate change arising from the project;
- identify and develop mitigation measures as a component of the iterative design process to avoid, reduce and where possible remedy adverse effects; and
- assess the significance of the residual landscape effects.

5.5.2.3 Landscape Quality

The quality of the landscape has been described and assessed based on the GLVIA, and this is detailed in the following table.

Table 5.5.1: Criteria used in the assessment of the quality of Landscape Character

Category	Criteria	Typical Example
Exceptional Landscape	Strong landscape structure, characteristics and patterns. Very scenic and/or dramatic. Distinct features worthy of conservation. Sense of place. No detracting features.	Internationally or Nationally recognised e.g. all or a great part of World Heritage Sites, National Parks, AONBs.
High Quality Landscape	Strong landscape structure, characteristics and patterns. Distinct features worthy of conservation.	Nationally or Regionally recognised e.g. parts of National Parks, AONBs.

	Sense of place. Occasional detracting features. Could be improved with appropriate management.	
Attractive Landscape	Recognisable landscape structure and patterns. Some features worthy of conservation. Sense of place. Some detracting features. Could be improved with appropriate management for land use and land cover.	Parkland landscape with distinct tree planting. Interesting topography.
Good Landscape	Distinguishable landscape structure and patterns. Some features worthy of conservation. Some detracting features. Scope to improve.	Pleasant agricultural landscape but not particularly noteworthy.
Ordinary Landscape	Weak landscape structure and patterns. Mixed land use evident. Land management. Frequent detracting features.	Rural areas with frequent one-off housing.
Poor Landscape	A damaged landscape. Disturbed or derelict land. Detracting features dominate.	Poor quality industrial areas. Degraded landscape at the edge of a settlement.

Source: Based on Guidelines for Landscape and Visual Impact Assessment, 2nd Edition, 2002 (pg. 143).

5.5.2.4 Classification of Landscape Sensitivity

The evaluation of landscape sensitivity to change involves consideration of the nature of the landscape and its ability to accommodate change without compromising its key elements or characteristics. Sensitivity to change is defined through appraisal of the following:

- the distinctiveness of character and quality of the existing landscape;
- the vulnerability of the key components determining character;
- the nature of predicted effects, the degree of change that would result, and the ability of the landscape to accommodate that change; and
- the significance of the landscape resource in a local, regional and national context.

The classification of landscape sensitivity and the criteria used to define sensitivity to change (as defined in IAN 135/10) is detailed in the following table.

Table 5.5.2: Criteria used in the assessment of Landscape Sensitivity

Sensitivity	Description
High	Landscapes which by nature of their character would be unable to accommodate change of the type proposed. Typically these would be: • of high quality with distinctive elements and features making a positive contribution to character and sense of place; • likely to be designated, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale; • areas of special recognised value through use, perception or historic and cultural associations; and • likely to contain features and elements that are rare and could not be replaced.
Moderate	Landscapes which by nature of their character would be able to partly accommodate change of the type proposed. Typically these would be: • comprised of commonplace elements and features creating generally unremarkable character but with some sense of place; • locally designated, or their value may be expressed through non-statutory local publications; • containing some features of value through use, perception or historic and cultural associations; and • likely to contain some features and elements that could not be replaced.

Low	Landscapes which by nature of their character would be able to accommodate change of the type proposed. Typically these would be: • comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place; • not designated; • containing few, if any, features of value through use, perception or historic and cultural associations; and • likely to contain few, if any, features and elements that could not be replaced.

Source: IAN135/10 'Landscape and Visual Effects Assessment' Table 2, Annex 1 (November 2010).

5.5.2.5 Magnitude of Landscape Change

The magnitude of landscape change (or effects) is an expression of the size or scale of change in the landscape, the geographical extent of the area influenced, and the duration and reversibility of the resultant effect. 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 development boundary itself; 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 (short-term, medium-term or long-term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

Table 5.5.3 details the criteria used to define the magnitude of landscape change (as defined in IAN 135/10).

Table 5.5.3: Estimating the Magnitude of Change on a Landscape Attribute

Magnitude of Change (Effect)	Description
Major Adverse	Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.
Moderate Adverse	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Minor Adverse	Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Negligible Adverse	Barely noticeable loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
No Change	No noticeable loss, damage or alteration to character or features or elements.
Negligible Beneficial	Barely noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
Minor Beneficial	Slight improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
Moderate Beneficial	Partial or noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features.
Major Beneficial	Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the

addition of new distinctive features.

Source: IAN135/10 'Landscape and Visual Effects Assessment' Table 1, Annex 1 (November 2010).

5.5.2.6 Significance of Landscape Effects

The significance of effects associated with the Scheme on the landscape can be determined by combining the magnitude of change with the sensitivity of each particular landscape area. This is determined by the use of a matrix, shown in Table 5.5.4, which balances the value of a feature against the magnitude of effects, taking into account the planned mitigation measures (based on the significance of effect categories defined within IAN 135/10).

Table 5.5.4: Estimating the Significance of Potential Landscape Effects

Landscape Sensitivity					
High	Neutral	Slight	Slight / Moderate	Moderate / Large	Large / Very Large
Moderate	Neutral	Neutral / Slight	Slight	Moderate	Moderate / Large
Low	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate
	No Change	**Negligible**	**Minor**	**Moderate**	**Major**
	Magnitude of Effects				

Source: IAN135/10 'Landscape and Visual Effects Assessment' Table 3, Annex 1 (November 2010).

Typical descriptors for significance of landscape effects (as defined in IAN 135/10) are detailed in Table 5.5.5.

Table 5.5.5: Significance of Landscape Effects Categories

Significance Category	Description of Effect
Very Large Beneficial Effect	The project would: • greatly enhance the character (including quality and value) of the landscape; • create an iconic high quality feature and/or series of elements; • enable a sense of place to be created or greatly enhanced.
Large Beneficial Effect	The project would: • enhance the character (including quality and value) of the landscape; • enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development; • enable a sense of place to be enhanced.
Moderate Beneficial Effect	The project would: • improve the character (including quality and value) of the landscape; • enable the restoration of characteristic features and elements partially lost or diminished as a result of changes from inappropriate management or development; • enable a sense of place to be restored.
Slight Beneficial Effect	The project would: • complement the character (including quality and value) of the landscape; • maintain or enhance characteristic features and elements; • enable some sense of place to be restored.
Neutral Effect	The project would: • maintain the character (including quality and value) of the landscape; • blend in with characteristic features and elements; • enable a sense of place to be retained.
Slight Adverse Effect	The project would: • not quite fit the character (including quality and value) of the landscape; • be at variance with characteristic features and elements; • detract from a sense of place.

Moderate Adverse Effect	The project would: • conflict with the character (including quality and value) of the landscape; • have an adverse impact on characteristic features or elements; • diminish a sense of place.
Large Adverse Effect	The project would: • be at considerable variance with the character (including quality and value) of the landscape; • degrade or diminish the integrity of a range of characteristic features and elements; • damage a sense of place.
Very Large Adverse Effect	The project would: • be at complete variance with the character (including quality and value) of the landscape; • cause the integrity of characteristic features and elements to be lost; • cause a sense of place to be lost.

Source: IAN135/10 'Landscape and Visual Effects Assessment', Table 4 Annex 1 (November 2010).

5.5.2.7 Visual Effects

Visual effects are determined by the extent of visibility and the nature of the visibility (i.e. how a development is seen within the landscape); for example, whether it appears integrated and balanced within the visual composition of a view or whether it creates a focal point.

Negative visual effects may occur through the intrusion of new elements into established views, which are out of keeping with the existing structure, scale and composition of the view. Visual effects may also be beneficial, where an attractive focus is created in a previously unremarkable view or the influence of previously detracting features is reduced. The significance of effects will vary, depending on the nature and degree of change experienced and the perceived value and composition of the existing view.

The staged process for undertaking a visual effects assessment (as outlined within Annex 1 of IAN 135/10) is detailed below:

- determine the extent of visibility of the Scheme;
- collect and collate information on the visual context of the Scheme;
- identify receptors and evaluate their sensitivity;
- describe the degree of visual change caused by the Scheme;
- identify and develop mitigation measures as a component of the iterative design process to avoid, reduce and where possible remedy adverse effects; and
- assess the significance of the resultant visual effects.

5.5.2.8 Visual Receptors

For there to be a visual effect, 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 various route options depends on a number of factors, including:

- Receptor activities, such as taking part in leisure, recreational and sporting activities, travelling or working;
- whether receptors are likely to be stationary or moving and how long they will be exposed to the change at any one time;
- the importance of the location, as reflected by designations, inclusion in guidebooks or other travel literature, or the facilities provided for visitors;
- the extent of the route or area over which the changes will be visible;

- whether receptors will be exposed to the change daily, frequently, occasionally or rarely;
- the orientation of receptors in relation to the various route options and whether views are open or intermittent;
- proportion of the route options 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.

5.5.2.9 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
- possible local value; 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 classification of visual sensitivity and the criteria used to define sensitivity to change (as defined in IAN 135/10) is detailed in Table 5.5.6.

Table 5.5.6: Criteria used in the assessment of Visual Sensitivity

Sensitivity	Description
High	Residential properties. Users of Public Rights of Way (PRoW) or other recreational trails. Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land etc.).
Moderate	Outdoor workers. Users of scenic roads, railways or waterways or users of designated tourist routes. Schools and other institutional buildings, and their outdoor areas.
Low	Indoor workers. Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes. Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities).

Source: IAN135/10 'Landscape and Visual Effects Assessment' Table 1, Annex 2 (November 2010).

5.5.2.10 Magnitude of Visual Effects

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 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 are described below:

- 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 table below presents the criteria used to define the magnitude of visual effects (as detailed in IAN 135/10).

Table 5.5.7: Magnitude of Visual Effects on a Visual Attribute

Magnitude of Effects	Description
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project would be discernible, or it is such a distance that it would form a barely noticeable feature or element of the view.
No Change	No part of the project, or work activity associated with it, is discernible.

Source: IAN135/10 'Landscape and Visual Effects Assessment', Table 2, Annex 2 (November 2010).

5.5.2.11 Significance of Visual Effects

The significance of effects will be 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 to 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 effect associated with the various route options on each visual receptor was determined by combining the magnitude of change with the sensitivity of each visual receptor. The criteria used to derive significance are detailed in the table below.

Table 5.5.8: Estimating the Significance of Potential Visual Effects

Visual Sensitivity						
	High	Neutral	Slight	Slight / Moderate	Moderate / Large	Large / Very Large
	Moderate	Neutral	Neutral / Slight	Slight	Moderate	Moderate / Large
	Low	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
				Magnitude of Effects (Impact)		

Source: IAN135/10 'Landscape and Visual Effects Assessment', Table 3, Annex 2 (November 2010).

Typical descriptors for significance of visual effects (as defined in IAN 135/10) are detailed in the table below.

Table 5.5.9: Significance of Visual Effects Categories

Significance Category	Description of Effect
Very Large Beneficial	The project would create an iconic new feature that would greatly enhance the view.
Large Beneficial	The project would lead to a major improvement in a view from a highly sensitive receptor.
Moderate Beneficial	The project would cause obvious improvement in a view from a moderately sensitive receptor, or perceptible improvement to a view from a more sensitive receptor.
Slight Beneficial	The proposals would cause limited improvement to a view from a receptor of medium sensitivity, or would cause greater improvement to a view from a receptor of low sensitivity.
Neutral	No perceptible change in the view.
Slight Adverse	The project would cause limited deterioration to a view from a receptor of medium sensitivity, or cause greater deterioration to a view from a receptor of low sensitivity.
Moderate Adverse	The project would cause obvious deterioration to a view from a moderately sensitive receptor, or perceptible damage to a view from a more sensitive receptor.
Large Adverse	The project would cause major deterioration to a view from a highly sensitive receptor and would constitute a major discordant element in the view.
Very Large Adverse	The project would cause the loss of views from a highly sensitive receptor, and would constitute a dominant discordant feature in the view.

Source: IAN135/10 'Landscape and Visual Effects Assessment', Table 4, Annex 2 (November 2010).

5.5.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. The following table outlines the responses from the Stage 2 consultation from a Landscape & Visual perspective. It should be noted that any relevant responses which were received during the Stage 1 consultation, although not recorded in this Stage 2 consultation table, are considered/addressed within the appropriate technical section.

Table 5.5.10: Summary of formal consultation responses in relation to Landscape & Visual Effects

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – NI Forest Service	09 Apr 2018 19 Apr 2018	22 May 2018	Preference for options that reduce woodland removal. Any reduction to the forest area will have a significant impact on forest design, forest management, access, and the landscape. These impacts will have an impact on local and regional stakeholders.

DAERA- Planning Response Team (Collaborated response)	09 Apr 2018 09 May 2018	17 May 2018	Have fewer concerns with the Blue Route options which are associated with the urban fringe which may lessen its impact on the landscape character and quality of the AONB. NED has serious concerns with both the Red and Yellow Routes due to the potential impact on Carlingford Lough ASSI, adverse effect on the landscape character and quality of two AONBs, and significant loss of irreplaceable Ancient and Long-established Woodland. They are opposed to these options and consider that these routes could have implications for DfI compliance with the duties within the Environment Order, Wildlife and Natural Environment Act, and Nature Conservation and Amenity Lands Order.
DFC - Historic Environment Division, Historic Monuments	09 Apr 2018 09 May 2018	29 May 2018	HED considers that the existing character of the locality of the Blue Route would offer opportunities to minimise impacts upon the character of the setting of the canal, and would be more appropriate here than the more rural southern options. Further detailed consideration of the design of the proposed bridge would be necessary to further mitigate any potential adverse impacts upon the setting of the canal.
Sustrans	09 Apr 2018 09 May 2018	07 Jun 2018	The visual/environmental impact of a high bridge over the canal, with access slopes and structures, will dominate the landscape and impact negatively on the spatial experience of walkers and cyclists who are already using the Greenway link in the vicinity.

5.5.4 Regulatory & Policy Framework

A hierarchy of strategies, policies and legislation operates to underpin the management of both land and landscape. Some of these enable statutory designation at national level and others provide for local designations and appropriate management, with the aim of conserving and protecting the quality of the landscape.

5.5.4.1 European Landscape Convention (2000)

The UK Government is a signatory to the European Landscape Convention. The Convention (also known as the Florence Convention) aims to encourage public authorities within Member States to adopt policies and measures for the protection, management and planning of all landscapes, whether outstanding or ordinary, that determine the quality of people's living environment. The Convention specially encourages local authorities to introduce exemplary and long-lasting polices or measures to protect, manage and plan landscapes.

The GLVIA 2nd Edition defines 'landscape character' as: "*a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse*."

Landscape Character Assessment (LCA) is a tool that allows landscape character to be understood, explained and described in a transparent and robust way. It does this by mapping and describing the variations in physical, natural and cultural attributes and experiential characteristics that make one area distinctive from another at a range of spatial scales. LCA also considers how landscapes have changed over time, and acknowledges the influences that human activities and the impacts of economic development have in shaping and changing landscapes. A better understanding of landscapes provided by LCAs (their diversity, character and distinctiveness, evolution, sensitivity to change and their management needs) is essential to effective spatial planning.

5.5.4.2 The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985

Under Part IV of the Order (National Parks and Areas of Outstanding Natural Beauty (AONB)) where the DAERA (formerly DOE) considers an area (not being an area within a National Park) to be of such outstanding natural beauty that it is desirable that the provisions of this Article should apply to the area, the Department may make an Order designating it as an AONB. This designation is designed to protect and enhance the qualities of each area and to promote their enjoyment by the public. It is the only designation currently in use in Northern Ireland to identify areas of high landscape quality. Although there is provision for the designation of National Parks, none currently exist in Northern Ireland.

5.5.4.3 The Planning (Northern Ireland) Order 1991

The Planning (Northern Ireland) Order 1991 ("the 1991 Order") requires the DAERA (formerly DOE) to "*formulate and co-ordinate policy for securing the orderly and consistent development of land and the planning of that development*."

The DAERA's main functions under the 1991 Order are the preparation of planning policy and Development Plans, controlling development through planning permission and consent procedures, and taking enforcement action against breaches of planning control. These functions were extended by the Planning (Amendment) (Northern Ireland) Order 2003 and the Planning Reform (Northern Ireland) Order 2006.

The Planning Bill was introduced to the NI Assembly in 2013. The primary objective of the Bill was to accelerate the implementation of a number of reforms contained within the Planning Act (Northern Ireland) 2011. The key provisions in the Bill were to aim to deliver:

- measures to strengthen the planning system in promoting economic development;
- measures to further sustainable development and enhance the environment;
- faster processing of planning applications;
- faster and fairer planning appeals system;
- enhanced community involvement; and
- simpler and tougher enforcement.

5.5.4.4 The Regional Development Strategy (RDS) 2035 – Building a Better Future

One of the aims of the RDS is to "*Protect and enhance the environment for its own sake*". The RDS states that:

"*Protecting the environment is essential for enhancing the quality of life of current and future generations. Northern Ireland's environment is one of its greatest assets, with its stunning landscapes, an outstanding coastline, a complex variety of wildlife, and a rich built and cultural heritage for the ecosystem services it provides, and its sense of place and history for all*."

Chapter 3 of the RDS outlines two types of strategic guidance:

- Regional Guidance (RG) – This applies to everywhere in the region and is presented under the three sustainable development themes of Economy, Society and Environment; and
- Spatial Framework Guidance (SFG) - This is additional to the region-wide guidance and is tailored to each of the five elements of the Spatial Framework.

The RDS sets out Regional Guidance in relation to the built and natural environment under RG11.

"RG11 - *Conserve, protect and, where possible, enhance our built heritage and our natural environment*"

In relation to landscape effects associated with the various route options, RG11 provides guidance under a number of headings:

- identify, protect and conserve the built heritage, including archaeological sites and monuments and historic buildings;
- identify, protect and conserve the character and built heritage assets within cities, towns and villages;
- maintain the integrity of built heritage assets, including historic landscapes;
- sustain and enhance biodiversity;

- identify, establish, protect and manage ecological networks;
- protect and encourage green and blue infrastructure within urban areas;
- protect and manage important geological and geomorphological features;
- protect, enhance and manage the coast;
- protect, enhance and restore the quality of inland water bodies;
- recognise and promote the conservation of local identity and distinctive landscape character;
- conserve, protect and where possible enhance areas recognised for their landscape quality;
- protect designated areas of countryside from inappropriate development (either directly or indirectly) and continue to assess areas for designation; and
- consider the establishment of one or more National Parks.

The RDS highlights the importance of the rich variety of landscapes within Northern Ireland. In particular, it states that "*The Northern Ireland Landscape Character Assessment 2000 provides valuable guidance on local landscape character and scenic quality*."

The RDS also recognises the need for the protection of designated landscapes and continued assessment of areas for designation.

5.5.4.5 A Sustainable Development Strategy for Northern Ireland 2006

Chapter 2 of the Sustainable Development Strategy (Natural Resource Protection and Environmental Enhancement) focuses on protection and enhancement of the environment. One of the five key strategic objectives for the protection of the environment is to '*conserve our landscape and manage it in a more sustainable way*'.

The key targets in relation to the landscape are:

- complete the review of AONBs and programme of designation by 2016;
- introduce enabling legislation for the designation of National Parks by 2009; and
- increase Northern Ireland's forested area by at least 500 hectares per annum in line with the published 'Forestry Strategy – A Strategy for Sustainability and Growth' (DARD 2006).

5.5.4.6 PPS 2 – Natural Heritage (July 2013)

PPS 2 sets out DAERA's land-use planning policies for the conservation, protection and enhancement of our natural heritage.

5.5.4.6.1 Development Plans

PPS 2 states that "*The development plan should consider the natural and cultural components of the landscape and promote opportunities for the enhancement or restoration of degraded landscapes, particularly those affecting communities*."

PPS 2 highlights the importance of Countryside Assessments as an integral part of the Development Plan making process and notes that "*local designations arising from the plan should be identified and policies brought forward for their protection and, where possible their enhancement*."

5.5.4.6.2 Trees and Woodlands

PPS 2 outlines the statutory framework for the protection of trees and woodland. It also states that development plans should seek to identify and promote green and blue infrastructure "*where this will add value to the provision, enhancement and connection of open space and habitats in and around settlements*." Green infrastructure is defined as parks, green spaces and street trees; blue infrastructure includes ponds, streams and lakes.

5.5.4.7 PPS 6 - Planning, Archaeology and The Built Heritage (March 1999)

PPS 6 states that development plans will, where appropriate, designate Local Landscape Policy Areas (LLPAs) and contain local policies and guidance to maintain the intrinsic environmental value and character of these areas. LLPAs consist of those features and areas within and adjoining settlements considered to be of greatest amenity value, landscape quality or local significance, and therefore worthy of protection from undesirable or damaging development.

LLPAs may include:

- archaeological sites and monuments and their surroundings;
- listed and other locally important buildings and their surroundings;
- river banks and shore lines and associated public access;
- attractive vistas, localised hills and other areas of local amenity importance; and
- areas of local nature conservation interest, including areas of woodland and important tree groups.

5.5.4.8 The Northern Ireland Regional Landscape Character Assessment (2014)

The purpose of the Northern Ireland Regional Landscape Character Assessment (NIRLCA) is to provide an evidence base which can be used equally by planners, developers and the public. It enables people to make informed decisions concerning the planning, management and protection of Northern Ireland's landscapes. It provides a strategic overview of the landscape, which can be complemented by more detailed local studies in future. The NIRLCA aims to draw together information on people and place, and the combinations of nature, culture and perception which make each part of Northern Ireland unique. This local identity can be referred to by the Irish term '*dinnseanchas*', meaning "the spirit of a place". This spirit results from the interactions of natural and human processes over time – processes which continue today since landscape must be viewed as a dynamic entity. The NIRLCA has been developed to meet commitments set out in Northern Ireland's Landscape Charter.

5.5.4.9 Northern Ireland Landscape Character Assessment (2000)

The NILCA 2000 contains landscape briefs for each of 130 local landscape character areas in Northern Ireland surveyed in 1999. It provides a baseline description of the landscape at a point in time based upon local patterns of geology, landform, land use, cultural and ecological features. This base information is still a valuable resource and has informed the 26 regional landscape character areas of the NIRLCA. However, there has been substantial development in both rural and urban areas of Northern Ireland since the NILCA 2000 was surveyed, which has impacted on many of its local landscape character areas.

5.5.4.10 Banbridge / Newry and Mourne Area Plan 2015

The Banbridge / Newry and Mourne Area Plan 2015 is a development plan prepared under the provisions of Part III of the Planning (Northern Ireland) Order 1991 by the then DOE.

The overall aim of the Plan is to provide a planning framework which is in broad conformity with the RDS in facilitating sustainable growth and a high quality of development in Banbridge / Newry and Mourne Area throughout the Plan period, whilst protecting and where appropriate, enhancing the natural and man-made environment of the Plan area.

Pertinent to this proposal from a landscape and visual perspective, the Plan has designations as discussed in the following section.

5.5.5 Baseline Environmental Conditions and Constraints

5.5.5.1 Areas of Designated Landscape Importance or Value

Areas of designated landscape importance or value have been identified from the relevant Statutory Development Plan (Banbridge/Newry and Mourne Area Plan 2015).

The area of study extends south-east from the southern fringes of Newry City, along the Newry River estuary towards Carlingford Lough (Figure 5.5.1). It includes two designated Areas of Outstanding Natural Beauty (AONB), namely the Ring of Gullion AONB to the west, and the Mourne AONB to the east. The Mourne AONB was designated in 1986 and the Ring of Gullion AONB in 1991, both under the Nature Conservation and Amenity Lands Order (Northern Ireland) 1985 in recognition of their 'exceptional scenic quality'.

There are also three designated Local Landscape Policy Areas (LLPAs) within the study area. These are the Newry Canal/River LLPA (Designation NY 114), the Warrenpoint Road/Greenan Road LLPA (Designation NY 136) and the Dublin Road LLPA (Designation NY 135).

The Newry Canal/River LLPA has been designated as an '*area of nature conservation interest including the Newry River and Canal corridors and associated vegetation/trees*'.

The Warrenpoint Road/Greenan Road LLPA has been designated as an '*area of local amenity importance including attractive vistas and characteristic stone walls and farm buildings'*. It is also an '*area of nature conservation interest including a SLNCI and areas of significant vegetation*'. This area comprises the land sloping up from Carlingford Lough between the Newry development limit and the boundary of the Mourne AONB.

The Dublin Road LLPA has been designated as such due to the '*listed Church of the Sacred Heart, its setting, views and associated land*'. It is deemed an '*area of local amenity importance including the mature trees in front of the Church and other areas of significant vegetation*'.

The Newry River estuary is also a designated Coastal Policy Area, '*of exceptional nature conservation importance and scenic quality*'.

5.5.5.2 NI Regional Landscape Character Assessment (NIRLCA)

The study area lies largely within the southern end of the Newry Valley and Upper Bann (RLCA 23). This marked divide in the drumlin belt includes the road, rail and canal transport corridor of the Newry Valley, cutting north-south through the area. The Newry Valley and Upper Bann form a lowland area between the uplands of the Mourne Mountains and Slieve Croob (RLCA 25) to the east, and Slieve Gullion and the South Armagh hills (RLCA 24) to the west. The lowland forms a link between Lough Neagh and Carlingford Lough which has long served as a strategic route. The lower Newry River and the Ship Canal are characterised as the Newry Estuary Seascape Character Area (SCA 21).

The following site-specific influences on the Landscape Character are referenced in the NIRLCA:

Natural Influences

- The 'valley' which runs north to south through this RLCA was formed during the last deglaciation, when melting ice forced a channel from Lough Neagh south via Poyntzpass to Carlingford Lough.
- Undulating area taking in two subtle but important valleys/basins and the ridges between them. These valleys have a backdrop of hills to the southeast (the Mourne Mountains) and southwest (the Ring of Gullion).
- The southern part of this area comprises the catchment of Newry River, which flows south through Newry City and on through a steep-sided valley into Carlingford Lough at Warrenpoint.

Cultural Influences

- The Newry Ship Canal opened for traffic in 1742, was the first summit level canal in the British Isles, and was built to link the Tyrone coalfields (via Lough Neagh and the River Bann) to the Irish Sea at Carlingford Lough near Newry.
- Albert Basin canal harbour within Newry was an important port for emigrant vessels sailing from Warrenpoint, with passengers fleeing the hardships of the Great Irish Famine.
- The towpath of the Newry Ship Canal has become part of a long distance footpath and also part of the National Cycle Network. The section from Newry to sea locks on the Omeath Road, has hosted the World Coarse Angling Championships.

Past, present and future forces for change

- Built development: Residential and commercial development pressure is likely to occur around the fringes of the main settlement of Newry. Pressure for dispersed housing across the landscape is likely to continue, with potential effects on the rural nature of much of the landscape.
- Canal: In the longer term, restoration of the Newry Canal could have a major positive effect on the landscape, bringing this historic feature back into use. It would be important to ensure high quality design and implementation of restoration works, and management of new development and recreational pressures which could subsequently occur.

- Access, recreation and tourism: Newry is a local centre for visitors to the area, on the main transport routes which use the A1 corridor; Newry Canal is a popular walking and cycling route as well as for boating; Ulster Way follows the canal; popular angling locations.
- Archaeological heritage: 18th century Newry Canal and Ship Canal and wider industrial heritage;
- Spiritual and religious values: Association of Newry with St Patrick and early Christian monastery site.
- Inspiration and aesthetic values: Long views to the Mourne Mountains and Ring of Gullion; attractive setting of towns and city of Newry within valley landscapes; demesne woodlands provide scenic diversity in the rolling farmland.

5.5.5.3 NI Landscape Character Assessment 2000

The study area straddles the Newry Basin Landscape Character Area (69) and the Ring of Gullion Landscape Character Area (71), as defined in the Northern Ireland Landscape Character Assessment No.99/17 Newry and Mourne (EHS, 1999).

The Northern Ireland Landscape Character Assessment (LCA) defines several Distinctive Landscape Settings within the study area. These are the Fringes of the Ring of Gullion AONB, Ridge top and Prominent Slopes (at Fathom Mountain), Newry River, and Narrow Water Estate.

The LCA also identifies several key views, namely that from Fathom Mountain looking north towards Newry City and looking south-east into the river valley, and also a key view from Greenan Wood looking south-west into the river valley and across to Fathom Mountain.

5.5.5.4 Landscape Description, Character and Value of Study Area

The study area extends from the urban fringe of Newry City at Greenbank in a south/south-easterly direction along the Newry River and Newry Canal towards Carlingford Lough, in a dramatic, steep-sided valley, approximately 1km wide. The study area comprises the land sloping up from the Newry River estuary to the Aghnamoira Road and Mourne AONB to the east, and into the Ring of Gullion AONB to the west, around the summit of Fathom Mountain to join the A1 Dublin Road which runs between Fathom and Cloghogue Mountains.

The overall landscape character of this area changes from the Poor Landscape character of the urban fringe at Greenbank, at the northern end of the study area, to a dramatic steep-sided valley contained by the designated AONBs and High Quality Landscape as it extends towards Carlingford Lough. The Drumalane Quarry to the immediate south-west of the Greenbank Industrial Estate is a significant scar on the slopes to the north-west of the river valley, and contributes to this poor quality landscape around Greenbank. The extensive forestry plantations at Fathom Forest on the steep slopes of Fathom Mountain to the west and extending beyond the summit to the A1 is a High Quality Landscape with High Sensitivity to change. The eastern slopes of the valley south-east of Newry, the landscape is assessed to be Good to Attractive with distinctive features such as the mixed woodland at Greenan and an overall sense of place adjacent to the Mourne AONB to the east which contain and enrich the landscape character of the valley. The area offers attractive vistas, particularly south/south-east from the A2 Warrenpoint Road and Fathom Line towards Carlingford Lough, Slieve Foye and the Carlingford Mountains. This is a High Quality Landscape of regional importance to Northern Ireland and County Louth, and has a High sensitivity to change. The amenity area at Victoria Lock offers panoramic views up the canal/river basin towards Newry City and downstream towards Carlingford Lough.

The landscape character of the upland area around Fathom Mountain and Cloghogue Mountain is rural, with narrow hedge-banked roads, attractive pastures and a scattering of bungalows and farms. The field layouts create striking patterns on the hillsides, separated by stone walls, gorse hedges and tree belts. This is a High Quality Landscape with High sensitivity to change. Fathom Forest offers only occasional glimpsed views down into the river valley from the Flagstaff Road.

5.5.5.5 Key Landmarks

- Fathom Mountain is a key landmark, rising some 247m above sea level.
- Drumalane Quarry is a key landmark, which is a significant scar on the western hillside of the river basin.

- Green Island is also a key landmark, as this small pocket of land juts out into the estuary adjacent to the A2 Warrenpoint Road. An occupied bungalow is sited on Green Island.

5.5.6 Assessment of Environmental Impacts

The following potential landscape and visual effects arising from each route option have been identified and assessed within the 'Zone of Visual Influence' only. A 'Zone of Visual Influence' is a delineation of an area within which all locations are intervisible. This is estimated according to landform, and ignores local screening features such as vegetation, local topography and built structures. The actual zone of visual influence may therefore be considerably less and more fragmented, relative to the theoretical area.

The 'Significance of effects' has been evaluated according to the magnitude of change and the sensitivity of the landscape character or view. The criteria adopted in assessment of the predicted magnitude of change are described in Section 5.5.2 above.

An approximate indication of properties with a potential for significant visual effects is included in Figure 5.5.1.

A list of potential mitigation measures is included in Section 5.5.7. These aim to reduce the significant effects of the various route options.

Ring of Gullion AONB

All route options encroach to some extent into the Ring of Gullion AONB on the western slope of the Newry River valley. Resulting Landscape and Visual effects would most likely range from Moderate/ Large to Very Large Adverse within the AONB for all options.

Bridging the River / Canal Valley

All route options require a bridge structure to traverse the Newry River valley. Any such structure is likely to result in significant landscape and visual effects. Whether these effects are adverse or beneficiary is a subjective assessment and will depend on the final architectural design of the bridge structure.

There are three potential crossing points:

- Blue Route (including all sub-options) - located within the Greenbank Industrial Estate on the Newry urban fringe with an approximate clearance height between the bridge and Newry River/Canal of 12.2m.
- Red Route – located further south along the Newry River valley between Green Island and Victoria Lock with an approximate clearance height between the bridge and Newry River/Canal of 6m.
- Yellow Route – located at Rough Island with an approximate clearance height between the bridge and Newry River of 5.3m.

5.5.6.1 Red Route

Baseline Landscape Character along this route option

The Red Route requires a bridge between the A2 Warrenpoint Road and the B79 Fathom Line located south of Green Island. At this location, the route option is located within two landscape character areas, the Newry Basin LCA east of Newry River and the Ring of Gullion LCA to the west of Newry River. This route would encroach into High Value Landscapes of the western fringes of the Mourne AONB on the eastern slopes of the Newry River valley and into the eastern fringes of the Ring of Gullion AONB on the western slopes of the river valley. The bridge would be located at one of the widest sections of the Newry estuary. The Newry River Valley is flanked by strong ridge-lines with steep wooded slopes at this location. The river valley south of Newry is of High Quality Landscape Value and of regional importance to Northern Ireland and County Louth. It is also a designated Coastal Policy Area which recognises its exceptional scenic quality. The river valley environs have a high sensitivity to change. The valley offers attractive vistas, particularly south / southeast towards Carlingford Lough, Slieve Foye and the Carlingford Mountains. The amenity area at Victoria Lock provides open panoramic views up and downstream the canal / river valley. The route would travel along wooded western slopes to an upland area around Fathom Mountain, where it turns west at the wooded gorge of Benson’s Glen and skirts around to the existing A1. The upland areas are rural and appear isolated with an established field pattern, hedgerows, tree belts, scrub and scattered residential dwellings and farms. This is also recognised as a High Quality Landscape with a high sensitivity to change. The western slopes of the Newry River valley and the areas around Fathom Mountain are also part of the Ring of Gullian AONB.

This route option would also traverse large sections of ‘Long-Established Woodland’ as well as an area of ‘Ancient Woodland’ when rising up along the western slopes of the Newry River valley to the upland areas of Fathom Mountain.

Landscape Effects

Beginning at a new at-grade roundabout on the A2 Warrenpoint Road, the route would bridge across Newry River and Newry Canal connecting to a new roundabout above the existing B79 Fathom Line and cut into the slopes of the western river valley. The existing B79 would be locally raised on an embankment in order to connect to the new roundabout in either direction. The new bridge, with a clearance of approximately 6m above the Newry River / Canal, would result in a major landscape effect. The bridge would introduce an uncharacteristic and prominent feature in the recognised scenic valley landscape. The significance is considered to be Very Large Adverse as it would detract from the overall scenic value of the valley and it is highly unlikely that the bridge would be able to be integrated into its environs (depending on the architectural quality of the final bridge design).

From the new roundabout intersection on the B79 Fathom Line, the route would travel uphill along the western slopes of the river valley until it reaches the uplands on the eastern and north-eastern slopes of Fathom Mountain, where it turns north-west passing Benson’s Glen. This route would require major cuttings and large embankments along the steep slopes towards the upland areas resulting in major landscape effects. The significance of these effects are considered Very Large Adverse due to the removal of large sections of established woodland and sections of ancient woodland, leaving a scar in this High Value Landscape along the western slope of the river valley.

The route would pass the upper end of Benson’s Glen and underpass Flagstaff Road (which would be bridged at that location) before entering an upland valley. There, it cuts into its northern slopes before continuing on an embankment across the valley and skirting around the northern slopes of Fathom Mountain while rising and bridging across the Dublin-Belfast Railway line. The route would join the existing Brogies Road and a new at-grade roundabout adjacent to the existing A1 Ellisholding Junction.

The routing through a currently rural upland valley would result in major landscape effects as the scale of the road would be an uncharacteristic element in this area and disrupt the natural flow of the valley. The significance is considered Very Large Adverse. The upland area in the vicinity of the railway line, the existing A1 and Brogies Road is characterised by existing major infrastructural developments. The route alignment bridging the railway line, merging with Brogies Road and joining a new at-grade roundabout at Ellisholding Junction would result in a minor to moderate change in landscape character as the route alignment would be able to be integrated into the existing environment at this location. The existing prevalence of road infrastructure, including the adjacent A1, would be intensified. The significance is therefore considered Slight to Moderate Adverse.

Visual Effects

The majority of visual effects would result from the bridge crossing over the Newry River / Canal and the significant earthworks (cut and fill) along the western slopes of the river valley. The bridge would become a prominent new feature within the valley. The bridge would be visible when travelling up and downstream either side of the valley and from elevated views such as Fathom Mountain and the eastern valley slopes across from the scheme. The bridge is likely to visually segment the river valley into two parts. Cuttings and large embankments would also be visible from many locations within the valley and from receptors (mainly residential) located along the eastern slopes opposite the development (along Aghnamoira Road). The sensitivity to visual change of receptors would range from medium (vehicle travellers) to high (residents, walker and cyclists). The visual effects are considered major. The significance would be Very Large Adverse. While landscape mitigation measures would begin to screen the new embankments, the visual effects of the development would remain high as the overall visual character of the western slopes would change along the full length of the route alignment in this area.

Visual effects in the upland valley between Benson's Glen and Brogies Road are considered to be major, as the route alignment would introduce a new prominent feature and focal point. The significance is considered Large to Very Large Adverse in close distance views. Due to the isolated nature and undulating adjoining topography further north, significant visual effects in open views caused by the development are limited to passing traffic on Flagstaff Road and a small number of residential visual receptors in the vicinity of the valley. However, longer distance views would be experienced from properties located on the slopes of Cloghogue Mountain resulting in minor visual effects. The significance is considered Slight Adverse.

The bridge crossing of the Dublin-Belfast railway line and the online route alignment along Brogies Road further south to a new at-grade roundabout, adjacent to the Ellisholding Junction, is considered to result in minor to moderate visual effects. The significance is considered Slight to Moderate Adverse. Existing road infrastructure in available views would remain prevalent and become more prominent due to the introduction of the bridge structures across the railway line and sections of the widened Brogies Road and the new roundabout adjacent to Ellisholding Junction. The visual effects on receptors located along Brogies Road would be less when compared to the Blue Route Options 1-3, as the northern at-grade roundabout would not be required.

5.5.6.2 Yellow Route

Baseline Landscape Character along this route option

The Yellow Route is the longest route alignment of all route options. It requires a bridge between the A2 Warrenpoint Road and the B79 Fathom Line at Rough Island. The route option is located within two landscape character areas, the Newry Basin LCA east of Newry River and the Ring of Gullion LCA to the west of Newry River. The route would encroach into High Value Landscapes of the western fringes of the Mourne AONB on the eastern slopes of the Newry River valley and into the eastern fringes of the Ring of Gullion AONB on the western slopes of the river valley. The required bridge would be shorter than the Red Route as it would take advantage of the narrowing Newry River at Rough Island. The Newry River Valley is flanked by strong ridge-lines with steep wooded slopes at this location. The river valley south of Newry is of High Quality Landscape Value and of regional importance to Northern Ireland and County Louth. It is also a designated Coastal Policy Area which recognises its exceptional scenic quality. The river valley environs have a high sensitivity to change. It offers attractive vistas, particularly south / southeast towards Carlingford Lough, Slieve Foye and the Carlingford Mountains. The amenity area at Victoria Lock provides open panoramic views up and downstream the canal / river valley. The route would travel along the existing route alignment of the B79 Fathom Line passing Victoria Lock. It would begin to travel uphill from a new roundabout southwest of Green Island, following the Red Route, along the wooded western slopes to an upland area around Fathom Mountain, where it turns west at the wooded gorge of Benson's Glen and skirts around to the existing A1. The upland areas are rural and appear isolated with an established field pattern, hedgerows, tree belts, scrub and scattered residential dwellings and farms. This is also recognised as a High Quality Landscape with a high sensitivity to change. The western slopes of the Newry River valley and the areas around Fathom Mountain are also part of the Ring of Gullian AONB.

This route option would also traverse large sections of 'Long-Established Woodland' as well as an area of 'Ancient Woodland' when rising up along the western slopes of the Newry River valley to the upland areas of Fathom Mountain.

Landscape Effects

Beginning at a new at-grade roundabout at the A2 Warrenpoint Road, the route would bridge across Newry River connecting to a new roundabout at Rough Island. The existing B79 would be locally raised on embankment in order to connect to the new roundabout in either direction. The new bridge with a clearance of approximately 6m above the Newry River would result in a major landscape effect. The bridge would introduce a prominent feature standing in contrast with the overall valley character at this point. The significance is considered to be Large to Very Large Adverse as it would detract from the overall scenic value of the valley.

The change to the landscape character, while following the existing B79 Fathom Line, is considered Minor Adverse. The significance of effects would be Neutral. From the new roundabout south-west of

Green Island, the Yellow Route would diverge from the existing B79 Fathom Line and would travel, very similar to the Red Route, uphill along the western slopes of the river valley until it reaches the uplands on the eastern and north-eastern slopes of Fathom Mountain, where it turns north-west passing Benson's Glen. This route, including the roundabout, would require major cuttings and large embankments along the steep slopes towards the upland areas, resulting in major landscape effects. The significance of these effects are considered Very Large Adverse due to the removal of large sections of established woodland and sections of ancient woodland, leaving a scar in this High Value Landscape along the western slope of the river valley.

The route would pass the upper end of Benson's Glen and underpass Flagstaff Road (which would be bridged at that location) before entering an upland valley. There, it cuts into its northern slopes before continuing on an embankment across the valley and skirting around the northern slopes of Fathom Mountain while rising and bridging across the Dublin-Belfast railway line. The route would join the existing Brogies Road and a new at-grade roundabout adjacent to the existing A1 Ellisholding Junction.

The routing through a currently rural upland valley would result in major landscape effects as the scale of the road would be an uncharacteristic element in this area and disrupt the natural flow of the valley. The significance is considered Very Large Adverse. The upland area in the vicinity of the railway line, the existing A1 and Brogies Road is characterised by existing major infrastructural developments. The route alignment bridging the railway line, merging with Brogies Road and joining a new at-grade roundabout at Ellisholding Junction would result in a minor to moderate change in landscape character as the route alignment would be able to be integrated into the existing environment at this location. The existing prevalence of road infrastructure, including the adjacent A1, would be intensified. The significance is therefore considered Slight to Moderate Adverse.

Visual Effects

The majority of visual effects would result from the bridge crossing over the Newry River, the roundabouts on either side of the bridge, the roundabout near Green Island and the significant earthworks (cut and fill) along the western slopes of the river valley. The bridge would become a prominent new feature within the valley. The bridge would be located in a better location when compared to the Red Route, as it would take advantage of a natural narrowing of the Newry River resulting in a shorter bridge, which could be integrated better into the overall valley depending on its architecture. Any bridge structure across the Newry River would, similar as for the Red and Blue Route options, become highly visible creating a new point of focus in views along the valley or from elevated viewpoints along the slopes to either side of the river valley. The magnitude of change would therefore be major for this location. The significance of effects is considered to be Large to Very Large Adverse.

The route alignment along the existing B79 Fathom Line corridor would be visually noticeable due to substantial areas of cut and fill along the route but it may integrate (depending on soil depth) following the establishment of mitigation planting proposals considering the existing transport route along this side of the river. The visual effects would be minor to moderate due to the relatively few proximal receptors. The significance is considered to be Slight to Moderate Adverse.

The cutting and large embankments along the western slopes would be visible from many locations within the valley and from receptors (mainly residential) located along the eastern slopes opposite the development (Aghnamoira Road). The route would follow a similar alignment as the Red Route until it reaches the A1. The sensitivity to visual change of receptors would range from medium (vehicle travellers) to high (residents, walker and cyclists). The visual effects are considered major. The significance would be Very Large Adverse. While landscape mitigation measures would begin to screen the new embankments, the visual effects of the route alignment would remain high as the overall visual character of the western slopes would change along the full length of the route in this area.

Visual effects in the upland valley between Benson's Glen and Brogies Road are considered to be major as the route would introduce a new prominent feature and focal point. The significance is considered Large to Very Large Adverse in close distance views. Due to the isolated nature and undulating adjoining topography further north, significant visual effects in open views caused by the development are limited to passing traffic on Flagstaff Road and a small number of residential visual receptors in the vicinity of the valley. However, longer distance views would be able to be experienced from properties located on the slopes of Cloghogue Mountain resulting in minor visual effects. The significance is considered Slight Adverse.

The bridge crossing of the Dublin-Belfast railway line and the online route alignment along Brogies Road further south to a new at-grade roundabout, adjacent to the Ellisholding Junction, is considered to result in minor to moderate visual effects. The significance is considered Slight to Moderate Adverse. Existing road infrastructure in available views would remain prevalent and become more prominent due to the introduction of the bridge structures across the railway line and sections of the widened Brogies Road and the new roundabout adjacent to the Ellisholding Junction. The visual effect on receptors located along Brogies Road would be less when compared to the Blue Route Options 1-3, as the northern at-grade roundabout would not be required.

5.5.6.3 Blue Route Options

Baseline Landscape Character along the route options

All Blue Route options (1-3) are located within two landscape character areas, the Newry Basin LCA east of Newry River and the Ring of Gullion LCA to the west of Newry River. All three options would travel along the same landscape baseline between the A2 Warrenpoint Road and the A1 near Ellisholding Junction. Beginning within the Newry River valley at the south-eastern urban fringe of Newry, the landscape is dominated by sub-urban housing developments along the eastern slopes of the Newry River valley, north-east of the A2. The Greenbank Industrial Estate with warehouses and large working yards is located at the centre of the valley between the A2 and Newry River. The route options traverse a ‘Major Area of Existing Open Space’ at the Newry Mitchels GAA Club located within the industrial estate. The overall quality of the landscape is poor, with a low sensitivity to change. Travelling westwards and crossing the Newry River and Newry Canal, the route also crosses a Local Landscape Policy Area (LLPA – Newry Canal / River, Designation NY114). The slopes west along the river valley rise up steeply. Drumalane Quarry, located opposite Greenbank Industrial Estate, is a significant scar on the slopes to the north-west of the river valley and the Blue Route options. The slopes further south are vegetated with bands and clusters of woodland; they contain also green fields and a small number of dwellings, mainly in the vicinity of Benson’s Glen; a narrow but densely wooded gorge along a tributary to the Newry River. The landscape quality improves to Good to Attractive along the western slopes with distance to the urban fringe of Newry. Benson’s Glen rises steeply towards the west before it underpasses Flagstaff Road (which will be bridged at this location) and opens up into an upland valley located at the northern and north-eastern slopes and foothills of Fathom Mountain. A number of residential properties and farms are located along Flagstaff Road. The rural upland valley skirts around to the north-west along the northern slopes of Fathom Mountain while it continues to rise ultimately towards Cloghogue Mountain. It is traversed by the Dublin-Belfast railway line and the A1. Fathom Mountain and surroundings are considered a High Quality Landscape with a High Sensitivity to change. The landscape character of the upland valley is rural and appears isolated with narrow and often hedge-banked roads and a small number of dwellings away from the main roads.

The Blue Route options enter the eastern fringes of the ‘Ring of Gullion’ AONB and pass small areas of ‘Long-Established Woodland’ including Benson’s Glen. The route options remain within the ‘Ring of Gullion’ AONB where they join the existing Brogies Road and ultimately the A1.

5.5.6.3.1 Blue Route Option 1

Landscape Effects

The initial section of this route option is the same as for Blue Route Options 2 and 3. Beginning at a new at-grade roundabout on the A2 Warrenpoint Road east of the Greenbank Industrial Estate, the route rises up on an embankment located in the grounds of Newry Mitchels GAA Club before bridging across the Newry River, Newry Canal, LLPA NY 114, and Drumalane Road / B79 Fathom Line. The at-grade roundabout would result in minor adverse landscape effects. The significance of the landscape change is considered Slight, as the roundabout would integrate well into the existing road infrastructure. The introduction of embankments and a new bridge with a clearing of approximately 12m above the Newry Canal would result in moderate adverse landscape effects. The significance is considered Moderate to Large Adverse. The bridge would become a prominent new feature in the area. Considering its location within the urban and light industrial southern fringe of Newry, the development would integrate into its urban / light industrial context and would not detract considerably from the overall landscape character in the area.

West of the bridge, the route would be carried on an embankment entering a new roundabout south of Drumalane Quarry, which is located on the slopes of the western side of the Newry River valley. A new section of road continues from the roundabout to the north-west in a cut, linking to the existing Drumalane Road / B79 Fathom Line. The route to the south-east of the new roundabout follows the contours while cutting into the slopes of the western Newry River valley while avoiding the majority of woodland areas. The road would be on embankment with an increasing length of embankments facing east into the Newry River valley. On approach to Benson's Glen, the alignment curves to the south / south-west while still on embankment.

Apart from Drumalane Quarry, the overall landscape character continuing south along the western slopes of the Newry River valley improves in quality. The introduction of the route would result in moderate to major adverse changes to the landscape character, due to considerable cuts and embankments. However, Option 1 would have the least amount of embankments facing east towards the Newry River valley when compared to the Blue Route Options 2 and 3. The significance of landscape effects is considered Large Adverse. However, while visible across the river valley, the route would likely be able to be absorbed into the eastern slopes over time as mitigation planting matures along the embankments facing the valley. The development is also located in an area of transition between the sub-urban end of Newry and the rural and wooded parts of the valley. Additional road infrastructure would therefore not be totally uncharacteristic when seen in conjunction with the south-eastern environs of Newry.

The route would bridge across Benson's Glen and underpass Flagstaff Road before entering an upland valley, where it cuts into the higher contours of the southern slopes of the valley. The route continues to the north-west, partially cut and on embankment along the southern upland valley slopes before rising on an embankment towards the Dublin-Belfast railway line.

The bridging of Benson's Glen and routing through a currently rural upland valley would result in major landscape effects as the scale of the road would be an uncharacteristic element in this area and disrupt the natural flow of the valley. The significance is considered Very Large Adverse.

The route would bridge the Dublin-Belfast railway line, followed by a new at-grade roundabout at Brogies Road. The alignment would then follow a refurbished and widened Brogies Road south to a new at-grade roundabout immediately south of the existing Ellisholding Junction.

The route alignment, including the bridging of the railway line, would result in a minor change in landscape character. The existing prevalence of road and railway infrastructure including the adjacent A1 would be intensified. The significance is therefore considered Slight to Moderate Adverse.

Visual Effects

Visual effects would result from the embankment and bridge crossing the Newry River and Newry Canal. Depending on the quality of the architecture, the bridge would become a prominent feature and possibly a new landmark in the southern urban area of Newry in views along the river and canal to the south-east or north-west. Receptors would include residents, vehicle travellers, walkers and cyclists. Receptors (mainly residents of the area or visitors) located on elevated viewpoints on the western and eastern slopes of the Newry River valley, including from Fathom Mountain, would also clearly recognise the bridge development as a new and prominent feature, as well as a local focal point. The bridge would be seen from most viewpoints in the context of existing light industrial or suburban developments, or indeed with the city of Newry as a backdrop. The visual sensitivity for receptors in this area is considered moderate to low. The visual change is considered major. The significance is considered Large Adverse or Beneficial, depending on the final architectural design of the bridge.

The new roundabout and route alignment along the western slopes of the Newry River valley, as well as the crossing of Benson's Glen, would result in major visual effects due to the introduction of new infrastructural features in the view, which is likely to become a new focal point until mitigation planting would begin to screen the new embankments facing the river valley. The significance of visual effects is considered to be Large Adverse. The majority of visual receptors would be residents and vehicle travellers on the eastern slopes of the Newry River valley, opposite the route alignment. Existing screening vegetation and steep slopes on the western side of the river valley would limit views of the route between Benson's Glen and the bridge when travelling along the B79 Fathom Line. Visual effects are considered moderate. The significance is considered Moderate Adverse.

Visual effects in the upland valley between Benson's Glen and Brogies Road are considered to be major, as the route would introduce a new prominent feature and focal point. The significance is considered Large to Very Large Adverse in close distance views. Due to the isolated nature and undulating adjoining topography further north, significant visual effects in open views caused by the development are limited to passing traffic on Flagstaff Road and a small number of residential visual receptors in the vicinity of the valley. However, longer distance views would be experienced from properties located on the slopes of Cloghogue Mountain, resulting in minor visual effects. The significance is considered Slight Adverse.

The bridge crossing of the Dublin-Belfast railway line, the new at-grade roundabout at Brogies Road, and the online route alignment along Brogies Road further south and the new at-grade roundabout adjacent to the Ellisholding Junction is considered to result in minor to moderate visual effects. The significance is considered Slight to Moderate Adverse. Existing road infrastructure in available views would remain prevalent and become more prominent due to the introduction of the bridge structures across the railway line and the new roundabouts.

5.5.6.3.2 Blue Route Option 2

Landscape Effects

The initial section of this route option is the same as for Blue Route Options 1 and 3. Beginning at a new at-grade roundabout on the A2 Warrenpoint Road east of the Greenbank Industrial Estate, the route rises up on an embankment located in the grounds of Newry Mitchels GAA Club before bridging across the Newry River, Newry Canal, LLPA NY 114, and Drumalane Road / B79 Fathom Line. The at-grade roundabout would result in minor adverse landscape effects. The significance of the landscape change is considered Slight, as the roundabout would integrate well into the existing road infrastructure. The introduction of embankments and a new bridge with a clearing of approximately 12m above the Newry Canal would result in moderate adverse landscape effects. The significance is considered Moderate to Large Adverse. The bridge would become a prominent new feature in the area. Considering its location within the urban and light industrial southern fringe of Newry, the development would integrate into its urban / light industrial context and would not detract considerably from the overall landscape character in the area.

West of the bridge, the route would be carried on an embankment entering a new roundabout south of Drumalane Quarry and located on the slopes of the western side of the Newry River valley. A new section of road continues from the roundabout to the north-west in a cutting, linking to the existing Drumalane Road / B79 Fathom Line.

In contrast to Blue Route Option 1, the alignment of Option 2 to the south-east of the new roundabout would be located slightly more to the east and mainly on embankment. It would mostly avoid cutting into the slopes of the western side of the river valley. However, this would result in more earthworks and significantly larger embankments when compared to Route Option 1. On the approach to Benson's Glen, the alignment curves to the south / south-west while still on an embankment. In contrast to Route Option1, Option 2 bypasses the majority of Benson's Glen and cuts into the land along the northern slopes of Benson's Glen.

Apart from Drumalane Quarry, the overall landscape character continuing south along the western slopes of the Newry River valley improves in quality. The introduction of the route would result in major adverse changes to the landscape character due to considerable cuts and embankments. Option 1 would have the least amount of embankments facing east towards the Newry River valley when compared to Blue Route Options 2 and 3. The significance of landscape effects is considered Large Adverse. However, while visible across the river valley, the route would likely be able to be mostly absorbed into the eastern slopes over time as mitigation planting matures along the embankments facing the valley. The development is also located in an area of transition between the sub-urban end of Newry and the rural and wooded parts of the valley. Additional road infrastructure would therefore not be totally uncharacteristic when seen in conjunction with the south-eastern environs of Newry.

The route would underpass Flagstaff Road (which would be bridged at this location) before entering an upland valley, where it initially cuts into the lower contours of the valley before it continues on embankment towards the lower slopes of Fathom Mountain, where it cuts into the slopes while rising up and bridging across the Dublin-Belfast railway line.

The avoidance of the majority of Benson's Glen would be beneficial to the landscape character of the area. However, the routing through a currently rural upland valley would still result in major landscape effects as the scale of the road would be an uncharacteristic element in this area and disrupt the natural flow of the valley. The significance is considered Very Large Adverse.

The route would bridge the Dublin-Belfast railway line, followed by a new at-grade roundabout at Brogies Road, which is located slightly further south than Option 1. The alignment would then follow parallel to the existing Brogies Road before joining the existing Brogies Road, which would be widened before reaching the new at-grade roundabout immediately south of the existing Ellisholding Junction.

The route alignment, including the bridging of the railway line, would result in a minor-moderate change in landscape character. The existing prevalence of road infrastructure, including the adjacent A1, would be intensified. The significance is therefore considered Slight to Moderate Adverse.

Visual Effects

Visual effects would be the same for the initial section of all Blue Route options and would arise from the embankment and bridge crossing of the Newry River and Newry Canal. Depending on the quality of architecture, the bridge would become a prominent feature and possibly a new landmark in the southern urban area of Newry in views along the river and canal to the south-east or north-west. Receptors would include residents, vehicle travellers, walkers and cyclists. Receptors (mainly residents of the area or visitors) located on elevated viewpoints on the western and eastern slopes of the Newry River valley, including from Fathom Mountain, would also clearly recognise the bridge development as a new and prominent feature as well as a local focal point. However, the bridge would be seen from most viewpoints in the context of existing light industrial or suburban developments, or indeed with the city of Newry as a backdrop. The visual sensitivity for receptors in this area is considered moderate to low. The visual change is considered moderate to major. The significance is considered Large Adverse or Beneficial, depending on the final architectural design of the bridge.

The new roundabout and route alignment along the western slopes of the Newry River valley would result in major visual effects due to the introduction of a new road with large eastern embankments in views available, which is likely to become a new focal point until mitigation planting would begin to screen the new embankments facing the river valley. The significance of visual effects is considered to be Large Adverse. The majority of visual receptors would be residents and vehicle travellers on the eastern slopes of the Newry River valley, opposite the route alignment. Considering the proposed larger embankments along the western side of the river valley, visual effects would be higher for residences and travellers along the B79 Fathom Line.

Existing screening vegetation and steep slopes on the western side of the river valley would be less likely to limit views of the route alignment along the slopes between Benson's Glen and the proposed bridge when travelling along the B79 Fathom Line. Visual effects are considered moderate to major. The significance is considered Large Adverse.

Visual effects in the upland valley between Benson's Glen and Brogies Road are considered to be major, as the route would introduce a new prominent feature and focal point. The significance is considered Large to Very Large Adverse in close distance views. Due to the isolated nature and undulating adjoining topography further north, significant visual effects in open views caused by the development are limited to passing traffic on Flagstaff Road and a small number of residential visual receptors in the vicinity of the valley. However, longer distance views would be experienced from properties located on the slopes of Cloghogue Mountain, resulting in minor visual effects. The significance is considered Slight Adverse.

The bridge crossing of the Dublin-Belfast railway line, the new at-grade roundabout at Brogies Road, and the partially offline route alignment parallel to Brogies Road further south, and the new at-grade roundabout adjacent to the Ellisholding Junction is considered to result in moderate visual effects. The significance is considered Moderate Adverse. Existing road infrastructure in available views would remain prevalent and become more prominent due to the introduction of the bridge structures across the railway line and the new roundabouts.

5.5.6.3.3 Blue Route Option 3

Landscape Effects

The initial section of this route option is the same as for Blue Route Options 1 and 2. Beginning at a new at-grade roundabout on the A2 Warrenpoint Road east of the Greenbank Industrial Estate, the route rises up on an embankment located in the grounds of Newry Mitchels GAA Club before bridging across Newry River, Newry Canal, LLPA NY 114, and Drumalane Road / B79 Fathom Line. The at-grade roundabout would result in minor adverse landscape effects. The significance of the landscape change is considered Slight, as the roundabout would integrate well into the existing road infrastructure. The introduction of embankments and a new bridge with a clearing of approximately 12m above the Newry Canal would result in moderate adverse landscape effects. The significance is considered Moderate to Large Adverse. The bridge would become a prominent new feature in the area. Considering its location within the urban and light industrial southern fringe of Newry, the development would integrate into its urban / light industrial context and would not detract considerably from the overall landscape character in the area.

West of the bridge, the route would be carried on an embankment entering a new roundabout south of Drumalane Quarry and located on the slopes of the western side of the Newry River valley. A new section of road continues from the roundabout to the north-west in a cutting, linking to the existing Drumalane Road / B79 Fathom Line.

Route Option 3 to the south-east of the new roundabout would be located slightly more to the east than Route Option 1, and mainly on embankment. It would mostly avoid cutting into the slopes of the western side of the river valley. In slight contrast to Option 2, the road levels would be lower resulting therefore in slightly less earthworks and lower embankment heights when compared to Option 2. On approach to Benson's Glen, the alignment curves to the south / south-west while still on embankment. Almost identical to Option 2, it bypasses the majority of Benson's Glen and cuts into the land along the northern slopes of Benson's Glen.

Apart from Drumalane Quarry, the overall landscape character continuing south along the western slopes of the Newry River valley improves in quality. The introduction of the route would result in major adverse changes to the landscape character due to significant embankments. The significance of landscape effects is considered Large Adverse. Option 1 would have the least amount of embankments facing east towards the Newry River valley when compared to Blue Route Options 2 and 3. However, while visible across the river valley, the route alignment would likely be mostly absorbed into the eastern slopes over time as mitigation planting matures along the embankments facing the valley. The development is also located in an area of transition between the sub-urban end of Newry and the rural and wooded parts of the valley. Additional road infrastructure would therefore not be totally uncharacteristic when seen in conjunction with the south-eastern environs of Newry.

Similar to Option 2, the route would underpass Flagstaff Road (which would be bridged at this location) before entering an upland valley, where it initially cuts into the lower contours of the valley before it continues on embankment towards the lower slopes of Fathom Mountain, where it cuts into the slopes while rising up and bridging across the Dublin-Belfast railway line.

The avoidance of the majority of Benson's Glen would be beneficial to the landscape character of the area. However, the routing through a currently rural upland valley would still result in major landscape effects as the scale of the road would be an uncharacteristic element in this area and disrupt the natural flow of the valley. The significance is considered Very Large Adverse.

The route would bridge the Dublin-Belfast railway line, followed by a new at-grade roundabout at Brogies Road, which is located slightly further south than Option 1. The alignment would then follow parallel to the existing Brogies Road before joining the existing Brogies Road, which would be widened before reaching the new at-grade roundabout immediately south of the existing Ellisholding Junction.

The route alignment, including the bridging of the railway line, would result in a minor-moderate change in landscape character. The existing prevalence of road infrastructure including the adjacent A1 would be intensified. The significance is therefore considered Slight to Moderate Adverse.

Visual Effects

Visual effects would be the same for the initial section of all Blue Route options and would arise from the embankment and bridge crossing of the Newry River and Newry Canal. Depending on the quality of architecture, the bridge would become a prominent feature and possibly a new landmark in the southern urban area of Newry in views along the river and canal to the south-east or north-west. Receptors would include residents, vehicle travellers, walkers and cyclists. Receptors (mainly residents of the area or visitors) located on elevated viewpoints on the western and eastern slopes of the Newry River valley, including from Fathom Mountain, would also clearly recognise the bridge development as a new and prominent feature as well as a local focal point. However, the bridge would be seen from most viewpoints in the context of existing light industrial or suburban developments, or indeed with the city of Newry as a backdrop. The visual sensitivity for receptors in this area is considered moderate to low. The visual change is considered moderate to major. The significance is considered Large Adverse or Beneficial, depending on the final architectural design of the bridge.

The new roundabout and route alignment along the western slopes of the Newry River valley would result in major visual effects due to the introduction of a new road with large eastern embankments in views available, which is likely to become a new focal point until mitigation planting would begin to screen the new embankments facing the river valley. The significance of visual effects is considered to be Large Adverse. The majority of visual receptors would be residents and vehicle travellers on the eastern slopes of the Newry River valley, opposite the route alignment. Considering the proposed larger embankments along the western side of the river valley, visual effects would be higher for residences and travellers along the B79 Fathom Line.

Existing screening vegetation and steep slopes on the western side of the river valley would be less likely to limit views of the route alignment along the slopes between Benson’s Glen and the proposed bridge when travelling along the B79 Fathom Line. Visual effects are considered moderate to major. The significance is considered Large Adverse.

As with Option 2, visual effects in the upland valley between Benson’s Glen and Brogies Road are considered to be major, as the route would introduce a new prominent feature and focal point. The significance is considered Large to Very Large Adverse in close distance views. Due to the isolated nature and undulating adjoining topography further north, significant visual effects in open views caused by the development are limited to passing traffic on Flagstaff Road and a small number of residential visual receptors in the vicinity of the valley. However, longer distance views would be experienced from properties located on the slopes of Cloghogue Mountain resulting in minor visual effects. The significance is considered Slight Adverse.

The bridge crossing of the Dublin-Belfast railway line, the new at-grade roundabout at Brogies Road, and the partially offline route alignment parallel to Brogies Road further south, and the new at-grade roundabout adjacent to the Ellisholding Junction is considered to result in moderate visual effects. The significance is considered Moderate Adverse. Existing road infrastructure in available views would remain prevalent and become more prominent due to the introduction of the bridge structures across the railway line and the new roundabouts.

5.5.7 Mitigation & Enhancement Measures

Irrespective of which route option is ultimately selected as being the preferred route, potential mitigation measures to reduce the landscape and visual effects of the scheme should include:

- align route options to follow existing contours as close as possible to minimise earthworks, reduce the footprint of the land take, and avoid disruption to topography and vegetation of steep valley slopes;
- Avoid taking out existing mature tree and woodland features, prominent clusters and single stands and hedgerows along the route to retain natural screening of new road;
- Develop opportunities to enhance areas of poor quality landscape, giving special consideration to the ‘gateway effect’ to the south of Newry and the north/south link;
- Design new planting as an integral part of all infrastructure development, aiming to reinforce local landscape character, giving special consideration to landscape patterns, traditional stone, hedgerows and tree planting, to create a seamless fit with the surrounding landscape. Avoid linear corridors, provide screening, emphasise areas of broad-leaved woodland, retain and frame key views;

- Consider the design of the bridge structure across the Newry River / Canal as an integral and important architectural landmark and gateway, signifying the north/south link, creating a highly attractive feature in the landscape.

5.5.8 Presentation of Key Issues

The key issues associated with the five route options from a Landscape & Visual perspective are listed below.

- All route options require a bridge structure to traverse the river valley and any such structure is likely to have a Moderate to Very Large Adverse Landscape & Visual Effect within this valley. Whether this effect is adverse of beneficiary would be strongly influenced by the final architectural design of the bridge structure. The bridge would become a prominent new feature at all locations.
- The river valley bridge locations as proposed in the Red and Yellow Routes would likely divide the river valley into two parts
- The river valley bridge of the Red Route is the least favourable as it would cross the river valley at its widest point, resulting in maximum landscape and visual impact.
- The river valley bridge location of the Yellow Route would take advantage of a natural narrowing of the Newry River, resulting in a shorter bridge. While it would still divide the valley into two parts, it could be integrated better into the overall valley environs.
- The river bridge location of the Blue Route within Greenbank Industrial Estate would likely become a gateway / landmark between the city and the river valley further south-east due to its required higher clearing between the bridge and Newry River / Canal. Considering its location within the urban and light industrial southern fringe of Newry, the development would integrate into its urban / light industrial context and would not detract considerably from the overall character in the area.
- The Blue Route options are the shortest when compared to the Red and Yellow Routes. While all options would result in major landscape and visual effects along most of their alignments due to significant sections of cut and fill, the Blue Route options would have the highest potential to integrate into their environment as they are located in an area of transition between the sub-urban end of Newry and the rural and wooded parts of the river valley. Additional road infrastructure would therefore not be totally uncharacteristic when seen in conjunction with the south-eastern environs of Newry.
- Blue Route Option 1 would have the least amount of embankments facing east towards the Newry River valley when compared to Blue Route Options 2 and 3.
- The Red and Yellow Routes would require the removal of large areas of long-established woodland as well as sections of ancient woodland.
- The Blue Route options would avoid the majority of long-established woodland or cluster of mature trees along their alignment. No areas of ancient woodland would be affected.
- The Blue Route options would traverse the LLPA NY114 Newry Canal / River.
- On balance therefore, a Blue Route option which minimises woodland loss and minimises cut & fill earthworks would be preferred from a Landscape & Visual perspective.

5.6 Land Use

5.6.1 Introduction

The assessment of landtake for a road scheme can cover a wide range of land values and primary uses. Under guidelines laid down in the DMRB, the principal issues to be considered when assessing impacts upon land use are as follows:

- potential demolition of property;
- loss of private land;
- loss of development land;
- loss and severance of agricultural land (including forestry);
- loss of land used by the community (recreation and open space); and
- effects on restoration proposals for abandoned waterways.

Land containing archaeological remains, historic buildings or gardens is dealt with in Section 5.3 (Cultural Heritage). Land of ecological importance (including woodland) is dealt with in Section 5.4 (Ecology & Nature Conservation). In addition, Section 5.5 (Landscape & Visual Effects) considers the contribution of all land affected by the scheme to the landscape or townscape and identifies designated areas, such as Areas of Outstanding Natural Beauty (AONB) and Local Landscape Policy Areas (LLPA).

5.6.2 Methodology

The principal objective at this secondary stage is to undertake sufficient assessment to give a clearer indication as to the potential land type losses and demolition required by each approved route option under consideration, in order to assist in the selection of a preferred route.

5.6.2.1 Demolition of Private Property and Private Land Loss

Where properties need to be demolished for a scheme to be built, the environmental impact of their loss and associated landtake should be included in the assessment, in accordance with the requirements of DMRB Volume 11, Section 3, Part 6, Chapter 2 (Demolition of Private Property and associated Landtake). Demolition can give rise to a range of other effects including loss of facilities, loss of attractive buildings or townscape, or the opening of views for other properties previously screened. The assessment also covers the effects of private land loss (i.e. gardens, driveways, open space, brownfield land, hardstanding etc.), taken in part or in whole.

At this secondary stage, the approved route options are sufficiently developed to allow an approximate estimate of properties at risk of demolition and where areas of private land would be lost. This resulted in a broad assessment and statement of range of properties which might need to be demolished, or from which land might need to be taken, accompanied by relevant drawings.

5.6.2.2 Development Land and Planning Applications

The environmental assessment takes account of, as far as practicable, future changes in land use due to new development which would likely occur in the absence of the scheme. Hence, in accordance with the requirements of DMRB Volume 11, Section 3, Part 6, Chapter 5 (Effects on Development Land), the steps taken were broadly similar with those undertaken at Stage 1, taking account of refinement to the route options and/or changes in development policies and plans.

For the effect of the scheme on development land, the extant Banbridge / Newry & Mourne Area Plan 2015 was inspected. In essence, the route options were plotted on a map of land-use designations, identifying landtake from areas designated for potential future development and the degree of impact assessed. The same process was undertaken for planning applications. This resulted in a broad assessment and statement of how each route option might affect local planning applications and development designations, accompanied by relevant drawings.

5.6.2.3 Community Land

As required by DMRB Volume 11, Section 3, Part 6, Chapter 4 (Assessing the Loss of Land Used by the Community), Newry, Mourne and Down District Council (NMDDC) was again consulted to establish any relevant constraints or factors that should be taken into account from a community perspective. Land used by the public is considered as ‘common’ and includes, for example, land laid out as public open space, community woodland or other recreational areas.

An assessment of potential woodland loss throughout the study area is dealt with in Section 5.4 (Ecology & Nature Conservation) and Section 5.5 (Landscape & Visual Effects); however, as many woodlands are commonly utilised as recreational and open spaces, the impact of their loss is again considered in this section, where relevant.

5.6.2.4 Agricultural Land

Typically, there are four main areas that are addressed in the assessment of effects on agricultural land. These are landtake, type of husbandry, severance and major accommodation works for access, water supply and drainage. In accordance with DMRB Volume 11, Section 3, Part 6, Chapter 10 (Stages in the Assessment of Effects on Agricultural Land), the main requirement at this secondary stage is to check that information on agricultural land quality and statutory areas designated for their agricultural importance obtained at Stage 1 is still valid and identify overall likely losses and potential severance of agricultural land. In terms of areas used for forestry, overall likely losses and potential severance of woodland areas has again been assessed in a similar manner to the assessment of impact on agricultural land.

5.6.2.5 Waterways

In terms of waterway restoration projects (if any), it is essential to consider any waterways, formerly navigable watercourses or dry watercourses for which there are currently restoration proposals. The steps taken were to confirm that the information obtained at Stage 1 is still correct and consult with the relevant interested parties.

5.6.2.6 Assessing the Significance of Effects

With reference to DMRB Volume 11, Section 2, Part 5, Chapter 2 (Determining Significance of Environmental Effects), it is not sufficient to assess only 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 impact (change). In other words, significance criteria are used to report the effect of the impact. In terms of land use impacts, there may be a significant degree of ambiguity with regards to the non-monetary valuation of land and property, and the importance of its primary usage. Therefore significance criteria used to assess impacts is based on professional judgement and used loosely.

Firstly, to assess the overall significance of potential effects of the approved route options on land and property, an assessment has been made of the sensitivity of the resource and magnitude of potential impacts using the general criteria contained in Table 5.6.1 & Table 5.6.2 for guidance.

Table 5.6.1: Estimating the Importance of Land Uses

Importance	Criteria
High	Existing beneficial land uses (i.e. active property, private land associated with an active property, community lands and woodlands).
Medium	Areas designated for future usage with a developer interest (i.e. land-use planning policy designations contained within the area plan, access lanes, and farm outbuildings).
Low	Existing land uses of less beneficial nature (i.e. inactive property, private land associated with an inactive property) and without developer interest.

Table 5.6.2: Estimating the Magnitude of Impact on an Attribute

Importance	Criteria
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. Demolition of property. Landtake from property and/or

	severance which would preclude or significantly affect current or future use.
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements. Landtake from property which would moderately affect current or future use.
Minor	Some measurable change in attribute's quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Landtake from property which would slightly affect current or future use.
Negligible	Barely perceptible impact upon current or future use.

DMRB Volume 11, Section 3, Part 6 does not describe how the significance of effects should be scaled with regards to land-use. Therefore, Table 5.6.3 outlines a suggested means of estimating the significance of potential effects, based upon the magnitude of impact and sensitivity of the receptor. Professional judgement and awareness of the relative balance of importance between sensitivity and magnitude allows the overall significance of impact to be assessed. The significance of impact is assessed with mitigation to define residual impacts.

Table 5.6.3: Estimating the Significance of Potential Effects

IMPORTANCE OF ATTRIBUTE					
	High	Neutral	Moderate/Large	Large/Very Large	Very Large
	Medium	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Low	Neutral	Slight	Moderate	Large
		Negligible	Minor	Moderate	Major
		MAGNITUDE OF IMPACT			

Source: DMRB 11.2.5.2 (Arriving at the Significance of Effect Categories - adapted)

5.6.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. Table 5.6.4 outlines the responses from the Stage 2 consultation in relation to Land Use. Responses received from the Stage 1 consultation and/or those received separately as part of the feedback to the Community Consultation Event remain pertinent and valid to the overall assessment, unless otherwise indicated by the consultee.

Table 5.6.4: Summary of formal Stage 2 consultation responses in relation to Land Use

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Forest Service	09 Apr 2018	22 May 2018	Based on application of Forest Service policy for woodland removal, they have no objection to any route option. Forest Service note that woodland removal increases from the Blue Route Options (7.3 hectares) to the Red Route (37.3 hectares) to the Yellow Route (82.0 hectares). The loss of long- established woodland shown on the Blue, Red and Yellow Routes follows a similar trend with the greatest loss occurring on the Yellow Route and the least loss on the Blue Routes. Forest Service preference is for options that reduce woodland removal.
DfC – Regional Development Office (South Eastern Team)	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.

DfC – Regional Development Office (Southern Team)	09 Apr 2018 09 May 2018	15 May 2018	Nil response as the scheme is located in the jurisdiction of the DfC – Regional Development Office (South Eastern Team).
DfI – Planning Policy Division	09 Apr 2018 09 May 2018		Did not respond to the consultation.
DfI – Strategic Planning Division	09 Apr 2018 09 May 2018	24 May 2018	No comment to make on scheme development at this time. Happy to be contacted as scheme progresses.
Louth County Council (LCC)	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.
Inland Waterways Association of Ireland (IWAI)	10 Apr 2018	29 Apr 2018	IWAI consider that the preferred route should not impede access to Albert Basin for large vessels, irrespective of route choice. The clearance under any fixed bridge must be at least 37m. They note the difficulty in this and would suggest that there should be an opening span of at least the same width as the Victoria Lock. No route preference indicated as long as the above criteria are met. Also provided detailed supporting document.
Mourne, Gullion & Lecale Rural Development Partnership	09 Apr 2018 09 May 2018	10 May 2018	Stated that they will not be making any formal comment at this stage.
Mourne Heritage Trust	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.
National Trust	09 Apr 2018 09 May 2018	15 May 2018	Noted the approved route options appear to be significant distances from any National Trust properties. In this instance, they have no comment to make but requested to be kept informed at the next stage.
Newry Maritime Association	09 Apr 2018	23 April 2018	Stressed the importance of considering the impacts of the scheme upon those who would be most adversely affected by it. In terms of route preference, indicated that the Blue Route would be preferred, with regeneration aspects included in the budget from inception.
Newry & Mourne Enterprise Agency	10 Apr 2018	01 May 2018	Asserted the importance of the route option which is ultimately chosen facilitating the passing along Newry Canal of high masted vessels either under the bridge, over the canal or by way of the bridge being able to open. Local non-statutory plans have all envisioned the Albert Basin as a focal point for tourist activity, sports events, shopping and festivals, of which it is envisioned that the presence of such vessels would be a key feature of its success.
NMDDC – Chief Executive	09 Apr 2018 09 May 2018		Council issued a collective response.
NMDDC – Enterprise, Regeneration and Tourism (ERT)	09 Apr 2018 09 May 2018	18 May 2018	Whilst reiterating their support for the scheme, the ERT committee did not indicate a preferred route. They did however note they would require further details in relation to design elements such as potential for a lifting bridge and any implications of the chosen route on land use, with particular reference being made to the playing field at Gerry Brown Park.

			Noted that the scheme is a strategic project for the area and have included this as a potential infrastructure project within the Belfast Region City Deal.
NMDDC – Local Planning Office / Development Plan Team	09 Apr 2018 09 May 2018	18 May 2018	Plan Team is currently preparing the Local Development Plan (LDP) Preferred Routes Paper. Note the two variants of the Blue Route and have no comment to make in respect of these. Highlighted that the Blue Route options cross the Newry River and pass through an area of open space identified in the Banbridge, Newry and Mourne Area Plan 2015. Currently both the Strategic Planning Policy Statement for NI (SPPS) and Planning Policy Statement 8: Open Space, Sport and Outdoor Recreation (PPS8) Policy OS1 afford protection to existing areas of open space with a presumption against development that would result in their loss. However both policy documents allow for an exception to this presumption against development where the redevelopment would bring 'substantial community benefits that decisively outweigh the loss of open space.' LDP team, in bringing forward the Council's new Planning Policy on protection of Open Space, will be guided by the SPPS. At this stage in the LDP process, following a preliminary review of operational policy, the Plan team propose that existing policy as contained within PPS8 is carried forward in its current form with some clarification and changes to reflect the SPPS.
Newry Mitchels GAC	09 Apr 2018 09 May 2018	18 May 2018	Strongly object to the Blue Route options. In particular, they feel that the loss of Gerry Brown Park would leave children in the area and players in general without a playing field and at a serious disadvantage.
Northern Ireland Agricultural Producers' Association	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.
Northern Ireland Housing Executive	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.
Ulster Farmers' Union	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.
Warrenpoint Harbour Authority (WHA)	10 Apr 2018	17 Apr 2018	Confirmed that the Blue Route is still WHA's preferred route. Noted a concern regarding the 8% gradient on Blue Route Option 3, thus identifying Blue Route Options 1 & 2 as their preference. The chosen route should ensure that it is capable of allowing HGV vehicles to use the road safely and without hindrance.
Woodland Trust	09 Apr 2018	09 May 2018	Strongly object to the Red Route, Yellow Route and Blue Route Option 1 given their impact on the ancient and long-established woodlands along these. Loss, fragmentation or damage to the woodlands highlighted above would generate further concerns given the presence of some protected priority species such as the Red Squirrel and Pine Marten. The Woodland Trust considers the level of loss and damage to such a scarce resource wholly unacceptable and in

contravention to the Strategic Planning Policy Statement, given the biodiversity value associated with such sites. The Trust requests that alternative proposals which will not result in the loss and damage of ancient or long- established woodland are sought.

5.6.4 Regulatory & Policy Framework

5.6.4.1 The Regional Development Strategy 2035 'Building a Better Future'

In terms of policy framework, there is a hierarchy of policy and plans in Northern Ireland, pertinent to development of the scheme. The Regional Development Strategy (RDS) 2035 provides an overarching strategic planning framework to facilitate and guide the public and private sectors. It does not redefine other government departments' strategies, but complements them with a spatial perspective. The RDS is a key document within the planning system. It sets out strategic guidance which is used in the preparation of development plans, planning policy statements and urban regeneration initiatives. Although many objectives of the previous strategy (the RDS 2025) are still valid, this document now replaces it. Of the eight aims of the revised RDS, those of relevance from a land use perspective include:

- Support strong, sustainable growth for the benefit of all parts of Northern Ireland.

A growing regional economy will benefit from strong urban and rural areas. This needs a co-ordinated approach to the provision of services, jobs and infrastructure and a focus on co-operation between service providers. Balanced regional growth and tackling regional imbalance are critical issues for the region.

- Support our towns, villages and rural communities to maximise their potential.

Our rural areas including our towns and villages have a key role in supporting economic growth. They offer opportunities in terms of their potential for growth in new sectors, the provision of rural recreation and tourism, their attractiveness as places to invest, live and work, and their role as a reservoir of natural resources and highly valued landscapes.

The aims and visions of the RDS are implemented through Regional Guidance (RG), which applies to everywhere in the region and is presented under the three sustainable development themes of Economy, Society and Environment, and Spatial Framework Guidance (SFG), which is additional to the region-wide guidance and is tailored to each of the five elements of the Spatial Framework for this plan.

From a Land Use perspective, region-wide guidance provided by RG1 (ensure adequate supply of land to facilitate sustainable economic growth) recognises that to ensure Northern Ireland is well placed to accommodate growth in jobs and businesses, there should be an adequate and available supply of employment land. This includes:

- assessing the quality and viability of sites zoned for economic development uses in the area plans;
- protecting Zoned Land;
- promoting economic development opportunities across the Region; and
- providing a network of economic development opportunities.

5.6.4.2 Strategic Planning Policy Statement for Northern Ireland (SPPS) – September 2015

The importance of the RDS is underpinned by Article 5 of the Strategic Planning (Northern Ireland) Order 1999, which requires that all government departments have regard to the RDS in exercising any function in relation to development in Northern Ireland. In terms of the general functions with respect to development of land, a government department or council must also ensure that any such policy contained therein (including emerging development plans) must be in general conformity with the RDS as per the requirements of Article 1 of the Planning Act (Northern Ireland) 2011.

As such, a government department or council, in preparing planning policies and development plans, is at present required to ensure that these are in general conformity with the strategic objectives and policies set out in the RDS, subject to any need to take account of emerging trends which are relevant to government department's or council's responsibility to secure the orderly and consistent development of land.

The planning system has been reformed and restructured from a unitary system where all planning powers rested with the Department, to a new two-tier model of delivery whereby councils have primary responsibility for the implementation of the following key planning functions:

- local plan-making;
- development management (excluding regionally-significant applications); and
- planning enforcement.

The Department retains responsibility for regional planning policy, the determination of regionally-significant and called-in applications, and planning legislation. It also provides oversight, guidance for councils, governance and performance management functions.

The SPPS is a statement of the Department's policy on important planning matters that should be addressed across Northern Ireland. It reflects the Minister's expectations for delivery of the planning system. It has been agreed by the Northern Ireland Executive and it is judged to be in general conformity with the Regional Development Strategy 2035.

It has a statutory basis under Part 1 of the Planning Act (Northern Ireland) 2011 which requires the Department to formulate and co-ordinate policy for securing the orderly and consistent development of land and the planning of that development.

5.6.4.3 Transportation

As stated in the SPPS, the successful integration of transport and land use is fundamental to the objective of furthering sustainable development. Planning has a vital contributing role for improving connectivity and promoting more sustainable patterns of transport and travel.

The following strategic policy must be taken into account in the preparation of Local Development Plans (LDPs) and in the determination of planning applications.

The preparation of a LDP provides the opportunity to assess the transport needs, problems and opportunities within the plan area and to ensure that appropriate consideration is given to transportation issues in the allocation of land for future development, including appropriate integration between transport modes and land use.

LDPs should identify active travel networks and provide a range of infrastructure improvements to increase use of more sustainable modes. In particular, within urban areas, providing enhanced priority to pedestrians, cyclists and public transport and an appropriate level of parking provision which is properly managed, should assist in reducing the number of cars in our urban areas.

Pertinent to the Newry Southern Relief Road scheme, transportation issues to be addressed in the LDP should include:

- New Transport Schemes, Walking and Cycling: New transport schemes (including major proposals for road, rail and public transport provision, park and ride proposals and cycle / pedestrian networks) or planned improvements to the transport network should be identified in LDPs. The land required to facilitate such infrastructure provision needs to be afforded adequate protection from development likely to jeopardise its implementation.

5.6.4.4 Banbridge / Newry and Mourne Area Plan 2015

The Banbridge / Newry and Mourne Area Plan 2015 is the extant development plan for the study area prepared under the provisions of Part III of The Planning (NI) Order 1991 by the (then) DOE and comprises three volumes:

- Volume 1: Plan Strategy and Framework;
- Volume 2: Banbridge District Proposals; and
- Volume 3: Newry and Mourne District Proposals.

The purpose of the Plan is to inform the general public, statutory authorities, developers and other interested bodies of the policy framework and land use proposals that are used to guide development decisions within the Banbridge / Newry and Mourne Area over the Plan period 2000 - 2015. The Area Plan was adopted in October 2013.

The Plan is prepared within the context of the priorities of the Northern Ireland Executive as set out in the Programme for Government, taking into account European, National and Regional policies which have implications for the future pattern of development within the Banbridge / Newry & Mourne District. The RDS and the Regional Transportation Strategy (RTS), seek to take forward the Executive's objectives for transport in Northern Ireland. The Plan establishes policy guidelines within which more detailed development proposals can be determined. It assists public agencies (i.e. The Department for Infrastructure) in decisions concerning infrastructure improvements and also assists private developers in reaching their land use based decisions over the plan period. The strategies and policies in the RDS are material considerations which may take precedence over existing development plans. The weight to be afforded to the RDS, the development plan, and to any other material considerations will be a matter for judgement and may vary from case to case.

5.6.4.5 Local Development Plan

Newry, Mourne and Down District Council is responsible for the preparation of a development plan for the District and has commenced work on the Newry, Mourne and Down Local Development Plan (LDP). This new Plan will (when adopted) replace the existing development plan (the Banbridge / Newry and Mourne Area Plan 2015) in so far as it applies to the District.

The LDP will provide a 15-year plan framework to support economic and social needs in the District, in line with regional strategies and policies, while providing the delivery of sustainable development. The LDP will inform the general public, statutory authorities, developers and other interested bodies of the policy framework and land use proposals that will guide development decisions; and will be the primary consideration in the determination of planning applications for the development or use of land in the District.

The LDP will be prepared within the context of the Council's Corporate Plan and Community Plan. In providing a statutory link with the Community Plan, the LDP will include a spatial land use reflection of the Community Plan providing a vision of how places should change and what they will be like in the future.

5.6.4.6 Newry City Centre Masterplan (October 2011)

Newry City Centre Masterplan was prepared by the (then) Department for Social Development (DSD) in partnership with the (then) Newry & Mourne District Council to inform regeneration and development decisions relating to Newry, setting-out a range of proposals. It forms a key reference to all those with an interest in the future of the city, including local and central government departments, private businesses, the community and voluntary sectors, and members of the public.

A number of aims and objectives have been identified within the plan, which has been developed into a series of proposals for the city. These proposals (or projects) vary in nature, scale and the timeframe associated with their delivery within an approximate period of 10 - 15 years.

5.6.4.7 Warrenpoint Harbour Authority – Port Masterplan 2018 - 2043

The Port Masterplan has been prepared by Warrenpoint Harbour Authority to guide strategic development decisions over the next 25 years. The purpose of this Masterplan is to address the strategic challenges facing the Port, which includes economics (business climate and resultant market challenges), dredging requirements and cost, and access (in particular the Newry Southern Relief Road).

The Masterplan is supported by a technical report covering baseline data, a review of relevant statutory and environmental policy, trade growth forecasts, an economic impact statement, and an operational review of Port activities.

5.6.5 Baseline Environmental Conditions & Constraints

5.6.5.1 Existing Development

The origins of Newry date back to the 12th Century, when a Cistercian Abbey was founded to the east of the Newry (Clanrye) River in 1144 AD. Today, the city forms a local hub within South Down, occupying a strategic location on the Eastern Seaboard Corridor.

The development of Newry over time has been influenced by the layout of the existing A-Class and B-Class road network, which until late last century, took strategic traffic through the centre of the city. Residential developments predominantly contain the road corridors which radiate out from the city, with more suitable areas of land between these roads giving way to large parcels/clusters of residential development. The city centre naturally consists of mixed development comprising leisure and cultural facilities (including arts, entertainment and built sport facilities), community centres and meeting places (including places of worship, libraries), facilities for children, education facilities, healthcare facilities, service-orientated businesses and public transport facilities.

The study area is located to the south of Newry City within the steep-sided Newry River valley which separates the Ring of Gullion to the west from the Mourne Mountains to the east. The Newry River flows through the centre of the study area, providing a natural boundary between counties Down and Armagh. The topography of the area has resulted in the constraint of the city, particularly within the study area.

To the east of the river, the majority of existing development can be found within Greenbank Industrial Estate flanking the eastern bank of the river, before giving way to predominantly residential areas that have progressively developed off and along the Old Warrenpoint Road and up the eastern valley side. The existing A2 Warrenpoint Road dual carriageway separates the industrial area from the predominantly residential area.

To the south, the industrial area terminates at the rampart, which provides flood protection at times of high tide and forms part of the settlement limit of the city. To the south of the rampart, are the broad mudflats associated with the transitional reach of the Newry River. On the eastern side of the valley, the residential areas at Forest Hills give way to agricultural land, which is the predominant land use through to the Aghnamoira Road. To the south of this road, agricultural land gives way to a large forestry woodland plantation at Narrow Water Wood/Forest. The wood also includes an active quarry (Bigwood Quarry).

To the west of the Newry River and Ship Canal, the majority of existing development is parcels/clusters of residential housing which have developed off the B79 Fathom Line, Flagstaff Road, Drumalane Road and the A28 Dublin Road in areas of land which are favourable to such development. Otherwise, the terrain is difficult as the landform steeply rises on the western side of the Newry River valley. The predominant land use quickly becomes agricultural, intersected by a large quarry (Drumalane Quarry) and pockets of possibly ancient/long-established woodland. Within the southern portion of the study area, forestry woodland plantation becomes the predominant land use (Fathom Forest), covering most of the eastern slope of Fathom Mountain. On the ridge of the western valley side, the Flagstaff Road has resulted in a ribboning of intermittent rural dwellings located off it; though apart from this, the predominant land use through to the A1 Dublin Road remains agricultural.

5.6.5.2 Planning Applications

Initial research via the 'Public Access for Planning' website, has confirmed that there are several extant planning applications for various forms of development within the study area. This website contains the details of all planning applications from 04th August 1973. Plans, maps, drawings and other documents supporting a planning application, such as consultation responses, are however only available for planning applications received after 01st June 2010. This confirmed that there are several extant planning applications for various forms of development within the study area, at varying stages in the planning process (Figure 5.6.3).

These include reserved matters, full and outline applications, which have either been approved or are pending a decision. Some applications have been refused permission, withdrawn by the applicant, or have lapsed (expired) their planning permission and are therefore not a consideration within this section. It cannot be assumed that the land in which an expired application was to be located is currently approved for future development, because new applications will have to be submitted for these developments to go ahead and would be determined in accordance with the policies contained within the ‘development plan’ and other material planning considerations.

5.6.5.3 Development Land

As noted previously, for the assessment of impacts upon development land, reference was made to the Banbridge / Newry & Mourne Area Plan 2015 and the consultation response from the NMDDC Local Planning Office.

In terms of development land within the study area, the majority of zoned areas are located within the settlement development limit of the city. As indicated on Map no. 3/02a (Newry Settlement Map) of the Area Plan, the settlement development limit of Newry (NY 01) is drawn to protect the natural setting of the city while providing development opportunities in line with its role as a main hub and gateway. Newry City serves as a key service centre for an extensive rural hinterland, consisting of a mixture of land uses providing a wide range of employment, services and facilities for both local inhabitants and visitors.

Outwith the settlement development limit, designations are more intermittent and typically include Sites of Local Nature Conservation Importance (SLNCIs), and Local Landscape Policy Areas (LLPAs).

SLNCIs have been identified and proposed on the basis of their flora, fauna or earth science (geological) interest. They represent a range of habitat types, such as woodland, heath or lakes.

LLPAs are designated to safeguard areas of attractive local landscapes and areas of important natural heritage within the city and on the urban fringe, and protecting areas of open space. They have a combination of features that contribute to the environmental quality, integrity and character of the area.

5.6.5.4 Newry City Centre Masterplan (October 2011)

The Newry City Centre Masterplan sets out a range of city-wide proposals on:

- Newry’s Setting;
- The Newry Canal;
- The Newry Super Greenway;
- The Southern Relief Road;
- Arrival Experience;
- Freight Distribution Centre;
- City Centre Gateways; and
- Sustainability Initiatives.

With regards to the scheme, the plan notes that congestion levels in Newry City Centre are a major cause for concern and risk seriously stemming its ability to develop as a more prosperous city centre. The Masterplan states that the relief road will significantly relieve congestion by alleviating city centre streets through reduction in traffic flow, making the city centre safer and opening-up possibilities to allow streets to function better for pedestrians, as well as being of benefit to Warrenpoint Port and major city developments.

The plan also sets out a range of city-centre proposals, which include proposals on a River Weir, improved linkages, Albert Basin and the Canal Navigation.

As noted in the plan, the Clanrye (Newry) River flows from the foothills of the Mourne Mountains to Carlingford Lough. Being tidal, water levels fluctuate in the city centre, exposing its banks and making the water less visible from adjacent areas. It is therefore proposed within the Masterplan to maintain high water levels through the implementation of a weir. A location for this weir has not been indicated in the plan.

In terms of improved linkages, the Masterplan proposes a new street connection between Drumalane Road and the A2 Warrenpoint Road, crossing the canal and river via two new road bridges. It is expected that this link would help to dissipate traffic congestion experienced on Dublin Bridge, whilst opening-up the Quays and Albert Basin to new development opportunities. The proposed canal bridge would include a lifting mechanism, thereby allowing the passage of boats to the basin and canal. This proposal has no connection to the Newry Southern Relief Road scheme.

The Masterplan proposes that the Albert Basin is established as a flagship city quarter and whilst it is acknowledged that there is tension between more recent proposals for this area (i.e. city centre park), the Masterplan illustrates an indicative layout of this area (though this is not a blueprint for development). The Masterplan notes that the history of Newry and the Albert Basin is a precious commodity, particularly when the majority of original structures in this area have been lost. Re-development presents an opportunity to celebrate the history of this unusual site through retention of any remaining industrial artefacts and re-animation of the water through the construction of a marina and mooring facilities.

The plan also notes that re-opening the Newry Canal to boat traffic would provide a major boost to the tourism economy of Northern Ireland. In Newry, challenges are posed by the number of low bridges across the water body. This project in the plan would therefore involve the implementation of locks and swing bridges to enable the passage of craft through the city centre.

5.6.5.5 Warrenpoint Harbour Authority – Port Masterplan 2018 - 2043

Pursuance of the following project priorities shall deliver the Masterplan's core objectives:

- broaden regional / strategic access through delivery of the Newry Southern Relief Road;
- enhance marine access through an improved maintenance dredging regime;
- address limited storage space which has been identified as the main constraint within the Port's operational area; and
- progress acquisition of sites within the potential port footprint.

Objective 1 of the Masterplan is to 'Improve Transportation and Circulation to and within the Port', which will ultimately improve its ability to retain and attract customers. The priority project to facilitate this is the delivery of the Newry Southern Relief Road.

5.6.5.6 Agricultural Land

As stated in the Banbridge / Newry & Mourne Area Plan 2015, agriculture is the predominant land use within the Plan Area.

Agricultural land within the study area is dominated by a mix of semi-improved and improved grasslands, supporting a variety of enterprise and husbandry types, including beef and sheep farming. Leisure horses are also grazed within the study area. Some grass is cut for silage and haylage, but very little arable farming takes place in the vicinity.

As noted previously, the agricultural land within the study area is largely located between Forest Hills and the Aghnamoira Road on the eastern valley side, and within the central portion of the study area, between the A1 Dublin Road and Flagstaff Road/B79 Fathom Line on the western valley side.

5.6.5.7 Forestry

With reference to the Banbridge / Newry & Mourne Area Plan 2015, public and private woodlands extend to approximately 4700 hectares, approximately 3.4% of the plan area. State forestry operations are carried out by DAERA – Forest Service, with their managed woodlands extending to approximately 4187 hectares within the boundary of the (then) Newry and Mourne District area.

Forest Service operates two forest parks (used for commercial timber and public recreation) in the Newry area at Rostrevor and Slieve Gullion, together with a number of other minor recreation areas. The aims of Forest Service are: "to contribute to the economic development of the entire forestry sector in Northern Ireland, whilst at the same time promoting the sustainable management of forests for multiple use and conserving and enhancing the rural environment".

Based on the most recent consultation response (May 2018) from Forest Service, the study area includes land to which DAERA has legal title and land which DAERA manages under lease arrangements - known as Fathom Forest and Narrow Water Forest respectively (221 hectares within the main forest blocks). The area also includes privately owned woodland (11 hectares). Each of these wooded areas includes broadleaf, conifer, mixed broadleaf, mixed conifer and native woodland.

The consultation with Forest Service also identified the woodland type, ownership, number of blocks and total area of woodland (including non-Forest Service land) for the route options under consideration.

5.6.5.8 Community Land (Recreation and Open Space)

Provision of open space and recreation facilities throughout the study area is the statutory responsibility of NMDDC. Other agencies such as the Cloghogue Pitch & Putt, Down County Board, Newry Shamrocks GAC, Newry City AFC and Newry Mitchels GFC also provide and manage a variety of publicly-accessible recreation facilities and open space which the community can utilise within the study area.

With reference to the Area Plan, a number of major areas of existing open space have been designated within the study area, covering the following community/recreational facilities:

- Pairc Esler (Gaelic Athletic Association (GAA) stadium within Greenbank Industrial Estate and the home of Down Gaelic football and hurling teams and the Newry Shamrocks GAC);
- Newry Showgrounds (football stadium within Greenbank Industrial Estate and the home of Newry City AFC); and
- Gerry Brown Park (GAA ground within Greenbank Industrial Estate and the home of Newry Mitchels GFC).

Whilst smaller open spaces are generally not identified in such plans for reasons of scale, there is a range of other notable facilities within the study area providing recreational and open space benefits, such as Phase 1 of the newly opened Carlingford Lough Greenway, the Rampart Walk, Cloghogue Pitch & Putt, the playing fields at Drumalane Park, Newry Bowling Green, Newry Tennis Club and Victoria Lock amenity & picnic site.

In terms of community woodlands, consultation with Woodland Trust did not identify woodland sites which the Trust operates within the study area. They did however identify a number of long-established and ancient woodlands within the study area. These include:

- WT896 (Ancient woodland, Grid Ref: J099222, 2ha);
- WT895 (Long-established woodland, Grid Ref: J107205, 77ha);
- WT907 (Long-established woodland, Grid Ref: J113208, 68ha);
- WT940 (Long-established woodland, Grid Ref: J094229, 1ha); and
- WT943 (Long-established woodland, Grid Ref: J093233, 1ha).

Whilst it is not known whether these woodlands serve as valuable areas of recreation and open space, they are of significant conservation value, largely based on age, rarity and biodiversity.

Identified by DAERA - Forest Service within their consultation response, the study area contains a number of small woodland parcels including in the vicinity of Forest Hills, Highfields Close, Dublin Road and Barracric Road. As discussed previously, larger parcels of woodland are identified at Fathom Line (Fathom Forest), Warrenpoint Road/Greenan Road, and at Narrow Water Wood/Forest, and currently subject to forestry. There are wayleaves and tracks through Fathom Forest, and members of the public are free to view the forest on foot, when it is safe to do so (i.e. when no forest operations are being undertaken). Narrow Water Wood/Forest is also known to be extensively utilised by the public for walking, mountain biking, etc., even though Forest Service do not allow public access to it.

5.6.5.9 Waterway Restoration Schemes

The Newry Ship Canal was originally completed in 1769, with Victoria Lock (three miles south of Newry) being subsequently completed in 1850, giving the Ship Canal its present form. The completion of the new sea lock (Victoria Lock) allowed Newry to increase its ship-handling ability. A variety of sea-faring vessels utilised the canal, from tall ships to steam collier fleets, passenger ships to tankers. However, due to canal restrictions and increasing ship size, the last commercial ship sailed along it in 1974. As the ship canal's future looked uncertain, the (then) Newry & Mourne District Council took control of the waterway and overhauled Victoria Lock allowing the passenger vessel, M. V. Balmoral, to berth in Albert Basin in 1994 and again most recently in 2007, and the Asgard II (Ireland's tallest tall ship) in 1999, amongst many others (e.g. the Soteria tall ship associated with the *Iur Cinn Fleadh* festival in recent years).

As recently as 2015, refurbishment works were undertaken on Victoria Lock, which included dredging of the lock chamber and repairs to the sea gates. At commencement of this refurbishment scheme, the Council noted that refurbishment works reflected their commitment to protect the unique built heritage that is Newry Canal and to maintain an important recreational and tourist facility in the Council District.

Previous consultation with the Council has indicated that they are aiming to attract more boating activity on the Ship Canal. The Canal infrastructure has been enhanced in recent years, through the help of Interreg funding. A condition of this funding is that the Council must attract a minimum of 90 vessels through Victoria Lock each year, from motor cruisers to tall ships. Consequently, continued access to the ship canal should be retained from Victoria Lock/Narrow Water to Albert Basin. The automation of the Lock Gates at Victoria Lock in 2007 has enabled the increased use of the ship canal by leisure craft and the installation of navigational buoys in the Newry River from Narrow Water to Victoria Lock, has helped provide safe navigation for vessels.

5.6.6 Assessment of Environmental Impacts

5.6.6.1 Demolition of Private Property and associated Landtake

Considering the location of the study area within the southern urban fringe of Newry and surrounding rural hinterland, it is inevitable that there would be cases where properties would be affected in terms of demolition and associated landtake, due to the scattered nature of development and the complexity of achieving current road design standards within an area of significant topographical constraint.

A detailed schedule of properties at risk of demolition with the options under consideration is contained within Table 5.6.5 and shown on Figure 5.6.1. This table contains information on property types potentially affected by respective route options, location and reason for expected loss.

The demolition of any property is assessed as being a ‘Major’ impact; though the significance of effect is dependent upon a combination of the property’s importance (determined by current usage and type) and magnitude of impact.

It is envisaged as the scheme design develops, landtake where feasible would be minimised, particularly as a clearer understanding of the underlying ground conditions during the detailed design stage may result in less extensive earthworks, and thus possibly reduced impact at certain properties. It may also equally result in the opposite, as poor ground conditions may require more extensive earthworks, and as the scheme is considered in line with relevant road design standards, there remains the possibility that additional properties could be affected (directly or indirectly) based on certain variations to horizontal or vertical geometry requirements of the preferred route (once selected).

Table 5.6.5: Properties at risk of demolition and associated landtake

Plot No.	Property Type	Property Description	Location	Route Option	Predicted Impact
D1	Commercial	Former bar/lounge in state of disrepair / dereliction	[redacted]	Yellow Route	Directly affected by the partial realignment of Fathom Line to tie-in to the new roundabout.
D2	Residential	Two-storey dwelling with garage	[redacted]	Red Route	Directly affected by the earthworks (embankment) associated with the mainline.
D3	Residential	Single-storey dwelling	[redacted]	Red Route	Directly affected by the earthworks (embankment) associated with the mainline.
D4	Residential	One & a half storey dwelling	[redacted]	Yellow Route	Directly affected by the earthworks (embankment) associated with the mainline.

D5	Community (recreational)	3 pre-fabricated modular changing / club units	Gerry Brown Park, Ballinacraig Way	Blue Route (all options)	Link to A2 Warrenpoint Road would result in the direct loss of the playing field and consequently the loss of the units.
D6	Residential	Two-storey dwelling with garage	[redacted]	Blue Route (all options)	Directly affected by the earthworks (embankment) associated with the bridge abutment on the western valley side.
D7	Commercial (agricultural)	Derelict farm outbuilding	[redacted]	Blue Route Option 1	Directly affected by the earthworks (embankment) associated with the mainline.
D8	Residential	Two-storey dwelling with garage	[redacted]	Blue Route (all options)	Directly affected by the earthworks (embankment) associated with the mainline.
D9	Residential	Single-storey dwelling with garage and outbuilding	[redacted]	Red & Yellow Route	Severance of access to this property as a result of the stopping-up of Barracric Road would likely result in its loss.
D10	Commercial	Large outbuilding	[redacted]	All Routes	Directly affected by the mainline.
D11	Residential	One & a half storey dwelling with outbuildings, mobile homes, etc.	[redacted]	All Routes	Severance of access to this property as a result of improvements to Ellisholding Junction would likely result in its loss.
D12	Residential	Single-storey dwelling with garage and outbuilding	[redacted]	All Routes	Severance of access to this property as a result of improvements to Ellisholding Junction would likely result in its loss.
D13	Residential	Derelict Farm Cottage with outbuildings	[redacted]	All Routes	Partial realignment of Upper Fathom Road would result in the loss of the main outbuilding.

As detailed in Table 5.6.5 and summarised below, there is very little to differentiate between the route options to aid in the selection of a preferred route from a demolition perspective.

5.6.6.1.1 Red Route

With reference to Table 5.6.5, the Red Route would result in a total of seven properties being at risk of demolition. This includes six residential properties (D2, D3, D9, D11, D12 and D13) and one commercial property (D10).

Two of the residential properties (D2, D3) are located on Fathom Line and would be affected by the extensive earthworks required to facilitate construction of the Red Route on the lower slopes of Fathom Mountain.

A residential property (D9) located on Barracric Road would be subject to access severance which would result in the loss of the property. It may however be possible that some form of accommodation works could be developed to provide a separate access but it is likely that the associated cost and impact would outweigh the residual value and viability of the property. This aspect would however be given further consideration at a more detailed design stage if the route is preferred.

The remaining properties at risk of demolition with the Red Route include two residential properties (D11, D12) on Ellisholding Road (east and west of the A1 Ellisholding Junction respectively), a derelict residential property (former farm) on Upper Fathom Road (D13) and a commercial property (D10) on the old Dublin Road. Similar to above, the residential properties on Ellisholding Road would be subject to access severance, with the associated cost and impact of providing accommodation works likely outweighing the residual value and viability of the properties. The commercial property would be subject to direct impact in order to accommodate the mainline and the derelict farm cottage would lose it main outbuilding to accommodate partial realignment of Upper Fathom Road.

5.6.6.1.2 Yellow Route

With reference to Table 5.6.5, the Yellow Route would also result in a total of seven properties being at risk of demolition. This includes five residential properties (D4, D9, D11, D12 and D13) and two commercial properties (D1, D10).

Two properties would be at risk of demolition on Fathom Line. This includes a commercial property (D1) that would be lost as a result of the partial realignment of this road in order to accommodate the tie-in with the new roundabout at the bridge crossing, and a residential property (D4) which would be affected by the extensive earthworks required to facilitate construction of the Yellow Route on the lower slopes of Fathom Mountain.

The Yellow Route would affect properties D9, D10, D11, D12 and D13 in a manner similar to that described above for the Red Route.

5.6.6.1.3 Blue Route

With reference to Table 5.6.5, Blue Route Options 2 & 3 would result in a total of seven properties being at risk of demolition. This includes five residential properties (D6, D8, D11, D12 and D13), one community property (D5) and one commercial property (D10). Blue Route Option 1 would also affect these same properties, and in addition directly affect an agricultural property (D7) which has fallen into a state of dereliction. On this basis, there is little to separate the Blue Route options in terms of property demolition.

Where the Blue Route crosses the valley floor, it would directly affect Gerry Brown Park, the home of Newry Mitchels GFC. Whilst the route would not directly affect the associated pre-fabricated modular changing / club units (D5), it would render redundant the continued use of this community facility, and thus the loss of these buildings would be inevitable.

On the Fathom Line, one residential property (D6) would be at risk of demolition to accommodate the abutments associated with the bridge crossing. On Barracric Road, a residential property (D8) would be lost to accommodate earthworks associated with the mainline of each of the options under consideration.

The Blue Route options would affect properties D10, D11, D12 and D13 in a manner similar to that described above for the Red and Yellow Route.

5.6.6.2 Potential Private Land Loss (non-agricultural)

There would also inevitably be cases where although there would be no demolition expected, properties would be affected in terms of private land loss (e.g. hardstanding, driveway, garden etc.), to accommodate any of route options under consideration. This assessment focuses specifically on land that is not in agricultural use, however does consider impacts on private land at farmhouses and their accesses, which is deemed as not necessarily being exclusively in agricultural usage and potentially entirely separate from farm operations.

For the purposes of assessment, the description of affected private land is of necessity generalised, and for those properties that may be subject to a Compulsory Purchase Order (‘Vesting Order’), in no way does it attempt to imply land value or rating.

Even though each plot detailed in Table 5.6.6 is at risk of direct private land loss, not all land would necessarily be vested by way of a Compulsory Purchase Order. In a number of cases, accommodation works such as access realignments and/or re-grading would be completed by agreement with the private landowner, with the affected parcel of land remaining in their ownership. Moreover, the Magnitude of Impact within a particular land holding may in reality not be as significant as that described below; particularly where it is predicted that land would be lost to accommodate earthworks.

A schedule consisting of Plot Number, Property Type, Property Description, Location, Route Option and Predicted Impact has been prepared and shown in Table 5.5.6. The relevant locations are also illustrated on Figure 5.6.2.

Table 5.6.6: Properties at risk of private land loss

Plot No.	Property Type	Property Description	Location	Route Option	Predicted Impact
PL1	Community	Amenity and Picnic Site	Victoria Lock	Yellow Route	Improvements required to Fathom Line may result in loss of land/fenceline adjacent to the road. Impact is likely to be minor.
PL2	Residential	Three-storey dwelling	[redacted]	Yellow Route	Improvements required to Fathom Line may result in loss of land from the access to this property. Impact is likely to be minor.
PL3	Residential	Two-storey dwelling with garage	[redacted]	Yellow Route	Improvements required to Fathom Line may result in loss of garden from this property. Impact is likely to be minor.
PL4	Residential	Single-storey dwelling with garage	[redacted]	Blue Route (all options)	Roundabout tie-in with the A2 Warrenpoint Road would likely result in encroachment into the rear garden. Impact likely to be moderate.
PL5	Residential	Two-storey dwelling	[redacted]	Blue Route Options 2 & 3	The earthworks associated with Blue Route Option 2 and to a lesser extent with Option 3 would encroach into the property, resulting in severance of the access and loss of private land from the property's extensive grounds. Impact would be moderate as it is expected that the associated cost and impact of providing accommodation would not outweigh the residual value and viability of the property. It is also not expected that landtake from the property and severance would not preclude or significantly affect current or future use.
PL6	Residential	Single-storey dwelling with garage	[redacted]	Blue Route (all options)	The tie-in of all Blue Route options would encroach into the access and front garden of the property however would cause no severance. The impact would be minor.
PL7	Residential	Single-storey dwelling (cottage)	[redacted]	All Routes	The alignment of each route along the old Dublin Road would encroach into the access and front garden of the property, however would cause no severance. Generally the impact would be minor; however, the Yellow Route would result in the greatest amount of land loss of all the routes under consideration.
PL8	Residential	One and a half storey dwelling with garage	[redacted]	All Routes	The alignment of each route along the old Dublin Road would encroach into the access and front garden of the property, however would cause no severance. Generally the impact would be minor; however, the Yellow

					Route would result in the greatest amount of land loss of all the routes under consideration.
PL9	Residential	Single-storey dwelling with outbuilding	[redacted]	All Routes	The alignment of each route along the old Dublin Road would encroach into the access and front garden of the property, however would cause no severance. Generally the impact would be minor; however, the Yellow Route would result in the greatest amount of land loss of all the routes under consideration.
PL10	Residential	Single-storey dwelling with garage	[redacted]	All Routes	The partial realignment and upgrading of Upper Fathom Road would encroach into the access and front garden of the property, however would cause no severance. Impact would be minor.
PL11	Residential	Single-storey dwelling with garage	[redacted]	All Routes	The partial realignment and upgrading of Ellisholding Road would encroach into the access and front garden of the property, however would cause no severance. Impact would be minor.

As detailed in Table 5.6.6, the Red Route would minimise the number of properties at risk of private land loss with five residential properties potentially affected, all being subject to minor impacts. In fact, all properties affected by the Red Route would be affected by all other options in a similar manner.

The Yellow Route would result in the potential loss of private land from eight properties in total (seven residential and one community). Overall, the impact on these properties is expected to be minor.

Blue Route Option 1 would result in the potential loss of private land from seven properties in total (all residential), with all except one of these being subject to minor impacts. One property (PL4 - [redacted]) would likely be subject to a moderate adverse impact as a result of loss of land from its rear garden to accommodate the roundabout tie-in with the A2 Warrenpoint Road.

Blue Route Options 2 & 3 would result in the potential loss of private land from eight properties in total (all residential). In addition to having the same impact upon the properties that would be adversely by Blue Route Option 1, they would also have a moderate adverse impact upon a residential property at [redacted] (PL5). The earthworks associated with Blue Route Option 2, and to a lesser extent with Option 3, would encroach into the property resulting in severance of the access and loss of private land from the property’s extensive grounds.

On this basis, Blue Route Option 2 and to a lesser an extent Blue Route Option 3 would have marginally the greatest impact upon private land loss of all the routes under consideration.

All route options would also have a number of other non-agricultural land loss impacts, such as loss of access lanes which may serve purposes other than just agricultural access. This includes an access lane along the northern side of Benson’s Glen which would be affected by the Blue Route. Of particular note however, a mainline crossing of the Belfast/Dublin railway line is required for all routes which would result in private land loss impacts. The railway line is dual track at this location but the length of the bridge would vary considerably between routes due to the proposed skew. A number of Translink requirements will also need to be considered during the route assessment, such as the lateral clearance to eliminate the abutment design for derailment loading and vertical clearance for future proofing for new overhead line equipment. The proposed structure would be fully integral (if possible <30° skew) which reduces the requirements for inspection and maintenance which is important as rail possessions would be required to carry out these routine inspections/maintenance works.

5.6.6.3 Potential Effect on Planning Applications

As noted previously, research via the ‘Public Access for Planning’ website in April 2018 confirmed that there are several extant planning applications for various forms of development within the study area that may be directly affected by the route options under consideration.

Considering the location of the study area within the southern urban fringe of Newry and surrounding hinterland, it is inevitable that there would be cases where approved or pending planning applications may be directly affected, with potential for either the complete loss of an application or marginal infringement on a development site.

The assessment of potential effects on planning applications focuses specifically on direct physical impact upon proposed development sites, in order to establish whether any of the route options under consideration would preclude or restrict development potential. With reference to Figure 5.6.3 and Table 5.6.7, it is expected at this stage that only eight applications of any particular significance would experience direct impacts associated with the route options, the majority of which would be affected equally by all routes.

Table 5.6.7: Planning applications at risk of direct impacts

Planning Ref:	Location	Proposal	Status	Route Option	Predicted Impact
LA07/2016/0501/F	Road crossing approximately 185m north-west of entrance to Victoria Lock, Fathom Line.	Pedestrian crossing the Fathom Line public road to connect Newry Canal "Greenway" and Victoria Lock to Fathom Forest.	Approved	Yellow Route	Improvement required to Fathom Line would directly affect the crossing point. Whilst a new crossing point would likely be accommodated, the road would be more heavily trafficked.
P/2010/0047/O	[redacted].	Proposed change of use from existing agricultural lands to lands for the use of outdoor pursuits	Refused	Blue Route (All Options)	All Blue Route options directly affect the application site, though Option 1 would cause significant severance if the application had been approved.
P/2013/0677/O	[redacted]	Site for dwelling	Refused (subject to appeal)	Yellow & Red Route	Directly affected by the earthworks (embankment) associated with the mainline.
LA07/2015/0881/O	[redacted]	Site for dwelling and garage	Withdrawn	All Routes	New Ellisholding Junction roundabout and associated legs would encroach significantly into the site.
LA07/2017/1737/F	[redacted]	Replacement dwelling & detached garage with new landscaping and associated site works.	Pending	All Routes	The partial realignment and upgrading of Upper Fathom Road would encroach into the access and front garden of the development site, however would cause no severance. Impact would be minor and not preclude the development of the site.
P/2011/0484/O	[redacted]	Site for dwelling	Refused	All	The partial realignment and

	[redacted]	and garage		Routes	upgrading of Ellisholding Road would encroach into the access and front garden of the development site, however would cause no severance. Impact would be minor and not preclude the development of the site.
P/2010/0453/F P/2013/0550/F	[redacted]	Proposal of a new dwelling and removal of existing dwelling - Replacement Dwelling	Approved	All Routes	The partial realignment and upgrading of Ellisholding Road would encroach into the access and front garden of the development site, however would cause no severance. Impact would be minor and not preclude the development of the site.
P/2015/0122/O	[redacted]	Farm Dwelling and garage with retention of existing agricultural building	Approved	All Routes	The partial realignment and upgrading of Ellisholding Road would encroach into the access and front garden of the development site, however would cause no severance. Impact would be minor and not preclude the development of the site.

As detailed in Table 5.6.7 and summarised below, there is very little to differentiate between the route options to aid in the selection of a preferred route from a planning application perspective. The type of planning applications at risk of being directly affected by the route options typically include:

- Sites for new dwellings;
- Sites for replacement dwellings; and
- Improvements to existing dwellings.

5.6.6.4 Potential Loss of Development Land

5.6.6.4.1 Red Route

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 5.6.4), the Red Route would not encroach into the settlement development limit of Newry, nor would it affect any areas of zoned land.

On the eastern valley side, the Red Route would marginally encroach into Narrow Water Forest SLNCI, but would cause no severance.

On the lower slopes of Fathom Mountain, the Red Route would encroach into and sever the most southerly (and by far the largest) of the three parcels associated with Fathom Lower Woods & Grasslands SLNCI. This would result in significant losses from this zoned area and a significant impact upon its nature conservation, setting and amenity value.

5.6.6.4.2 Yellow Route

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 5.6.4), the Yellow Route (as with the Red Route) would not encroach into the settlement development limit of Newry, nor would it affect any areas of zoned land.

On the eastern valley side, the Yellow Route would marginally encroach into Narrow Water Forest SLNCI, but would cause no severance.

On the lower slopes of Fathom Mountain, the Yellow Route would encroach into and sever the most southerly (and by far the largest) of the three parcels associated with Fathom Lower Woods & Grasslands SLNCI. This would result in significant losses from this zoned area and a significant impact upon its nature conservation, setting and amenity value.

5.6.6.4.3 Blue Route

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 5.6.4), the Blue Route would be within the settlement development limit of Newry from its tie-in with the A2 dual carriageway through to the eastern bank of the Newry River. Within this area, it would encroach into a major area of existing open space (associated with Gerry Brown Park) effectively resulting in its loss and functionality from a community/recreational perspective.

Although the Blue Route would effectively split an existing area of economic development associated with Greenbank Industrial Estate, it would result in no loss of land from this zoned area. Whilst this would create new severance for the existing area of economic development and an area of land zoned for future economic development to the south of the Blue Route, it is envisaged that access could be facilitated which would likely provide improved connectivity to the strategic road network for the existing and future businesses served by this area. The resolution of access would have to be established through more detailed design and consultation with affected parties if this route is preferred.

At the crossing of the Newry River and Canal, the bridge structure associated with the Blue Route would directly affect the Newry Canal/River LLPA (NY 114). Whilst the bridge would not result in severance, it would have a significant impact upon setting and amenity value.

On the climb up the western valley side, Blue Route Option 1 would marginally encroach into the most northerly of the three parcels associated with Fathom Lower Woods & Grasslands SLNCI. It is envisaged that Blue Route Options 2 & 3 would avoid direct encroachment into this portion of the SLNCI.

Furthermore, Blue Route Option 1 would encroach into and sever the central parcel of this SLNCI. This would result in significant losses from this zoned area and a significant impact upon its nature conservation, setting and amenity value. It is envisaged that Blue Route Options 2 & 3 would avoid direct encroachment into this portion of the SLNCI.

5.6.6.5 Potential Loss of Agricultural Land

As with any major road scheme, agricultural land would inevitably be lost to accommodate the infrastructural development, thus potentially having considerable impact on farm businesses traversed. To this end, expanses of agricultural land, of varying quality would be traversed south of Newry, largely on the eastern and western slopes of the Newry River valley. For any of the route options under consideration, it could reasonably be anticipated that farm units would be impacted, having a subsequent knock-on effect on their overall farm operations.

In terms of land currently in agricultural usage that would be lost to the scheme, there is very little to differentiate between route options under consideration. A broad estimate of the length of route option that would affect land currently in agricultural usage is provided below:

- Red Route – 1.8km;
- Yellow Route – 1.8km; and
- Blue Route (all options) – 1.9km.

Whilst it would naturally be expected that the Yellow and Red Routes would have the greater impact upon agricultural land considering their length and more rural location than the Blue Route, this is not the case due to the influence of forestry activities within the study area (as discussed below). On this basis, there is very little to differentiate between all route options from an agricultural perspective.

5.6.6.6 Potential Loss of Forestry and Non-Forestry Woodland

DAERA – Forest Service policy on proposals for woodland removal in the course of planned development is to:

- Seek to avoid removal of woodland within the planning application area, other than the area required for construction and ancillary works unless there are overriding environmental considerations such as the opportunity to restore priority habitats;
- Seek woodland regeneration where clear-felling (as opposed to woodland removal) is permitted within the planning application area in keeping with good forestry practice;
- Ensure that the views of the local community are represented in any decision.

Based on applying this policy, Forest Service has no objection to any route option. They note however that woodland removal increases (as detailed further below) from the Blue Routes [7.3 hectares] to the Red Route (37.3 hectares) to the Yellow Route (82.0 hectares) in both total woodland area and long-established woodland. It is therefore the preference of Forest Service for options that reduce woodland removal.

5.6.6.6.1 Red Route

With reference to the DAERA – Forest Service consultation response, the Red Route would have similar impacts as the Yellow Route to both Narrow Water Forest and Fathom Forest resulting in the loss of productive forest at the location of the roundabouts either side of the proposed bridge crossing.

Whilst the Red Route would enter Fathom Forest further north than the Yellow Route, consequently resulting in less woodland loss, the impacts would still be similar to those described for the Yellow Route, with approximately 68 hectares of woodland remaining with route implementation.

5.6.6.6.2 Yellow Route

With reference to the DAERA – Forest Service consultation response, the Yellow Route would necessitate the loss of productive forest at the location of the roundabouts either side of the proposed bridge crossing in Narrow Water Forest and Fathom Forest. Where the route enters the Fathom Forest near Victoria Lock, it would entirely result in the loss of productive forest through to the exit point near Benson's Glen.

Forest Service also has an access road across the middle of Fathom Forest and this would be lost due to the alignment of the Yellow Route. There are also access implications throughout the remainder of the forest due to severance and encroachment into other internal access lanes. This may result in significant detrimental impact on the ability to carry out potential harvesting interventions in future due to steep terrain conditions.

The remnant area within the forest block at Fathom (32 hectares) would be very complex and difficult to manage. Forest road access would be severely restricted or lost entirely and along with increased harvesting and operational costs, there is a reduction of commercially productive forest area and heightened safety risks from slope instability. The overall effect would be to reduce forest land that currently provides a wide range of ecosystem services, including: timber, access, landscape improvement and habitat for priority or protected species including red squirrels and badgers.

5.6.6.6.3 Blue Route

With reference to the DAERA – Forest Service consultation response, it is estimated that the Blue Route (all options) would result in the loss of 7.3 hectares of non-Forest Service woodlands (including 4 hectares of long-established woodlands protected by Planning Policy Statement 2). The Blue Route (all options) however, would have no impact on Departmental managed Fathom or Narrow Water Forests; therefore, no additional issues arise with regard to future operational management of these forests.

5.6.6.7 Potential Loss of Community Land (Recreation and Open Space)

5.6.6.7.1 Community Land

With reference to the Banbridge / Newry & Mourne Area Plan 2015 and as shown on Figure 5.6.4, a number of major areas of existing open space have been designated within the study area, covering the following community/recreational facilities:

- Pairc Esler (Gaelic Athletic Association (GAA) stadium within Greenbank Industrial Estate and the home of Down Gaelic football and hurling teams and the Newry Shamrocks GAC);

- Newry Showgrounds (football stadium within Greenbank Industrial Estate and the home of Newry City AFC); and
- Gerry Brown Park (GAA ground within Greenbank Industrial Estate and the home of Newry Mitchels GFC).

None of these areas would be affected by the Red or Yellow Routes. The Blue Route (all options) would however encroach into the major area of existing open space associated with Gerry Brown Park, effectively resulting in its loss and functionality from a community/recreational perspective.

5.6.6.7.2 Community Woodlands

As noted previously, consultation with the Woodland Trust indicated their mandate is to ensure there is no loss of long-established or ancient woodland and whilst they are not opposed to progress/development, they would lobby hard (among their members, local planning authority and other statutory and non-statutory bodies) to ensure scheme development was not to the detriment of such woodlands.

With reference to the Woodland Trust – Woodland Inventory digital database, there are a number woodlands identified as being of significant conservation value, largely based on age, rarity and biodiversity (as shown on Figure 5.4.3). It is not however evident whether they all serve as valuable areas of recreation and open space as community woodlands. The consultation with DAERA Forest Service did note community usage of their managed woodlands, particularly Fathom Forest, though it is evident that the community utilises Narrow Water Wood/Forest and a lot of anecdotal information garnered from the Community Consultation Event in November 2017 indicated the value of Benson's Glen to the local community, even though they are not open to public access. The consultation with DAERA – Forest Service also provided information on long-established woodland (as detailed in sub-section 5.6.5.7; however, this was limited to where such features occur on Forest Service land. As shown on Figure 5.4.3 and described below, there are parcels of long-established woodland outwith Forest Service land and potentially affected by the scheme.

The consultation response from Woodland Trust identified ancient and long-established woodland that would be affected by the route options. In terms of the Red and Yellow routes, they estimate that these would result in the direct loss of 2ha of Ancient Woodland, 145ha Long-Established and 150ha of non-designated, and would include:

- WT896 (Ancient woodland, Grid Ref: J099222, 2ha);
- WT895 (Long-established woodland, Grid Ref: J107205, 77ha); and
- WT907 (Long-established woodland, Grid Ref: J113208, 68ha).

The Woodland Trust also notes that Blue Route Option 1 would result in the direct loss / fragmentation / damage to 2ha of Long-Established woodland, and would include:

- WT940 (Long-established woodland, Grid Ref: J094229, 1ha); and
- WT943 (Long-established woodland, Grid Ref: J093233, 1ha).

On this basis, the Woodland Trust strongly objects to these route options.

Of all the routes under consideration, the Red and Yellow Routes would have the greatest impact upon community woodland. Further to the impacts described above under the potential loss of forestry land, they would also affect parcels of long-established and possibly ancient woodland within Fathom Lower Woods & Grasslands SLNCI, resulting in severance of the latter.

On the climb up the western valley side, Blue Route Option 1 would marginally encroach into the most northerly of the three parcels associated with Fathom Lower Woods & Grasslands SLNCI. It is envisaged that Blue Route Options 2 & 3 would avoid direct encroachment into this portion of the SLNCI.

Furthermore, Blue Route Option 1 would encroach into and sever the central parcel of this SLNCI. This would result in significant losses from this zoned area and a significant impact upon its nature conservation, setting and amenity value. It is envisaged that Blue Route Options 2 & 3 would avoid direct encroachment into this portion of the SLNCI.

Alongside the significant potential for loss of ancient and long-established woodland, the Woodland Trust Northern Ireland is also deeply concerned about the following additional impacts:

- Fragmentation and degradation of surrounding and/or adjacent wooded environment as a result of the separation from adjacent semi-natural habitats, such as small wooded areas, hedgerows, and individual trees;
- Significant disturbance due to adjacent infrastructure during both construction and operational phases including, but not limited to, the long-term impacts of increased noise and light pollution from traffic, as well as considerable dust pollution. The impacted woodlands will also be subject to increased nitrogen oxide emissions from vehicles, which can change the character of woodland vegetation (in terms of species composition) through altering nutrient conditions.
- Significant pollution from adjacent infrastructure particularly during construction phases, from the use of hazardous materials, and the risk of spillages of chemicals, fuels or waste materials.
- There will inevitably be safety issues in respect of any trees adjoining the newly constructed carriageway, whereby branches and even whole trees being indiscriminately lopped/felled, causing reduction of the woodland canopy.
- Potential changes to the hydrology stemming from large areas of hard-standing altering ground water and surface water quantities. Also the introduction of water run offs from road development will result in changes to the characteristics and quality of the surface water as a result of pollution and contamination; and
- Any effect of development can impact cumulatively on ancient and long-established woodland - this is much more damaging than individual effects.

5.6.6.8 Effects on restoration proposals for abandoned waterways

The Newry Ship Canal would be crossed by all route options (except the Yellow Route, which instead would cross the navigational channel of the Newry River). The impact of each route would be dependent on the bridge deck height and air draft to allow passage of vessels from Narrow Water to Albert Basin. During previous consultations, the Council advised that a bridge deck with a canal clearance of at least 35m would provide sufficient air draft for the Newry Ship Canal to remain passable for all vessels potentially using it, as ship size within the canal is limited by the width which the existing lock chamber can accommodate.

A deck clearance of approximately 12m associated with the Blue Route options would provide sufficient air draft for the ship canal to remain passable for the majority of vessels using it regularly. On this basis, it is proposed at this stage that this is a fixed bridge structure.

Conversely, a bridge deck with canal clearance of approximately 6m associated with the Red Route and Yellow Route would limit the number and type of vessels on or that can access the ship canal. On this basis, should the Red or Yellow Route be selected as the preferred route, a bascule bridge could be incorporated into the design to negate any restriction on passage along the ship canal.

The response received from the IWAI on 29th April 2018, noted that whilst they have no objection to the scheme proposal, they have identified that without an opening bridge structure or air draft clearance of 37m with a fixed bridge structure, the scheme would adversely affect and undermine the work that has been undertaken by various concerned groups over the past 50 years to preserve and protect the Newry Canal and Newry Ship Canal for generations to come from a heritage, community, economic and tourism perspective. This position was also reflected in a range of other consultee responses received.

5.6.6.9 Assessment of Environmental Impacts (Construction)

Land and property required to facilitate construction of the scheme would be acquired in advance of the construction works. Access to the site areas is likely to be directly from the public road network, as the line of the scheme would cross several existing roads. In general, construction works should not have a major impact on adjacent land use; however some agricultural activities could be affected depending on the timing of the works. Temporary access arrangements would be provided as appropriate, in consultation with landowners to minimise disruption to adjacent agricultural land and other activities.

Some temporary landtake may be required for site compounds or stockpile locations for the duration of the construction period. Access to these areas would be directly off the public road network and such areas would be reinstated upon completion.

5.6.7 Mitigation & Enhancement Measures

In terms of properties at risk of either demolition or partial land loss, further design at a later stage would aim to reduce potential impact and subsequent loss of property (where highway design standards allow). Where demolition of third party property is required, compensation would be made in accordance with the statutory requirements for land acquired by compulsory purchase (vesting).

With respect to loss of development and community land, landtake would again be reduced where possible. However where loss is unavoidable, mitigation measures would be implemented so that residual development or community land remains viable (if possible) and where necessary, compensation is made in accordance with the statutory requirements for land acquired by compulsory purchase (vesting).

Impact on the Newry Canal waterway would be reduced by implementation of a suitable bridge structure on the ultimately selected route, which would not restrict access for sailing vessels to the canal.

Agricultural land loss would be minimised where possible, yet may be unavoidable, depending on the preferred route. Where agricultural land is affected, typical mitigation would involve alternative means of access and accommodation works as agreed with the respective landowner and/or compensation made in accordance with the statutory requirements for land acquired by compulsory purchase (vesting).

5.6.8 Presentation of Key Issues

The key issues associated with the route options under consideration from a Land Use perspective are listed below:

- Property loss would be broadly similar with any of the routes;
- The Red and Yellow Routes would affect the least amount of land designated in the Banbridge / Newry & Mourne Area Plan 2015;
- From an agricultural perspective, all route options would traverse a similar length of agricultural land;
- The Red and Yellow routes would not affect any designated Community areas or facilities; however, they would affect publically accessible woodland at Fathom Forest;
- The Blue Route Options would encroach into a major area of existing open space (associated with Gerry Brown Park) effectively resulting in its loss and functionality from a community/recreational perspective;
- The Red and Yellow routes would have by far the greatest impact on Forest Service woodlands and long-established/ancient woodland;
- The Red and Yellow routes would impact the greatest amount of non-Forest Service woodland;
- The Newry Ship Canal would be crossed by all route options (except the Yellow Route). The requirement for a bascule bridge over the canal, to negate any restriction on passage along the ship canal would be investigated further, once a preferred route has been selected;
- On balance, in light of a range of land use related constraints, the Blue Route options are considered to have the least impact in terms of integration with the existing land use environment, although other routes may have performed better in individual elements of assessment.

5.7 Noise & Vibration

5.7.1 Introduction

The sources of noise from traffic can be separated into two components. The first is generated by the engine exhaust system and transmission, and is the dominant source when traffic is not freely flowing, particularly from heavy vehicles which contribute a significant proportion of low frequency noise. Noise levels will vary primarily according to engine speed rather than vehicle speed. The second noise source component is generated from the interaction of tyres with the road surface and is the dominant noise source under free flow traffic conditions at moderate to high road speeds and contributes a significant proportion of high frequency noise. Noise levels will vary depending on vehicle speed, the road surface and whether the surface is wet or dry.

The noise from a stream of traffic at a reception point at any one instant is an aggregation of noise from each of many vehicles at various distances. Among factors which influence a basic traffic noise level are traffic flow, speed, composition (percentage Heavy Duty Vehicles (HDVs)), road gradient and road surface characteristics.

Noise annoyance is described by the World Health Organisation (WHO) as "*a feeling of displeasure associated with any agent or condition, known or believed by an individual or group to adversely affect them*". It can affect people in houses, the street or even during recreational activities. People are now known to be more sensitive to abrupt changes in traffic noise than research had previously suggested. New information suggests that human hearing is sensitive at the 1dB (A) level. This is equivalent to a 25% increase or a 20% decrease in traffic flow. This sensitivity to new schemes is an effect that can last for a number of years and will vary according to the sensitivity of hearing of the individual. There are also reported correlations between noise exposure and sleep disturbance, which can be significant, even at low noise levels.

To forecast a change in the noise level, the ambient noise must be measured. Ambient noise can be put into one of three categories; the first being dominated by traffic noise, the second being dominated by undefined sources such as rural areas (watercourses, livestock, tree swaying, etc.), and the third being non-traffic sources such as railways or aircraft.

Vibration can also occasionally be caused by traffic movement. Vibration is a low frequency disturbance producing physical movement in buildings and their occupants. It is the rolling of wheels on the road surface when passing over irregularities in the road that causes vibration.

Vibration is usually measured in terms of Peak Particle Velocities (PPVs) and is the maximum speed of movement (measured in mm/s) of a point in the ground during passage of vibration. Vibration can be problematic because of:

- its ability to affect precision tasks (for example in hospitals); and
- possible architectural damage, which affects the building and the occupants.

5.7.2 Methodology

The objective at this secondary stage is to undertake sufficient assessment to identify the noise and vibration impacts and effects associated with each of the approved route options under consideration in order to determine a preferred route. The Design Manual for Roads and Bridges (DMRB) is the standard document for use in the UK for the assessment of impact from road schemes.

In general, the noise assessment is used to predict the noise impact on receptors close to the various route options and to compare these impacts with existing noise levels at these locations in terms of a change in noise level and potential nuisance. This is then compared to the effects of not proceeding with the scheme (the 'Do-Minimum' option) in terms of ongoing noise impact on receptors close to these routes. A comparison of the route options is also provided to determine the relative noise impact and ultimately aid in the selection of a preferred route.

The adopted methodology is outlined in DMRB Volume 11, Section 3, Part 7, HD 213/11 (Noise and Vibration) Chapter 3 (Procedure for Assessing Impacts) (November 2011). The assessment methodology is intended to apply to various phases of planning, design and execution of projects associated with the construction and maintenance of roads. This process has four discrete phases:

- Screening - to determine whether the scheme has the potential to cause a change to the receiving environment which could result in noise and vibration impacts;
- Scoping - to determine the likely extent of any assessment and to identify sensitive receptors;
- Simple - assessment of noise and vibration impact at dwellings and other sensitive receptors; and
- Detailed - assessment of noise and vibration impact at dwellings and other sensitive receptors.

These phases are generally followed in sequence, although progression may depend on the stage and scale of the scheme, the site and local circumstances/conditions. At this secondary stage, a 'Detailed' assessment was deemed most appropriate, with an appropriately qualified acoustic specialist engaged to undertake this study.

The 'Detailed' assessment involved quantification of the noise and vibration impact at dwellings and other receptors in the vicinity of each route option. In addition, the calculations were carried out at 1.5m and 4m height within the baseline/assumed year of opening (2023) and future/15th year (2037) after opening for the 'Do-Minimum' and 'Do-Something' scenarios. An assessment range/area of approximately 300m from each route option, and where there is a change in noise level of at least 1 dB, was used as a basis for the assessment due to the comparatively low traffic volumes that are expected to use the route options and the complex terrain surrounding each of these.

DMRB dictates that road traffic noise is calculated under the method described in the Technical Memorandum Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988) and the "Northern Ireland Modifications" of that publication. This describes a procedure for determining the level of noise from the highway, based on the traffic parameters, the propagation distance, and conditions between the highway and receptor. This is the accepted methodology to quantify noise levels for use within this assessment procedure. The predicted noise levels have been calculated using the Datakustik Cadna/A proprietary acoustic modelling software. The Cadna/A calculation system complies with the CRTN methodology (DOT, 1990) and is also in accordance with DMRB.

In general, the noise assessment is used to predict noise impact on properties close to the route options and to compare these impacts with existing noise levels at these locations, in terms of a change in noise level and potential nuisance. This is then compared to the effects of not proceeding with the scheme - the 'Do-Minimum' option - in terms of ongoing noise impact on properties close to the existing route. In this regard, it is considered appropriate for use as the basis of a noise assessment as part of this Stage 2 assessment.

In addition, there is a potential noise impact from construction works associated with the scheme, although this would be temporary in nature. This involves preparation of the route, supply of materials, construction of roads and bridges, and landscaping, and has been assessed in line with BS 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites*'.

5.7.2.1 DMRB Assessment Methodology

The DMRB methodology considers noise levels with regard to the $L_{A10,18h}$ index. This value is the noise level exceeded for 10% of the time, averaged over a period between 06:00-00:00 (midnight), and is widely considered to best represent the perceived traffic noise impact at a location. Some guidance documents refer to the L_{Aeq} index, which is used to describe a variety of noise sources. With reference to BS8233:2014 *'Guidance on sound insulation and noise reduction for buildings'* Section 6.2.2, an approximate relationship for moderate and heavy traffic flows is that $L_{Aeq,16h} \approx L_{A10,18h} - 2$. Under low flow conditions, such as rural settings, there is no consistent relationship and L_{Aeq} values can be higher than equivalent L_{A10} values. In this assessment, the $L_{A10,18h}$ index is used in the prediction and assessment of traffic noise, while the L_{Aeq} index is used in the prediction and assessment of construction noise.

All properties and noise sensitive locations within 300m of the route options have been identified. There are approximately 72 receptor locations within the route options assessment area. The receptor locations are presented on Figure 5.7.1. Each receptor has been assigned an identification number.

Under DMRB 11.3.7.2, HD 213/11 - Revision 1 (Noise and Vibration), paragraph 2.29, it states that a night-time noise assessment may be a consideration where the project introduces a new noise source into an area. The assessment has been completed to ensure robustness.

DMRB 11.3.7, HD 213/11 - Revision 1 (Noise and Vibration), Annex 1, A1.19 (xiii) requires that the night-time noise assessment identify any properties exposed to $L_{night,outside}$ levels in excess of 55 dB as a result of the scheme, where it is currently below this level; and, where pre-existing levels exceed 55 dB $L_{night,\ outside}$ and are predicted to increase.

Following the guidance in DMRB Volume 11.3.7, the assessment of night-time noise has been predicted. DMRB 11.3.7.3 (Procedure for Assessing Impacts) paragraph 3.26 recommends that the night-time noise level is calculated using one of the three methods presented in the Transport Research Laboratory (TRL) report *'Converting the UK traffic noise index $L_{A10,18h}$ to EU indices for noise mapping'*.

Method 3 has been selected as the best fit calculation for the available traffic flow data. This method converts the calculated $L_{A10,18h}$ figure to the L_{night} figure using the following formula for non-motorway traffic:

$L_{night} = 0.90 \times L_{A10,18h} – 3.77$

5.7.2.2 Limitations & Assumptions

- Due to the stage of the process, detailed design information such as road surface finish, texture depth, and accurate ground conditions are not available. This includes the exact type of low noise road surface. As this information is not available, the assessment and noise modelling has not considered any surface treatments.
- Calculations have been conducted using Datakustik Cadna/A (Computer Aided Noise Abatement) proprietary noise modelling software;
- The assessment has been based on provided 3D digital route option and terrain information.
- A receptor height of 4.0m is used to assume worst case. For single-storey dwellings, a 1.5m assessment height has been used. The noise models were run using both the 4.0m and 1.5m heights;
- The Baseline Year (Assumed Year of Opening) is set as 2023;
- The Future assessment year (Design Year) is set as 2037; and
- The latest predicted Annual Average Weekday Traffic (AAWT) traffic flows have been used.

This is presented as a fair assessment of potential impact of the route options on surrounding areas, and is entirely appropriate to a 'Detailed' assessment, the purpose of which is to establish the overall impact. The AAWT traffic flow is the arithmetical mean of the days from Monday to Friday during the counting period. The flows are modified with a correction factor for the month of counting to obtain annual average values. The traffic flows have been produced as part of the Traffic & Economic assessment.

5.7.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. Table 5.7.1 outlines the responses from the Stage 2 consultation in relation to Noise & Vibration. Responses received from the Stage 1 consultation and/or those received separately as part of the feedback to the Community Consultation Event remain pertinent and valid to the overall assessment, unless otherwise indicated by the consultee.

Table 5.7.1: Summary of formal Stage 2 consultation responses in relation to Noise & Vibration

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Air and Environmental	09 April 2018	09 May 2018	No additional information at this stage to offer and referred to previous advice provided at Stage 1, which is to consult

Quality Unit			with the relevant district council regarding potential air and noise impacts, as well as the most recent guidance in the Design Manual for Roads and Bridges (DMRB).
NMDDC – Enterprise, Regeneration & Tourism	09 April 2018 09 May 2018	18 May 2018	Stage 2 response did not provide any comment regarding potential noise impacts. It is assumed the comments made in this regard at Stage 1 remain valid.

5.7.4 Regulatory & Policy Framework

With reference to DMRB 11.3.7.1, there are two main areas of current legislation which are pertinent to the assessment of the scheme in relation to noise and vibration impacts. The first of these provides a means to redress the adverse impacts of noise and vibration attributable to vehicular activity during the operational phase on both land and people. The second area of legislation provides a means to redress the adverse impacts of transient noise and vibration generated during the construction phase.

5.7.4.1 The Land Acquisition and Compensation (Northern Ireland) Order 1973

Part II of the Order (Compensation for Depreciation Caused by Use of Public Works) provides a means by which compensation can be paid to owners of land and property which has experienced a loss of value caused by the use of public works such as new and improved roads. Noise and vibration are two of the issues that would be considered under any such claim for compensation. Under the Order, Notice should be published one year after the opening of the road and the claim period is for 2 years after the date of publication of the Notice, although there is a facility for allowing consideration of likely extent of claims during detailed design, following the completion of statutory processes.

5.7.4.2 The Noise Insulation Regulations (Northern Ireland) 1995

The noise impact of traffic noise is assessed with reference to the Noise Insulation Regulations (Northern Ireland) 1995. These regulations seek to determine the impact of noise from any new or altered road, in relation to the noise sensitive receivers. In respect of road traffic noise, properties may qualify for an offer of noise insulation under the Regulations if all four of the following conditions are satisfied:

- the property must be within 300 metres of the nearest point on the carriageway of the road following construction;
- the façade noise level due to road traffic on any highway (the 'relevant' noise level) for the design year, or for any intervening year if noisier, must equal or exceed 68 dB $L_{A10,18h}$ (the 'specified' level), with levels of 67.5 dB $L_{A10,18h}$ rounded upwards;
- the 'relevant' noise level for the design year, or for any intervening year if noisier, must be at least 1 dB $L_{A10,18h}$ higher than the pre-construction year road traffic noise level; and
- noise from the new or altered road must contribute at least 1 dB $L_{A10,18h}$ to the 'relevant' noise level.

The Department has a duty under these Regulations to offer insulation for residential properties with respect to a new road, and discretionary powers in relation to altered roads. Various discretionary powers are also available in relation to façades or parts of façades contiguous with the qualifying façade. The Department also has discretionary powers to reduce the impact of construction noise. The Regulations apply to habitable rooms and so precludes bathrooms, toilets, halls and usually kitchens.

Some residential buildings are not eligible under the Regulations. These include clearance areas and any building which was first occupied after the 'relevant date' (the date a new road was first opened to public traffic or an altered road was opened following completion of the alteration). Buildings for which a Condition was attached to their planning permission requiring insulation against traffic noise are also not eligible. Furthermore, the Regulations do not apply to any buildings for which a planning application has been submitted to the local council or which was constructed after the date of publication of the Department's proposal to construct a road, altered road or additional carriageway as indicated:

1. in a draft Order referred to in a notice published in accordance with Paragraph 1 of Schedule 8 to the Roads (Northern Ireland) Order 1993, or an Order made under Articles 4(1), 14(1) or 15(1) of that Order; or
2. in a development plan or draft development plan published in accordance with Part II of the Planning Act (Northern Ireland) 2011.

5.7.5 Baseline Environmental Conditions & Constraints

The Noise Insulation Regulations (Northern Ireland) 1995 (NIR) determines that the most accurate way to assess the existing noise levels (both Baseline and Future conditions) at sites influenced primarily by transportation noise, is to calculate the levels based on the methodology of CRTN and the "Northern Ireland Modifications" of that publication, to ensure the accuracy of typical daily traffic flows based on annual averages, and not one-off local conditions.

It is therefore considered that the calculated traffic noise levels derived from available traffic data are more directly comparable to predicted levels for the Baseline and Future states. This determination method reflects the greater potential impact at a location which, prior to the introduction of the new road, would not have been exposed to traffic noise levels as compared with a location already subject to traffic impact. The layout of the approved route options impacts on noise sensitive locations within both of these broad classifications. The majority of the properties are currently influenced by traffic on local roads or the main A1 Dublin Road or A2 Warrenpoint Road.

5.7.6 Assessment of Environmental Impacts

5.7.6.1 Operation

The receptor locations are presented on Figure 5.7.1. Noise model outputs for the 'Do-Minimum' and 'Do-Something' comparisons for each of the five route options are illustrated on Figures 5.7.2 – 5.7.6.

5.7.6.1.1 Prediction of Traffic Noise Impact

The noise level at each of the identified locations has been predicted. The predicted noise levels at each receptor, in the Baseline Year (2023) and Future assessment year (2037), in the 'Do-Minimum' and 'Do-Something' scenarios are summarised in Tables 5.7.2 to 5.7.12. Calculations have been made at both 1.5m and at 4m receiver heights, with the summary tables reporting 4m to ensure a 'worst case' scenario is considered.

It is necessary to apply a +2.5 dB façade correction to the predicted noise values which has been incorporated within the DMRB assessment. The corrected predicted noise levels are presented within the data tables and are compatible with the calculation method used within the model.

5.7.6.1.2 Impact at Properties close to Roundabouts and other Junctions

The CRTN document excludes the prediction of noise from a junction. Rather, it states that noise levels should be predicted by considering free-flowing traffic on either side of the junction with no reduction in mean traffic speed (ref: CRTN Paragraph 33 and Annex 16). Therefore, any effect from the proposed new junctions with any of the approved route options would be neglected in the DMRB assessment, and the noise impact would be as assessed for the free-flowing carriageways.

The differences between free-flow conditions and restricted flow at roundabouts and other junctions can be demonstrated by reference to recorded work on the assessment of the effects of the Corr's Corner Roundabout on the predicted noise impact from the A8 Belfast-Larne road. Noise measurements using the CRTN Shortened Measurement Procedure were conducted on 17 March 2000 under appropriate conditions (ref. CRTN, Paragraphs 39-41). Two measurement locations were chosen: firstly, at equal distances to traffic on the roundabout, on a minor approach road and exit traffic towards Larne; and secondly, approach traffic from Larne and traffic on the roundabout.

Calculations in line with CRTN were made using the measured levels and data available for this section of road such that a comparison could be made of predicted levels of free-flowing traffic against measured levels at the roundabout.

The measurements and calculations indicate that:

- measured levels and resulting change in impact are consistent at both locations;

- the assumption of free-flowing traffic at locations close to a junction will tend to over-estimate the noise impact by circa 2.5 dB;
- the equivalent reduction in mean traffic speed to obtain this reduction in noise level has been calculated as -26 km/h.

Therefore, it is considered that the assessed noise impact at any property close to junctions would tend to over-estimate the level at that property, due to an effective reduction in mean traffic speed on approach to the junction.

5.7.6.1.3 Noise Assessment Comparisons

The following comparisons have been completed based on the predicted noise levels.

A short-term assessment table has been produced for each route option comparison required by DMRB. The number of properties which would experience a positive or negative change in level within the range of ‘0’ (No Change), ‘0.1 – 0.9’ (Negligible), ‘1 - 2.9’ (Minor), ‘3 – 4.9’ (Moderate) and 5 + dB (Major) are presented below. The classification in the brackets following each dB range is the ‘Magnitude of Impact’ in the short-term with reference to DMRB.

A long-term assessment table has been produced for each route option comparison required by DMRB. The number of properties which would experience a positive or negative change in level within the range of ‘0’ (No Change), ‘0.1 – 2.9’ (Negligible), ‘3 -4.9’ (Minor), ‘5 – 9.9’ (Moderate) and 10 + dB (Major) are presented below. The classification in the brackets following each dB range is the ‘Magnitude of Impact’ in the long-term with reference to DMRB.

Any location that would experience an increase in noise levels of more than 5 dB in the Baseline Year and 10 dB in the Future Year has been identified and presented in the supplementary noise tables.

5.7.6.1.3.1 Do-Minimum Option (Long-Term)

Table 5.7.2: Do-Minimum in the Baseline Year against Do-Minimum condition in the Future Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0				
0.1 – 0.9	72			
1 – 2.9				
3 – 4.9				
5 +				
Total	**72**	**0**	**0**	**0**

5.7.6.1.3.2 Red Route

Baseline Year (Short-Term)

Table 5.7.3: Do-Minimum in the Baseline Year against Do-Something condition in the Baseline Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0	12			
0.1 – 0.9	18			
1 – 2.9	20			
3 – 4.9	9			
5 +	13			
Total	**72**	**0**	**0**	**0**

Future Assessment Year (Long-Term)

Table 5.7.4: Do-Minimum in the Baseline Year against Do-Something condition in the Future Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0				
0.1 – 2.9	43			
3 – 4.9	13			
5 – 9.9	15			
10 +	1			
Total	**72**	**0**	**0**	**0**

5.7.6.1.3.3 Yellow Route

Baseline Year (Short-Term)

Table 5.7.5: Do-Minimum in the Baseline Year against Do-Something condition in the Baseline Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0	6			
0.1 – 0.9	16	2		
1 – 2.9	24			
3 – 4.9	10			
5 +	14			
Total	**70**	**2**	**0**	**0**

Future Assessment Year (Long-Term)

Table 5.7.6: Do-Minimum in the Baseline Year against Do-Something condition in the Future Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0				
0.1 – 2.9	47	1		
3 – 4.9	9			
5 – 9.9	14			
10 +	1			
Total	**71**	**1**	**0**	**0**

5.7.6.1.3.4 Blue Route Option 1

Baseline Year (Short-Term)

Table 5.7.7: Do-Minimum in the Baseline Year against Do-Something condition in the Baseline Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0	16			
0.1 – 0.9	15	1		
1 – 2.9	20			
3 – 4.9	10			
5 +	10			
Total	**71**	**1**	**0**	**0**

Future Assessment Year (Long-Term)

Table 5.7.8: Do-Minimum in the Baseline Year against Do-Something condition in the Future Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0				
0.1 – 2.9	51			
3 – 4.9	11			
5 – 9.9	9			
10 +	1			
Total	**72**	**0**	**0**	**0**

5.7.6.1.3.5 Blue Route Option 2

Baseline Year (Short-Term)

Table 5.7.9: Do-Minimum in the Baseline Year against Do-Something condition in the Baseline Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0	16			
0.1 – 0.9	13			
1 – 2.9	21			
3 – 4.9	10			
5 +	12			
Total	**72**	**0**	**0**	**0**

Future Assessment Year (Long-Term)

Table 5.7.10: Do-Minimum in the Baseline Year against Do-Something condition in the Future Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0				
0.1 – 2.9	50			
3 – 4.9	8			
5 – 9.9	12			
10 +	2			
Total	**72**	**0**	**0**	**0**

5.7.6.1.3.6 Blue Route Option 3

Baseline Year (Short-Term)

Table 5.7.11: Do-Minimum in the Baseline Year against Do-Something condition in the Baseline Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0	16			
0.1 – 0.9	15			
1 – 2.9	27			
3 – 4.9	8			
5 +	6			
Total	**72**	**0**	**0**	**0**

Future Assessment Year (Long-Term)

Table 5.7.12: Do-Minimum in the Baseline Year against Do-Something condition in the Future Year

Change in noise level, $L_{A10,18h}$ dB	Number of dwellings subject to a change in noise level			
	Increase in noise level	Decrease in noise level	Increase in noise level	Decrease in noise level
0				
0.1 – 2.9	53			
3 – 4.9	11			
5 – 9.9	7			
10 +	1			
Total	**72**	**0**	**0**	**0**

5.7.6.2 Noise Nuisance Assessment

5.7.6.2.1 Change in Nuisance

Implementation of any of the route options would result in changes to the number of vehicles on the surrounding road network. The noise levels at existing properties located close to these would experience a relative increase in noise levels. The indicative route option layouts would create a perceptible increase in noise levels at locations currently not exposed to high levels of transportation noise. As part of the 'Detailed' assessment, it is therefore necessary to assess the following two comparisons to determine the change in nuisance for each option:

1. 'Do-Minimum in the Baseline Year' (assumed year of Opening) with 'Do-Minimum in the Future assessment year' (15th Year after Opening); and
2. 'Do-Minimum in the Baseline Year' (assumed year of Opening) with 'Do-Something in the Future assessment year' (15th Year after Opening).

Detailed Assessment Summary tables have been completed for these noise nuisance comparisons for each route option, as set out in the sub-sections below.

5.7.6.2.2 Red Route

Comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Minimum in the Future Year (15th Year) and comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Something in the Future Year (15th Year) for the Red Route.

Table 5.7.13: Red Route Noise Nuisance Assessment Summary

Change in noise/nuisance level		Number of dwellings	
		Do-Minimum Baseline/Do-Minimum Future Year	Do-Minimum Baseline/Do-Something Future Year
Increase in nuisance level	< 10%	68	62
	10 – 20%		7
	20 – 30%		
	30 – 40%		
	> 40%		
No Change		4	3
Decrease in nuisance level	< 10%		
	10 – 20%		
	20 – 30%		
	30 – 40%		
	> 40%		

5.7.6.2.3 Yellow Route

Comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Minimum in the Future Year (15th Year) and comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Something in the Future Year (15th Year) for the Yellow Route.

Table 5.7.14: Yellow Route Noise Nuisance Assessment Summary

Change in noise/nuisance level		Number of dwellings	
		Do-Minimum Baseline/Do-Minimum Future Year	Do-Minimum Baseline/Do-Something Future Year
Increase in nuisance level	< 10%	68	64
	10 – 20%		7
	20 – 30%		
	30 – 40%		
	> 40%		
No Change		4	
Decrease in nuisance level	< 10%		1
	10 – 20%		
	20 – 30%		
	30 – 40%		
	> 40%		

5.7.6.2.4 Blue Route Option 1

Comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Minimum in the Future Year (15th Year) and comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Something in the Future Year (15th Year) for Blue Route Option 1.

Table 5.7.15: Blue Route Option 1 Noise Nuisance Assessment Summary

Change in noise/nuisance level		Number of dwellings	
		Do-Minimum Baseline/Do-Minimum Future Year	Do-Minimum Baseline/Do-Something Future Year
Increase in nuisance level	< 10%	68	59
	10 – 20%		8
	20 – 30%		
	30 – 40%		
	> 40%		
No Change		4	5
Decrease in nuisance level	< 10%		
	10 – 20%		
	20 – 30%		
	30 – 40%		
	> 40%		

5.7.6.2.5 Blue Route Option 2

Comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Minimum in the Future year (15th Year) and comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Something in the Future year (15th Year) for Blue Route Option 2.

Table 5.7.16: Blue Route Option 2 Noise Nuisance Assessment Summary

Change in noise/nuisance level		Number of dwellings	
		Do-Minimum Baseline/Do-Minimum Future Year	Do-Minimum Baseline/Do-Something Future Year
Increase in nuisance level	< 10%	68	62
	10 – 20%		6
	20 – 30%		
	30 – 40%		
	> 40%		
No Change		4	4
Decrease in nuisance level	< 10%		
	10 – 20%		
	20 – 30%		
	30 – 40%		
	> 40%		

5.7.6.2.6 Blue Route Option 3

Comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Minimum in the Future year (15th Year) and comparison of the Do-Minimum in the Baseline Year (assumed year of Opening) with the Do-Something in the Future year (15th Year) for Blue Route Option 3.

Table 5.7.17: Blue Route Option 3 Noise Nuisance Assessment Summary

Change in noise/nuisance level		Number of dwellings	
		Do-Minimum Baseline/Do-Minimum Future Year	Do-Minimum Baseline/Do-Something Future Year
Increase in nuisance level	< 10%	68	62
	10 – 20%		4
	20 – 30%		1
	30 – 40%		
	> 40%		
No Change		4	5
Decrease in nuisance level	< 10%		
	10 – 20%		
	20 – 30%		
	30 – 40%		
	> 40%		

5.7.6.3 Night-time noise assessment

DMRB recommends that a 'Future Year' assessment is carried out of night-time noise exposure of relevant receptors for each route option under consideration.

5.7.6.3.1 Do-Minimum Option

There are 10 properties which would be exposed to levels in excess of 55 dB $L_{night, outside}$ under the 'Do-Minimum' scenario in the Future assessment year.

5.7.6.3.2 Red Route

There are 17 properties which would be exposed to levels in excess of 55 dB $L_{night, outside}$ under the 'Do-Something' scenario in the Future assessment year.

5.7.6.3.3 Yellow Route

There are 17 properties which would be exposed to levels in excess of 55 dB $L_{night, outside}$ under the 'Do-Something' scenario in the Future assessment year.

5.7.6.3.4 Blue Route Option 1

There are 17 properties which would be exposed to levels in excess of 55 dB $L_{night, outside}$ under the 'Do-Something' scenario in the Future assessment year.

5.7.6.3.5 Blue Route Option 2

There are 18 properties which would be exposed to levels in excess of 55 dB $L_{night, outside}$ under the 'Do-Something' scenario in the Future assessment year.

5.7.6.3.6 Blue Route Option 3

There are 19 properties which would be exposed to levels in excess of 55 dB $L_{night, outside}$ under the 'Do-Something' scenario in the Future assessment year.

5.7.6.4 Potential Vibration Impact

The assessment of vibration impact and disturbance is detailed in Volume 11, Chapter 3, Section 3, Part 7 of DMRB. It is likely that the reference source of this chapter is research work by the Transport Research Laboratory (TRL) and particularly Report 246 '*Traffic Induced Vibrations in Buildings*'. The DMRB chapter makes a number of points:

- vibration levels from traffic are low, even in properties close to heavily trafficked roads, and normal use of the building often generates much higher vibration levels;
- extensive research has shown that traffic-induced vibrations do not cause significant damage to buildings;
- the highest levels of traffic-induced vibration are generated by irregularities in the road, and this is unlikely to be an important consideration for new roads. However, as road conditions may be improved during maintenance work, it should not be presented as a benefit of a new scheme. (The TRL Report 246 presents a prediction method for traffic vibration in which the depth/height of an irregular surface is a main component in the assessment of peak particle velocity effects. As this value approaches 0, the induced vibration also approaches 0. Thus a new surface has limited potential for vibration impact);
- notwithstanding the TRL report, DMRB concludes that ground-borne vibration levels depend on many factors and are difficult to accurately predict;
- airborne vibration is more likely to cause disturbance than ground-borne vibration, but both sources of vibration will cause less disturbance than noise, and are applicable within a shorter distance from the road.

Other empirical matters, relating to traffic induced vibrations, have been monitored and noted. Some general guidance on the effect of vibrations is contained in BS6472 (1992), '*Guide to Evaluation of Human Exposure to Vibration in Buildings'* and BS7385 (1990 and 1993), '*Evaluation and Measurement for Vibration in Buildings*'.

Vibration associated with heavy impact activities on other construction sites have been measured as less than 0.5 mm/s at 20m. Vibration from HGV road traffic has also been measured as less than 0.5mm/s at 15m in other locations with good road conditions.

Empirical data, as detailed above, suggests that vibration levels would be less than 0.5mm/s at the majority of properties and therefore an assessment of traffic airborne vibration nuisance assessment is unlikely to provide any benefit in the selection of a preferred route at this stage. With reference to BS6472, it is considered that this represents a “low probability of adverse comment” by residents. With reference to BS7385 and allowing for normal circumstances, this vibration level is not of a severity that might cause any structural damage to a property. This matter will however be considered further at Stage 3.

5.7.6.5 Construction

5.7.6.5.1 Prediction of Short-term Construction Noise Impact

There is a potential for noise impact from construction works associated with any of the route options, although this would be short-term in nature, and a temporary impact at any single property.

It would ultimately be the responsibility of the nominated contractor to specify the plant to be used and the most efficient methodology. However, there are types of plant and activities which are typical for these construction works, and ‘worst case’ levels have been compiled from BS5228 and presented in Table 5.7.18. Further, the prediction of noise levels due to combined activity has been calculated for each significant stage of work using the individual plant noise levels, and the resulting impacts at varying distances from the activity are shown in Table 5.7.18.

Due to the linear nature of the road construction, the duration of activity at any property near the works would be very short in nature. There may be occasions where work is extended in one location or it may be the contractor’s preference to carry out different stages of works at different times.

Table 5.7.18: Noise levels for construction plant and activities (ref: BS5228)

Plant / Activity	dB L_{Aeq} at 10 m
Haulage lorries	70
30 tonne excavator	87
D6 dozer	86
Wheeled dozer	80
2 dump trucks (combined)	81
Pumping/dewatering	81
Demolition (rock breaking)	90
Compacting fill (vibrating roller)	78
Road surfacing (asphalt work)	75-80
Road roller (finishing)	80

Source: BS5228

Table 5.7.19: Typical combined construction noise levels.

Activity	dB				
	L_{Aeq} at 10m	L_{Aeq} at 50m	L_{Aeq} at 100m	L_{Aeq} at 200m	L_{Aeq} at 400m
Site clearance and preparation of working width	87	73	67	61	55
Preparation of access	90	76	70	64	58
Topsoil stripping	89	75	69	63	57
Route excavation and preparation	85	75	65	59	54
Road works	91	77	71	65	59
Landscaping	85	71	65	59	53
HGV movements (up to 3 units together)	75	61	55	49	43
Pile Driving assume driven precast (worst case)	91	77	71	65	59
Sheet Piling (Kring/Ice Hammer)	90	76	70	64	58

NB: No correction for absorbent ground is applied to this data

5.7.6.5.2 Assessment of Short-term Construction Noise Impact

Based on the predicted impact levels, it is anticipated that construction noise levels would exceed the existing ambient noise level at properties closest to the site. The extent of this impact at any property will vary – depending on the specific plant being used, the distance or range of distances to the property, the “on time” of each activity, and any localised screening.

However, it is recognised that construction activity is typically temporary in nature, with a requirement to use plant with high noise levels at specific locations. Therefore, the ability to control construction noise levels relates primarily to the duration and time of construction activity in any one day.

BS 5228 provides recommendations for temporary construction noise limits, based on an assessment of the existing ambient noise levels within the vicinity of the works. The 'ABC' method, as found in BS 5228 Section E.3.2, provides an appropriate assessment method for determining temporary construction noise level targets. The level is determined by rounding the ambient noise level within the vicinity of the construction works to the nearest 5 dB. This resultant level is then compared with Category A, B and C values. When this resultant level is 5 dB less than Category A values, then noise limits should be set in line with Category A values. When the resultant level is similar to Category A values, then noise limits should be set in line with Category B values. When the resultant level is similar to Category B values or higher, then noise limits should be set in line with Category C values. Table 5.7.20 below outlines Values for Categories A, B and C.

Table 5.7.20: Construction Noise Limits

Assessment Category and Threshold Value Period L_{Aeq}	Threshold Value, in Decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00-07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00-09:00) and Saturdays (07:00-13:00)	65	70	75

As it is expected that ambient levels at the most proximate residential properties where the route options would intersect with the existing A-class road network would be relatively high, the Category C targets should therefore be used. It is expected that ambient levels at the most proximate residential properties in the more rural sections (i.e. Flagstaff) would be relatively low due to the rural setting. It would be deemed appropriate to set noise target levels similar to Category A/B.

Mitigation measures are presented to aid contractors in the appropriate control of construction noise to within these target levels.

5.7.7 Mitigation & Enhancement Measures

5.7.7.1 Operation

The changes in flow and distance and the introduction of the new road and junctions would cause the noise levels at a number of properties to increase.

Following the Noise Insulation Guidelines, if a property is exposed to a noise impact level greater than 68 dB $L_{A10,\ 18hr}$, and is subject to an increase of more than 1 dB, then the property is eligible for Noise Insulation.

It is predicted that the 68 dB $L_{A10,\ 18hr}$ value would be exceeded at six properties under the 'Do-Something' scenario in the 'Future Year'.

5.7.7.1.1 Blue Route Option 1

Under this scenario, it is predicted that the 68 dB $L_{A10,\ 18hr}$ value would be exceeded at seven properties under the 'Do-Something' scenario. It is noted that six of these properties would exceed this value under the 'Do-Minimum' scenario due to the existing road network.

5.7.7.1.2 Blue Route Option 2

Under this scenario, it is predicted that the 68 dB $L_{A10,\ 18hr}$ value would be exceeded at seven properties under the 'Do-Something' scenario. It is noted that six of these properties would exceed this value under the 'Do-Minimum' scenario due to the existing road network.

5.7.7.1.3 Blue Route Option 3

Under this scenario, it is predicted that the 68 dB $L_{A10,\ 18hr}$ value would be exceeded at nine properties under the 'Do-Something' scenario. It is noted that six of these properties would exceed this value under the 'Do-Minimum' scenario due to the existing road network.

5.7.7.1.4 Red route

Under this scenario, it is predicted that the 68 dB $L_{A10,\ 18hr}$ value would be exceeded at seven properties under the 'Do-Something' scenario. It is noted that six of these properties would exceed this value under the 'Do-Minimum' scenario due to the existing road network.

5.7.7.1.5 Yellow Route

Under this scenario, it is predicted that the 68 dB $L_{A10,\ 18hr}$ value would be exceeded at seven properties under the 'Do-Something' scenario. It is noted that six of these properties would exceed this value under the 'Do-Minimum' scenario due to the existing road network.

Mitigation

It is predicted that, in order to mitigate the impact to below the 68 dB $L_{A10,\ 18hr}$, or within +1 dB of the 'Do-Minimum' value if 68 dB $L_{A10,\ 18hr}$ is exceeded, the noise impact from the route option must be reduced at the identified locations by up to 2.8 dB.

The use of a low noise road surface would mitigate the noise impact by circa 3-5 dB. It is therefore submitted that, with the inclusion of a low noise road surface on the mainline, it is possible to mitigate the impact of all approved route options to within Noise Insulation Regulations (NIR) requirements. Alternatively, it would also be possible to use acoustic barriers at specific locations to reduce the impact to within the NIR requirements. This would typically be considered in more detail at Stage 3.

5.7.7.2 Construction

There are a number of mitigation measures considered appropriate and of good working practice for all construction contracts. These measures are detailed in BS5228 (2009), '*Code of practice for Noise and Vibration Control on Construction and Open Sites*', and are summarised below. These guidelines should form the basis of control and limiting of potential impact to noise sensitive locations.

It should be noted that local councils also have power to control the hours and methods of work, pursuant to the Pollution Control and Local Government (Northern Ireland) Order 1978. The National Planning Policy Framework, published in March 2012, although not strictly applicable to Northern Ireland, may also be referred to for guidance.

5.7.7.2.1 Choice of Plant

The Contractor (once appointed) should take note of the control measures for relevant plant listed in BS5228 and apply the appropriate measures where practicable. These measures should include:

- Positioning of static plant as far as possible from residential properties, and utilising available screening by temporary structures, stock piles, etc.;
- Use of well-maintained plant, and where possible new plant manufactured under more strict EC guidelines for manufacturers;
- Substitution of unsuitable plant; and
- Maintenance of silencers and moving components.

5.7.7.2.2 Screening

Temporary screening using sandbags, 20mm plywood sheeting or similar dense boarding, may be required to reduce impact of static machinery or extensive works close to noise sensitive locations. Such measures can be best assessed during the construction contract by monitoring.

5.7.7.2.3 Monitoring

It would be appropriate to conduct noise monitoring of construction during noisy or extensive works at locations close to residential properties. Noise levels presented in Tables 5.7.18 and 5.7.19 should be used as a guide in this regard. Measurements should be conducted using a Type 2 or better sound level meter to check on the continuing impact of the works. With regard to vibration, it may be beneficial to monitor vibration levels at the beginning of any pile driving process to ensure that levels at the most proximate properties do not cause damage.

5.7.7.2.4 Appointment of a Responsible Person

It is recommended that the Contractor (once appointed) should appoint or delegate a 'responsible person' who would be present on site and who would be willing to answer and act upon queries from the local public.

5.7.7.2.5 Night Works

It is not anticipated at this stage that the Contract would require any construction works to take place outside normal hours. However, there may be items of plant (e.g. de-watering pumps and similar) in use during night-time hours. They should be chosen, sited and enclosed such that levels at the nearest properties do not exceed 45 dB L_{Aeq}. This level is based on the World Health Organisation criteria for undisturbed sleep, and assumes a resident may have a partially open window.

5.7.8 Presentation of Key Issues

The potential noise impact from the various route options have been assessed based on the guidance provided by the Design Manual for Roads and Bridges document (2011). The 'Detailed' assessment methodology has been adopted for this assessment.

The predicted noise impact at each identified receptor (within a calculation area of 300m from the route options) has been calculated based on the digital terrain model and the latest route alignments and traffic data available at the time of assessment using Cadna A proprietary modelling software.

The assessment has established the existing and forecasted noise climate in the vicinity of the route options and assessed the impact with reference to DMRB and the Noise Insulation Regulations (Northern Ireland) 1995.

The assessment has also included the impact of temporary construction noise, based on activities typical to this type of scheme.

Where deemed necessary, mitigation measures have been identified for temporary and permanent impacts to ensure compliance with the relevant standards and legislation.

DMRB does not present a definition to the significance of the predicted increase or decrease in noise impact from road traffic noise. However, as stated previously, the document presents a methodology for assessing the magnitude of change in noise levels. In order to compare the key issues from a noise perspective of each route option, a comparison of the 'Moderate' and 'Major' impacts is presented in Table 5.7.21.

Table 5.7.21: Significance of Potential effects of Approved Route Options

Change/Option	Magnitude	Blue 1	Blue 2	Blue 3	Red	Yellow
Baseline Year (2023)						
3 - 4.9 dB	Moderate	10	10	8	9	10
5 + dB	Major	10	12	6	13	14
Total		20	22	14	22	24
Future Year (2037)						
5 – 9.9 dB	Moderate	9	12	7	15	14
10 + dB	Major	1	2	1	1	1
Total		10	14	8	16	15
Overall Total		30	36	22	38	39

Blue Route Option 3 would have the least number of properties exposed to changes in noise levels that would be considered as 'Moderate' or 'Major' under DMRB. The Yellow Route would have the most properties exposed to changes in noise levels that would be considered as 'Moderate' or 'Major'. However, Blue Route Option 3 has the highest increase in noise levels at a single property. The number of properties which exceed the NIR 68 dB $L_{A10,\ 18hr}$ trigger level are similar for all options, with 1 to 2 properties being subjected to an increase that would exceed this value. It is therefore submitted that, with the inclusion of mitigation measures, the 68 dB $L_{A10,\ 18hr}$ can be achieved at all properties close to all approved route options.

It is further noted that, due to the assessment methodology, the calculation area does not directly assess the noise levels at properties within the Newry City Centre, and on the Warrenpoint Road which would benefit from a decrease in noise levels due to lower traffic volumes.

5.8 Pedestrian, Cyclists, Equestrians & Community Effects

5.8.1 Introduction

This section considers the impact of the various route options on journeys which people make in their locality as Non-Motorised Users (NMUs), such as pedestrians, cyclists or equestrians. In addition, the impact of the route options on local vehicle movements in relation to accessing community facilities is considered. Consequently, there are three main aspects addressed in this assessment:

- changes in journey lengths and times;
- changes in amenity; and
- changes in community severance.

The impact on journey length considers how the scheme might affect the duration or distance of journeys made as a result of temporary and permanent disruption to routes taken such as footways, cycleways, and Public Rights of Way (PRoW).

Amenity is defined as the relative pleasantness of a journey and is concerned with changes in the degree and duration of people's exposure to traffic, in terms of fear/safety, noise, dirt and air quality, and the impact of the road itself, primarily any visual intrusion associated with the scheme and its structures.

Community severance is defined 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 flows. In addition, severance may sometimes be caused by the demolition of a community facility, or the loss of land used by members of the public. Conversely, if a new road diverts traffic and makes an existing road easier for people to cross, community severance may also be reduced. Aged people, the disabled and children are particularly vulnerable to disruption of their travel patterns.

5.8.2 Methodology

The objective at this secondary stage is to undertake sufficient assessment to identify the routes used by pedestrians and others, the community facilities and the effects upon these two categories to be taken into account in developing and refining the five route options under consideration.

In accordance with the requirements of DMRB 11.3.8.9 (Stages in the Assessment of Impacts on Pedestrians, Other Travellers and Communities), the steps taken include:

- identification and assessment of the existing usage of community facilities and routes used by pedestrians and others which might be affected by any of the options;
- an assessment of any changes in the safety and amenity value of routes used by pedestrians and others, which might be affected by any of the options;
- where journey lengths would be increased, or where journey amenity would be reduced, an assessment of the likely changes in community severance;
- where cyclists will be significantly affected, obtain the views of the local highway authority officer responsible for cycling provision on the implications of the various options under consideration.

5.8.2.1 Assessing the Significance of Effects

With reference to DMRB Volume 11, Section 2, Part 5, Chapter 2, it is not sufficient to assess only 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 impact (change). In other words, significance criteria are used to report the effect of the impact.

In terms of pedestrians, cyclists, equestrians and community effects, these should be assessed firstly in terms of the sensitivity and value of the receptor (e.g. High, Medium or Low), and secondly in terms of magnitude of impact (e.g. Major, Moderate, Minor or Negligible). The sensitivity and value of receptors that may be affected by any of the route options is based on professional judgement, considering general usage and type. The scales adopted for the magnitude of impact are contained in Table 5.8.1 below:

Table 5.8.1: Estimating the Magnitude of Impact on an Attribute

Magnitude	Criteria
Major	Loss of community resource / NMU provision and/or quality and integrity of community resource / NMU provision. Large scale or major improvement to community resource / NMU provision quality; extensive restoration or enhancement.
Moderate	Loss of community resource / NMU provision, but not adversely affecting quality and integrity. Benefit to, or addition of, key characteristics of community resource, features or elements.
Minor	Some measurable change in attributes of community resource / NMU provision, quality or integrity. Minor benefit or addition to a community resource / NMU provision.
Negligible	No perceptible change to community baseline conditions.

DMRB Volume 11, Section 3, Part 8, does not describe how the significance of effects should be scaled with regards to pedestrians, cyclists, equestrians and community impacts.

Therefore, Table 5.8.2 outlines a suggested means of estimating the significance of potential effects, based upon the magnitude of impact and sensitivity of the receptor. Professional judgement and awareness of the relative balance of importance between sensitivity and magnitude allows the overall significance of impact to be assessed. The significance of impact is assessed with mitigation (where known) to define residual impacts.

Table 5.8.2: Estimating the Significance of Potential Effects

Importance of Attribute	**High**	Neutral	Moderate/Large	Large/Very Large	Very Large
	Medium	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Low	Neutral	Slight	Moderate	Large
		Negligible	**Minor**	**Moderate**	**Major**
			Magnitude of Impact		

Source: DMRB 11.2.5.2 (Arriving at the Significance of Effect Categories – adapted)

5.8.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. The following table outlines the responses from the Stage 2 consultation in relation to Pedestrians, Cyclists, Equestrians, and Community effects. It should be noted that any relevant responses which were received during the Stage 1 consultation, although not recorded in this Stage 2 consultation table, are considered/addressed within the appropriate technical chapter.

Table 5.8.3: Summary of formal consultation responses in relation to Pedestrians, Cyclists, Equestrians and Community Effects

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Confederation of Community Groups – Newry & District	09 April 2018 09 May 2018	18 May 2018	Favour the Blue Route options on the proviso that an opening bridge is provided. A 12m clearance is insufficient for taller sailing vessels which would prohibit future potential development of Albert Basin. The associated significant costs would be value for money and would future proof for development at the basin for tourism, social and

			recreational use.
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs	09 April 2018 09 May 2018 30 May 2018	-	No response received.
DfC – Regional Development Office (South Eastern Team)	09 April 2018 09 May 2018 30 May 2018	-	No response received.
DfI – Walking and Cycling Unit	09 Apr 18	18 Apr 18	The Department has a commitment to increasing the number of journeys taken by walking, cycling and public transport, in line with work undertaken for the draft Programme for Government. New transport routes must make sufficient provision for this increase. The scheme should not act as a barrier to active travel, and should provide a 3m wide (minimum) shared footway/cycleway tied into similar infrastructure either side of the bridge crossing.
DfI – Sustainable Transport Branch	09 Apr 18	18 Apr 18	Joint response with DfI – Walking and Cycling Unit, see above.
Down Gaelic Athletic Association (GAA)	09 April 2018 09 May 2018 30 May 2018	-	No response received.
Education Authority – Southern Region	09 April 2018 09 May 2018	16 May 2018	No comments to make on the scheme.
Loughs Agency	09 April 2018 09 May 2018	16 May 2018 13 June 2018	Clearance of 9m may result in tourism issues associated with sail boat access to Albert Basin. Consider the Blue Route as having the least impact on fisheries.
Newry & District Anglers Association	09 April 2018 09 May 2018 30 May 2018	-	No response received.
Newry & Mourne Enterprise Agency	09 April 2018	01 May 2018	The chosen route option should facilitate high masted vessels passing along Newry Canal. The Albert Basin has been envisioned by local stakeholder partnerships as a focal point for tourist activity, sports events, shopping and festivals. Key feature would be the presence there of vessels which could come and go from the open sea. The attraction of Tall Ships which recall Newry's long maritime history has long been an aspiration of those who believe Newry can and should attract tourists and be a focus for leisure activity, as well as being a place for shopping and business.
Newry Mitchels Gaelic Athletic Club (GAC)	09 May 2018 09 April 2018	18 May 2018	Strongly object to the selection of a Blue Route. This would have major ramifications for the club ground and future development. It would leave players and children in the area without a playing field and at a serious disadvantage.
NI Greenways	09 April 2018 09 May 2018	15 May 2018	No view on route options, but request dedicated cycling space is included with any route chosen. Prioritised cycling and pedestrian space at proposed roundabouts and junctions must be included. Referenced the Dutch style roundabout in

			the London Cycle Design Standards. Would expect direct linkages with the Great Eastern Greenway and north to Portadown.
Mourne Heritage Trust	09 April 2018 09 May 2018 30 May 2018	-	No response received.
PSNI – Road Policing Command Unit	09 April 2018 09 May 2018	17 May 2018	Plans will bring road safety benefits to pedestrian and cyclist road users. Would favour Blue Route options to encourage maximum use of road, as it allows ready access to Industrial Estate and A1. Feel the Red and Yellow routes would probably favour tourist traffic and an opening bridge would be an attraction. It also would involve considerable up-grading of the B79 route and involves significant additional mileage, which hauliers are aware of and in the police view might be a factor to dissuade them from fully utilising the new road.
Ring of Gullion Landscape Partnership	09 April 2018 09 May 2018 30 May 2018	-	No response received.
Southern Health & Social Care Trust	09 April 2018 09 May 2018 30 May 2018	-	No response received.
Sustrans	09 April 2018 09 May 2018	07 June 2018	Advised as to ongoing cycling projects in the area. Stated the need to ensure continuity of the recently developed Greenway route adjacent to canal, linking Newry and Victoria Lock. Bridge would need to span the infrastructure, and construction phase works should not affect the Greenway. The visual and environmental impact of a bridge over canal will dominate landscape negatively. Bridge should include loop to allow for cycling provision and allow connection to wider network.
Tourism NI	09 April 2018 09 May 2018 30 May 2018	-	No response received.
Translink – Infrastructure Division	09 April 2018	12 April 2018 16 April 2018	Response discussed requirements in terms of bridge construction over railway line and clearance distances during construction. There may be impacts to the community in terms of disruption to rail services, particularly if blasting is required. These impacts to be discussed at meeting with engineers.
Translink – Technical Support	09 April 2018 09 May 2018	11 April 2018 10 May 2018	No route options would have a direct impact on the contracted bus network in terms of routes or existing bus stops. It is unlikely that the relief road would become part of the bus network.
Ulster Angling Federation	09 April 2018 09 May 2018 30 May 2018	-	No response received.

5.8.4 Regulatory & Policy Framework

Newry, Mourne and Down District Council (NMDDC) has a statutory responsibility for provision of public open space and recreation facilities within Newry and its surrounding hinterland ('the study area'). Their statutory powers to provide for and facilitate recreation are considerable, ranging from leisure and tourism promotion, acquisition of land for recreational use and provision of facilities, to securing public access to the countryside.

5.8.4.1 The Access to the Countryside (Northern Ireland) Order 1983

Under The Access to the Countryside (Northern Ireland) Order 1983, NMDDC has a duty 'to assert, protect and keep open and free from obstruction or encroachment, any public right of way'.

The Council is also given discretionary powers to repair and maintain Rights of Way, to create, divert or close public paths, and to make access agreements or Orders to open land.

5.8.4.2 Planning Policy Statements

PPS 3: Access, Movement and Parking (February 2005)

This Planning Policy Statement (PPS) sets out the DfI's planning policies for vehicular and pedestrian access, transport assessment, the protection of transport routes, and parking. It forms an important element in the integration of transport and land use planning. It sets out a number of policies in relation to the provision of new accesses onto public roads and embodies the Government's commitments to the provision of a modern, safe, sustainable transport system, the improvement of mobility for those who are socially excluded or whose mobility is impaired, the promotion of healthier living, and improved road safety.

The main objectives of this PPS are to:

- promote road safety, in particular, for pedestrians, cyclists and other vulnerable road users;
- restrict the number of new accesses and control the level of use of existing accesses onto Protected Routes;
- make efficient use of road space within the context of promoting a modal shift to more sustainable forms of transport;
- ensure that new development offers a realistic choice of access by walking, cycling and public transport;
- ensure the needs of people with disabilities and others whose mobility is impaired, are taken into account in relation to accessibility to buildings and parking provision;
- promote the provision of adequate facilities for cyclists in new development;
- promote parking policies that will assist in reducing reliance on the private car and help tackle growing congestion; and
- protect routes required for new transport schemes, including disused transport routes with potential for future reuse.

PPS 8: Open Space, Sport and Outdoor Recreation (February 2004)

This PPS sets out the DfI's planning policies for the protection of open space, the provision of new areas of open space in association with residential development and the use of land for sport and outdoor recreation, and advises on the treatment of these issues in development plans. It embodies the Government's commitment to sustainable development, to the promotion of a more active and healthy lifestyle, and to the conservation of biodiversity.

Open space, for the purposes of this assessment, is defined as all open space of public value. The definition includes not just outdoor sports facilities, parks and gardens, amenity green space and children's play areas, but also natural and semi-natural urban green spaces, allotments, cemeteries, green corridors and civic spaces. It includes not just land, but also inland bodies of water that offer important opportunities for sport and outdoor recreation and which can also act as a visual amenity.

The main objectives of this PPS are to:

- safeguard existing open space and sites identified for future such provision;
- ensure that areas of open space are provided as an integral part of new residential development, and that appropriate arrangements are made for their management and maintenance in perpetuity;

- facilitate appropriate outdoor recreational activities in the countryside;
- ensure that new open space areas and sporting facilities are convenient and accessible for all sections of society, particularly children, the elderly and those with disabilities;
- achieve high standards of siting, design and landscaping for all new open space areas and sporting facilities; and
- ensure that the provision of new open space areas and sporting facilities is in keeping with the principles of environmental conservation, and helps sustain and enhance biodiversity.

5.8.4.3 Banbridge/Newry and Mourne Area Plan 2015

The purpose of the Banbridge/Newry and Mourne Area Plan 2015 is to inform the general public, statutory authorities, developers and other interested bodies of the policy framework and land use proposals that will be used to guide development decisions within Banbridge District Council and Newry and Mourne District Council areas over the Plan period of 2000-2015 (as per the Council boundaries at that time). The plan is prepared within the context of priorities of the Northern Ireland Executive, and is in general conformity with the Regional Development Strategy (RDS). The policy frameworks of relevance from a pedestrian, cyclist, equestrian and community perspective for the study area are provided in the sub-sections below. This is the current Area Plan.

Transportation Strategy

The movement of people and the efficient distribution of goods and services are essential to the functioning of any area. Good communications are, therefore, important to the local economy and to attract inward investment. Good transport links also connect people socially and provide access to leisure and recreational opportunities.

As detailed within Volume 1 (Plan Strategy and Framework) of the Area Plan 2015, the study area contains a number of disused transport routes, both rail and tramway track, which have potential for future use for road lines, public transport routes, cycle or walking routes.

Walking and Cycling

The Plan provides for the enhancement of walking and cycling networks through the Key Site Requirements for many of the zonings and development opportunity sites, as outlined in Volumes 2 and 3 of the Plan.

National Cycle Network routes 9 and 93 pass through the Plan Area, and Sustrans intend to extend and improve these routes. The Sub-Regional Transport Plan (SRTP) makes further provision for walking and cycling within the Plan Area, and also targets improved integration between walking and cycling and public transport through better links to stations and stops and the provision of cycle stands.

Public Transport

The Northern Ireland Transport Holding Company, under the 'Translink' brand name, operates most rail and bus services within the Plan Area. The Belfast to Dublin railway line runs through the Plan Area, with a station at Newry. During the plan period, a new/upgraded railway station in Newry with associated park & ride provision has been completed.

The RTS identified the need to improve public transport travel opportunities by providing new bus services in urban and rural areas. Inter-urban express bus services link Newry and Banbridge to Belfast, Dublin and other main towns. Local town bus services operate in the larger settlements and further services operate in rural areas.

Highways

The RDS emphasised the importance of improving connections between regional gateways, cross-border links and the RSTN, especially the Key and Link Transport corridors.

A Newry Southern Relief Road is proposed as a long term SRI to improve the link from the A1 to the A2 Warrenpoint Road, and consequently provide a better connection from Warrenpoint Port to the Eastern Seaboard KTC and provide Newry City Centre with further relief from through traffic.

Disused Transport Routes

The Plan Area contains a number of disused rail and tramway track beds and the Newry Canal. Those sections of route with potential for future use are identified in Plan Volumes 2 and 3. The potential of these disused routes for the provision of road lines, public transport routes, cycle or walking routes will be assessed during the Plan period. Those could be used for transport or recreational purposes and are protected under Policy AMP 5 of PPS 3 - Access, Movement and Parking, which seeks to ensure that disused transportation routes are not severed by non-transportation land uses.

Open Space, Sport and Outdoor Recreation

As noted above and detailed within Volume 1 of the Area Plan, the Council has a statutory responsibility for provision of public open space, sport and outdoor recreation facilities within the study area, though sports and recreational facilities are also provided by other public and private organisations. Other public agencies also provide and manage a variety of publicly accessible outdoor recreation facilities and open spaces.

The Area Plan acknowledges that open space is not only used for exercise and relaxation purposes. It can also enhance the character of an area and improve the quality of urban life by providing important green lungs, health benefits, and visual breaks from development, reducing flood risk and protecting wildlife habitats in built-up areas. The natural resources of the area provide numerous opportunities for open space, sports and outdoor recreational activities, including Slieve Gullion Forest Park, and Newry Canal and Tow Path. In terms of open space and recreation proposals for Newry, the Plan identifies some opportunities to add to the existing supply of amenity space by protecting existing areas of open space, and zoning others for future Open Space and Recreation Provision.

Education, Health, Community and Cultural Uses

Education, health, community and cultural uses play an important role in maintaining and creating sustainable and cohesive communities. There are a wide range of facilities spread throughout the Plan Area including schools, further education campuses, libraries, hospitals, surgeries, community centres and arts venues.

As outlined in the Area Plan, applications for planning permission for community-related facilities will be considered in the context of prevailing regional planning policy and the Plan Proposals. Unforeseen demands for new community facilities may arise over the lifetime of the Plan. Accordingly, a flexible approach is required in considering such development within settlement development limits in order to make the most effective use of existing facilities, infrastructure, utilities and resources.

5.8.4.4 A Strategic Plan for Greenways (November 2016)

The Strategic Plan for Greenways (Exercise Explore Enjoy) was published in November 2016 by the Department for Infrastructure. It sets out an agreed framework for local authorities to develop and plan for a network of greenways, connecting Northern Ireland’s communities via sustainable routes across the region.

To achieve the aims of this Strategic Plan, the following overarching objectives have been set:

- To improve health and wellbeing by creating opportunities for exercise in developing greenways;
- To increase the areas and populations that have access to and the use of greenways;
- To increase safety for people walking and cycling;
- To improve opportunities for social inclusion and interaction; and
- To provide opportunities for the development of local economies.

There has been some investment in greenways in recent years, although this has been focussed in specific areas. Much of this has been driven at local level and on a cross-border basis through the sustainable transport theme in the INTERREG V programme. The aim of this Strategic Plan is to build significantly on that work and to create an asset which creates local and regional value and benefits.

In line with the commitment set out in the Bicycle Strategy, the former Department for Regional Development (DRD) engaged AECOM, in association with Sustrans, to develop a strategic approach to a shared Greenway Network. The AECOM report, upon which the Strategic Plan is based, provides full details of the development of the network.

The AECOM Report has identified an initial set of routes that should be explored to develop a primary greenway network from which a secondary greenway network could progressively extend. The primary routes will provide long distance connectivity and secondary routes will serve as feeders.

The primary network has been developed to include a number of east-west and north-south spines. In general, these include the main areas of population as well as the major tourist attractions. The north-south spine, via two spurs, connects Derry/Londonderry (and Co. Donegal) and the Causeway Coast to Newry and onwards south via another cross border route. The latter route passes through the current study area.

5.8.5 Baseline Environmental Conditions & Constraints

5.8.5.1 Existing Road Network

Newry City occupies a strategic position on the Eastern Seaboard Key Transport Corridor between Belfast and Dublin, forming a gateway between the Republic of Ireland and Northern Ireland. Due to the city's strategic location, the existing road network is characterised by a series of A-Class roads radiating from the city centre, which include:

- A1 to Lisburn/Belfast;
- A1/N1 to Dublin;
- A2 to Warrenpoint;
- A25 to Camlough;
- A25 to Downpatrick;
- A27 to Portadown; and
- A28 to Armagh.

These A-class roads are interconnected by numerous B-class, C-class and unclassified roads serving not only the sprawling suburban area, but also the many villages, hamlets, farms and individual dwellings throughout Newry's hinterland.

The existing route from Warrenpoint causes a significant degree of severance through the city. Traffic from Warrenpoint travelling towards either Belfast or Dublin (or other destinations) currently accesses the congested centre of Newry via the A2 Warrenpoint Road, which is dualled to Greenbank Roundabout and single carriageway after that. On the approach towards the city, Belfast and Dublin-bound traffic access the congested William Street/Kilmorey Street junction (via A2 Kilmorey Street). Alternatively, Dublin-bound traffic can utilise River Street (which is one-way) to access William Street at a priority junction, adjacent to Dublin Bridge.

From the William Street/Kilmorey Street junction, Dublin-bound traffic utilises the former A1 route through to Cloghogue Roundabout (via A28 Bridge Street and Dublin Road, which includes a climbing lane in part). From the William Street/Kilmorey Street junction, Belfast-bound traffic utilises the former A1 route through to Damolly Roundabout (via the Abbey Way dual carriageway, Upper William Street, Trevor Hill, Downshire Road and Belfast Road).

In terms of congestion, convergence at the William Street/Kilmorey Street junction has attributed to significant traffic management issues, inhibiting access to/from Warrenpoint. As the existing route to Belfast and Dublin occupies part of the road network around the city centre, there are also a number of other locations where congestion and conflict with other traffic, pedestrians and cyclists is also a significant issue, particularly at peak periods.

5.8.5.2 Community Facilities

For the purposes of this assessment, the term 'community facility' ranges from health and social services, to education, arts, culture and religious facilities. It also includes facilities for leisure and social purposes, including community centres, meeting places and halls. Essentially, this definition includes:

- Leisure and culture facilities (including arts, entertainment and built sports facilities);
- Community centres and meeting places (including places of worship, libraries);
- Facilities for children (from nursery provision to youth clubs);
- Education (including adult education);
- Social services;
- Healthcare facilities;
- Service-orientated businesses (i.e. locally-based shops); and
- Public transport facilities.

It is obvious that the vast majority of these facilities are located in the city centre; however, there are a variety of facilities located on the southern periphery of the city (within the Approved Options study area), as shown on Figure 5.8.1. Those of particular note include:

- Fun House;
- Southern Regional College;
- Gerry Brown Park (home of Newry Mitchels GAA);
- Morgan School of Dance;
- Cloghogue Pitch & Putt;
- Church of the Sacred Heart & Cemetery;
- Flagstaff Lodge;
- Newry Golf Academy and Footgolf;
- Rascals Soft Play Centre;
- Laser Quest;
- Puzzles Childcare;
- NorthEast Adventures;
- Newry Ship Canal;
- Flagstaff Amenity Area; and
- Victoria Lock Picnic Site & Amenity area.

This list of community facilities is not exhaustive and does not imply value or importance over and above others which have not been listed above. There are a variety of other facilities (i.e. schools, shops, banks, restaurants, churches, etc.) within the City and its surrounds, providing valuable service to the local community.

5.8.5.3 Public Transport Network

Public transport in and around Newry is facilitated by both rail and bus services.

5.8.5.3.1 Public Rail Services

Translink (in partnership with Irish Rail (Iarnrod Eireann)) operate the cross-border Enterprise Train Service between Belfast Central and Dublin Connolly with a regular timetabled stop at Newry. Local train services also operate from Newry (which essentially forms a terminus on the line) providing connections to the wider rail network throughout the province. There is a Park & Ride facility at Newry Station, which facilitates parking for 334 cars, with disabled parking spaces for 12. There is also provision for bicycle parking and two electric charge points. A town service operates between the train station and Newry Buscentre.

Newry Railway Station is located outwith the immediate Approved Options study area to the north-west of the city at Derrybeg Lane, close to the A25 Camlough Road Junction. The double-track railway, which connects Newry to Dundalk (and onwards to Dublin), is however located within the study area as shown on Figure 5.8.1. Although there are no stops in the study area, the railway line is located to the immediate east of the A1 dual carriageway between Cloghogue and Ellisholding.

5.8.5.3.2 Public Bus Services

The Newry Bus station is located in the city centre at Kildare Street, between the Newry River and Canal. A range of cross-border, inter-urban, local and city bus services operate from this station, including:

- Local City Services with connections to Damolly, Ballyholland, Barcroft, Bessbrook, Carrivemaclone, Camlough, Derrybeg, Drumgullion and Newry Railway Station;
- Local Ulsterbus Services with connections to Belfast, Rathfriland, Kilkeel, Warrenpoint, Armagh, Bessbrook, Crossmaglen, Forkhill, Kilnasagart, Hogan's Bridge, Newtownhamilton, Portadown, Banbridge, and Five Mile Hill;
- Local Bus Eireann Services with connections to Dundalk, Carlingford and Omeath; and
- Inter-Urban/Cross-Border Services (Goldliner and Bus Éireann) with connections to Belfast (via Banbridge, Dromore and Sprucefield), Coleraine (Ulster University), Downpatrick and Dublin (via Dublin Airport).

Primarily the buses which service South Down, South Armagh and cross-border, utilise the existing road network within the study area in some form or other. The roads utilised by these services include:

- A1 Belfast to Dublin Road;
- A28 Dublin Road;
- A2 Warrenpoint Road;
- B79 Fathom Line; and
- Old Warrenpoint Road.

In terms of school bus services, previous consultation with the Education Authority (EA) did not return any detail on services or routes taken by EA or Translink-operated school buses within the study area. The consultation did indicate that EA do have operational interests within the study area and thus there would be potential for impact with scheme implementation. At this stage, it is reasonable to assume that school buses utilise the above roads when servicing local schools. It is also reasonable to assume that such services, particularly the EA buses, may service the adjacent side roads (i.e. Flagstaff Road) as part of their school route.

5.8.5.4 Pedestrian Facilities

Within the city itself, there is an extensive network of footways and signalised crossing points which cater for pedestrian movements to and from the residential areas and local community facilities. Pedestrian movements along and across the existing road network is facilitated by footways of varying widths, with a range of dedicated controlled (i.e. signalised and staggered-signalised) and uncontrolled (i.e. drop kerbs and refuge islands) crossings where footways meet the road network.

There are a significant number of pedestrian journeys along the existing route through Newry, particularly in the vicinity of the Quays and Buttercrane shopping centres. The current congestion in and around the city centre, partially caused by the volume of HGVs to and from Warrenpoint Harbour, heightens the risk of vehicular/pedestrian conflict, as adults and children attempt to cross the street, again mainly between the two shopping centres, and between the main services/commercial thoroughfare of Hill Street and Kilmorey Street. Although such movements are controlled at signalised and pedestrian junctions, it results in a reduction in amenity and safety for pedestrians.

Within the study area, little provision is currently made for pedestrians along the rural roads with many verges being narrow and overgrown, particularly on the western side of the valley (i.e. B79 Fathom Line, Flagstaff Road, Hillhead Road and part of Drumalane Road). There are however, pedestrian footways provided alongside the main roads, including:

- A28 Dublin Road;
- A2 Warrenpoint Road; and
- Old Warrenpoint Road.

In terms of footpaths and walking routes, the Ring of Gullion Way (part of the Ulster Way) lies generally to the west of the study area (as shown on Figure 5.8.1), beginning in the centre of Newry.

Classified as a long distance permissive path, it is a 38-mile waymarked walking route in and around the volcanic landscape of South Armagh and the designated Ring of Gullion Area of Outstanding Natural Beauty (AONB), which uses quiet country lanes and forest tracks as it journeys across the rugged landscape surrounding County Armagh's highest mountain, Slieve Gullion. The Ring of Gullion Way follows the natural geological formation known as ring-dyke formations. The route visits a succession of quiet villages and historic monuments that show the area's rich heritage.

As shown on Figure 5.8.1, there are at least two alleged PROWs located within the study area and one asserted PROW. The first alleged PROW is located on top of the Rampart (Flood Protection Embankment) which essentially forms the eastern bank of the Newry River. It is locally known as the Greenbank Trail and provides a valuable grassed walking route for ramblers from the City towards Warrenpoint. The asserted PROW is located between the Old Warrenpoint Road and the A2 Warrenpoint Road, providing a pedestrian connection to the Greenbank Trail from the residential areas on the eastern side of the valley.

The second alleged PROW is on a short laneway between Hillhead Road and Flagstaff Road and effectively starts where the Hillhead Road has been closed to through movements, south of Drumalane Quarry. It is approximately 530m long.

As part of the new Carlingford Lough Greenway, work has recently been completed on Phase 1 of the scheme from Albert Basin, Newry to the Weir on the Middlebank, a distance of approximately 2.2km. The Middlebank is a thin strip of land between Newry Canal and Newry River, which was previously not easily accessible and was underused by the general public. Construction work on this project started in September 2016 and was completed in January 2017. The section from the Weir to Victoria Lock was scheduled to be completed by December 2017 and was opened to the public in May 2018. These works have provided an upgrade and improvement to the existing pathway. There are new pedestrian crossings at the existing weir and Victoria Lock gates. Phase 2 of the works will run from the weir on the Middlebank to Omeath and from Carlingford Marina to Carlingford, with funding from the EU’s INTERREG VA Programme. When complete, the Greenway will provide a cross-border walking/cycling route over approximately 25km, from Newry City through the villages of Omeath and Carlingford to Greenore. It will also link with the existing Newry/ Portadown Cycleway/Towpath resulting in a total length of 52km of Greenway, allowing an off-road route between Belfast and Dublin on NCN Route 9.

Along the B79 Fathom Line (adjacent to Victoria Lock Amenity Area), a number of Forest Service paths are accessible to the general public. These paths zig-zag through Fathom Forest through to the top of Flagstaff Mountain, giving vista views of the Ring of Gullion, Carlingford Lough and the Mourne Mountains.

5.8.5.5 Cycling Facilities

National Cycle Network (NCN) Route 99 is located to the north of the study area, travelling southwards through the city centre via Canal Quay, Merchants Quay, Margaret Street, Water Street, Mill Street, Hill Street, Kildare Street, William Street, and St Mary’s Street, before heading northward on the Mall to tie-back into Margaret Street. This route is connected to NCN Route 9, which intersects with NCN Route 99 at Erskine Street, west of Newry River. NCN Route 9 is open to cyclists and is signposted between the Queen Elizabeth Bridge in Belfast and Slieve Gullion to the south of the study area. Along the route between Portadown and Newry, is a 20-mile linear stretch of NCN 9 along the western bank of the Newry Canal towpath, which passes Scarva, Poyntzpass and Jerrettspass.

Furthermore, there is a segregated cycle lane adjacent to both sides of the A2 Warrenpoint Road between Greenbank Roundabout and Warrenpoint Roundabout, which forms part of the Mourne Coastal Route.

As mentioned previously, construction has recently been completed on upgrading and improvement of the existing pathway and improved access along the Middlebank and Albert Basin in Newry, as part of the Carlingford Lough Greenway. Phase 1 of the scheme from Albert Basin, Newry to the Weir on the Middlebank was completed in January 2017. In terms of cyclist provision, this scheme includes a shared use high quality off-road cycle and walking greenway of approx. 5.4km. This Greenway will link up with cycle networks on both sides of the border (including the Great Eastern Greenway in Omeath). The Great Eastern Greenway currently terminates at Omeath, approximately 5km south of Victoria Lock. Phase 2 of the works will run from the weir on the Middlebank to Omeath and from

Carlingford Marina to Carlingford, with funding from the EU's INTERREG VA Programme, and will connect the two greenways.

Independent to this scheme, consideration is being given to linking the former Dundalk, Greenore and Newry Railway (in which the Great Eastern Greenway is partly located) to this new shared use greenway, thus providing cycling connection to Newry Canal to Portadown and onwards to Lough Neagh and linking Northern Ireland and the Republic Ireland. Funding has recently being allocated to this project.

Consultation with Sustrans at Stage 2 expressed a desire to ensure the continuity of the Newry / Carlingford / Dundalk cycle route, which (as mentioned above) has recently opened following the canal alignment. They requested that any bridge structure would span the greenway and avoid the infrastructure, including during the construction phase. The bridge should be sensitively designed and offer the potential to create a loop for cycling, linking the greenway to the A2 on the eastern shore of the lough. Sustrans also stated that a cycle route between Newry and Warrenpoint has previously been considered, and that the southern relief road should take this potential route into account during the assessment.

DfI - Cycling Unit, during the consultation process, indicated that it has embraced a commitment to increase the number of journeys undertaken by walking, cycling and public transport. They stated that new transport infrastructure must make sufficient provision for the increase of these types of journey. Walking and cycling should be at the forefront of the design of all new infrastructure schemes and the new relief road should not act as a barrier to walking and cycling.

Any river crossing that is constructed should make provision for a segregated 3m (ideally 4m) wide shared footway / cycleway which is tied in to walking and cycling infrastructure at either side (or can be in the future).

5.8.5.6 Equestrian Facilities

Within the study area, there are two known equestrian facilities. Narrow Water Equestrian Centre is located at Narrow Water Castle, at the southern extent of the study area. This horse riding and trekking centre also incorporates livery facilities and is operated within the grounds of Narrow Water Castle Estate. The centre is open to the public for riding lessons and trekking in the Estate grounds.

A private equestrian facility is also located at [redacted] (Carlingford Horses). This facility is not open to the public, and is used for developing horses. In addition, horses and ponies have been noted in the surrounding fields within the study area, and are exercised on the local road network. Public consultation has confirmed that Hillhead Road, Barracric Road and Flagstaff Road are used as hacking routes, subsequently it can be confidently assumed that other local routes are also utilised by equestrians.

5.8.5.7 Angling Facilities

Newry is located on the banks of the Newry River, and at the head of Carlingford Lough. The Ship Canal runs adjacent to the river for approximately 3 miles from the Albert Basin, south to Victoria Lock, and linked Newry to the sea via Carlingford Lough. All these waters can be used for angling.

For anglers who wish to fish the Ship Canal, several fishing platforms (pegs) have been built along the Newry to Omeath road (B79 Fathom Line), with limited car parking available. There is year round coarse fishing for perch, roach, rudd, bream and pike. Carlingford Lough is a narrow sea lough which provides shore, rock and sea fishing opportunities for a variety of species including tope, sea trout, ray and bass.

As part of the consultation with Newry & District Anglers Association, it has been established that the association operate a fish hatchery at Benson's Glen, adjacent to B79 Fathom Line. The Association also controls the angling rights to 15 miles of river from Newry to just north of Rathfriland.

5.8.5.8 Boating Facilities

As mentioned above, Newry is located on the banks of the Newry River, with the Ship Canal running adjacent to the river. The canal is used by the boating community to access Newry City from the Irish Sea via Carlingford Lough and Victoria Lock, which was automated in 2007. The Albert Basin in Newry City provides mooring facilities adjacent to the Quays Shopping Centre for vessels up to 60m long by 10m wide.

In recent times, the Basin has hosted tall ships as part of festivals, such as Newry City of Merchants, and *Iúr Cinn Fleadh*.

5.8.6 Assessment of Environmental Impacts

5.8.6.1 Operation

5.8.6.1.1 Local Vehicle Movements (Proposed Road Network)

The movement of people and the efficient distribution of goods and services are essential to the functioning of any area. It is the responsibility of the Department for Infrastructure to ensure that:

- the public road network is maintained and improved;
- the road network is developed to improve road safety and traffic management;
- measures are taken to implement the Department's sustainable transportation policy; and
- the most efficient use is made of public car parking spaces.

Any of the route options under consideration would improve road safety for strategic and local road users, remove a bottleneck on the key network where a lack of capacity is causing serious congestion, and improve the environment by relieving the effects of heavy through-traffic in the city centre. Hence local traffic, wishing to access facilities in the city centre, should benefit with the reduction in traffic flows, easier access onto and across the existing road network, possibly resulting in marginally shorter journey times. Traffic should flow more easily along the existing route, and the safety of the highway environment should improve for vehicles, pedestrians and cyclists.

Red Route

The Red Route crosses the Newry River/Canal upstream of Victoria Lock, and would require a new at-grade roundabout junction connecting to the A2 Warrenpoint Road, and a new at-grade roundabout on B79 Fathom Line. Providing a roundabout on the B79 Fathom Line would reduce the free-flow movement for strategic traffic, but would provide an important link to the existing road network, which is of significant benefit to local vehicle movements. From this point, the Red Route would head north-west towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor.

The length of road construction required for the Red Route is approximately 3.84km (including bridge crossing, climbing section and B79 Fathom Line upgrade). This route would require a connection into the existing grade-separated Ellisholding Junction on the A1/N1 Corridor. In comparison, there is little to differentiate between the two crossing points of the Red and Yellow routes and their respective at-grade tie-ins with the A2 Warrenpoint Road and B79 Fathom Line from a local vehicle movement's perspective.

In terms of the local road network, aside from the tie-ins, the Red Route crosses two main roads (B79 Fathom Line and the old A1 Dublin Road) and two minor side roads (Flagstaff Road and Barracric Road), and also crosses some minor accommodation and agricultural access lanes. It is envisaged that several minor side roads and accesses may be stopped-up or linked to nearby side road crossings.

It is expected that there would be some impact on the A2 Warrenpoint Road and B79 Fathom Line as works would be required to accommodate the new roundabouts, though these impacts would be temporary in nature. The Flagstaff Road would be carried over on a bridge structure as the new carriageway would be in cutting at this location. Other side roads/accommodation lanes would then be accessed either from the B79 Fathom Line or from Flagstaff Road; though significant upgrade works may be required to the latter to bring it up to standard.

Yellow Route

The Yellow Route crosses the Newry River downstream of Victoria Lock at Rough Island, and would require a new at-grade roundabout junction connecting to the A2 Warrenpoint Road, a new at-grade roundabout on B79 Fathom Line, and would also require additional localised upgrading/widening of the B79 Fathom Line. A second at-grade roundabout would also be required on the B79 Fathom Line opposite Green Island. From this point, the Yellow Route would head north-west towards Ellisholding

Junction on the A1/N1 Belfast-Dublin Corridor, where a connection into the existing grade-separated Ellisholding Junction would be required.

The length of road construction required for the Yellow Route is approximately 5.23km (including bridge crossing, and climbing section). Providing two roundabouts on the B79 Fathom Line would reduce the free-flow movement for strategic traffic, but provides important links to the existing road network, which is of significant benefit to local vehicle movements. As mentioned above, there is little to differentiate between the two crossing points of the Red and Yellow routes and their respective at-grade tie-ins with the A2 Warrenpoint Road and B79 Fathom Line from a local vehicle movement's perspective.

In terms of the local road network, aside from the tie-ins, the Yellow Route crosses two main roads (B79 Fathom Line and the old A1 Dublin Road) and two minor side roads (Flagstaff Road and Barracric Road), and also crosses some minor accommodation and agricultural access lanes. It is envisaged that several minor side roads and accesses may be stopped-up or linked to nearby side road crossings.

It is expected that there would be some impact on the A2 Warrenpoint Road and B79 Fathom Line as works would be required to accommodate the new roundabouts, though these impacts would be temporary in nature. The Flagstaff Road would be carried over on a bridge structure as the new carriageway would be in cutting at this location. Other side roads/accommodation lanes would then be accessed either from the B79 Fathom Line or from Flagstaff Road; though significant upgrade works may be required to the latter to bring it up to standard.

Blue Route Options

The Blue Route runs west from an at-grade roundabout on the A2 Warrenpoint Road, through Gerry Brown Park, before bridging the Newry River and Canal. The Blue Route then contours the side of Fathom Mountain to the south, before heading towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor. With all Blue Route options, two new at-grade roundabouts would be required; one to link onto the B79 Fathom Line, and the other connecting onto the old A1 Dublin Road. Providing additional roundabouts along the route would reduce the free-flow movement for strategic traffic but would provide links to the B79 Fathom Line and a roundabout on the old A1 Dublin Road, which would be of significant benefit to local vehicle movements. The length of road construction required, including tie-ins, junctions and realignments, with Blue Route Option 1 is approximately 3.20km, and with Options 2&3 is approximately 2.98km, and Option 3 is approximately 2.98km (including bridge crossing and climbing section).

In terms of local vehicle movements, the connection to the A2 Warrenpoint Road in the vicinity of Newry Building Supplies/Gerry Brown Park would necessitate localised realignment of Ballynacraig Way to maintain at a minimum, continued through movements.

Aside from the tie-ins, the Blue Route options cross one main road (B79 Fathom Line) and two side roads (Flagstaff Road and Barracric Road), and connect to the old A1 Dublin Road. They also cross some minor accommodation and agricultural access lanes. As with the Red and Yellow routes, it is envisaged that several minor side roads and accesses may be either stopped-up or linked to nearby side road crossings to maintain continued access and/or through movements, though some re-construction may be required. With all Blue Route options, there would be some impact on the A2 Warrenpoint Road, B79 Fathom Line and the old A1 Dublin Road to accommodate the new roundabouts and junctions; however these impacts would be temporary in nature. The Flagstaff Road would be carried over on a bridge structure as the alignment would be in cutting at this location. Other side roads/accommodation lanes would then be accessed either from the B79 Fathom Line or Flagstaff Road, though significant upgrade works may be required to the latter to bring it up to standard.

5.8.6.1.2 Community Facilities

The change in local vehicle movements described above largely addresses the issue of access, which is of relevance when considering the accessibility of community facilities throughout the study area. It is evident with any of the route options under consideration, the vast majority of roads affected would be maintained to facilitate through movements or subject to localised realignment. Of particular note however, is the fact that all options would provide direct connection to the B79 Fathom Line, which although would hinder the free-flow movement of strategic traffic, would be of significant benefit from a local vehicle movement perspective, effectively opening-up a new connection between Newry, south County Down and north County Louth.

As noted previously, the principal facilities within the community which residents would be travelling to and from on a regular basis, include: Health Facilities, Schools, Library, Shops, Recreation Facilities, Churches, and Public Transport facilities (as shown on Figure 5.8.1). Essentially, the majority of these are located within the city itself. As Newry is a hub on the local and strategic traffic network, significant volumes of traffic would continue to be drawn into the city from all directions. However, relief on some of the urban road network by any of the options under consideration may improve access to community facilities within the city, with a possible reduction in vehicular/pedestrian conflict due to the slight easing of congestion.

The benefits may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass congested areas. Not only may this lead to improved access to community facilities throughout the wider urban area, but also partially reduce the degree of existing community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the roads.

The remainder of this sub-section primarily focuses on direct impacts associated with the scheme upon community facilities in close proximity to it.

Victoria Lock Picnic Site & Amenity Area

With implementation of the Red Route, although there is no direct impact on the Victoria Lock Amenity area, the bridge crossing would be visible to the north, causing a slight reduction in amenity. Subsequently, the impact to the site can be assessed as 'Minor'. There would also be an impact on the Carlingford Lough Greenway, which would pass under the bridge; however this is discussed in Section 5.8.6.1.4 (Pedestrian Facilities), and Section 5.8.6.1.5 (Cycling Facilities).

The Yellow Route would require partial realignment and upgrading of the B79 Fathom Line to improve the standard of the road. Whilst this would not have an adverse impact upon Victoria Lock Amenity area, it would be in very close proximity to it, thus having an adverse Minor impact upon amenity setting, as a result of the introduction of some strategic traffic to an area currently dominated by local traffic movements. The bridge structure would also be visible to the south, again reducing the amenity.

The Blue Route options would have no impact on the Victoria Lock Picnic site & Amenity area.

Gerry Brown Park

In terms of direct impacts, the Blue Route options would directly affect the Newry Mitchels GAC pitches at Gerry Brown Park on Ballynacraig Way. The facilities currently comprise a main pitch, hardstanding parking area, changing rooms and a grassed training area. Implementation of any of the Blue Route options would result in the loss of the community facility at this location. The subsequent impact of the loss of this facility would be Major, unless it can be accommodated or mitigated (i.e. at a viable alternative site).

No other known community facilities would be directly or indirectly affected through to Ellisholding Junction.

5.8.6.1.3 Public Transport Network

Public Rail Services

Each route option would have a direct impact upon the Belfast – Dublin railway line, requiring a new bridge crossing of the line to the north of Ellisholding Junction. The Red and Yellow routes would cross on a skewed alignment, approximately 200m north of the existing Barracric Road bridge.

The Blue Route options would cross on a straight perpendicular alignment, adjacent to the associated roundabout tie-in to Dublin Road. With Blue Route Option 1, this crossing would be approximately 375m north of the existing Barracric Road bridge. Blue Route Options 2 & 3 would cross some 65m south of Blue Route Option 1, approximately 310m north of the existing Barracric Road bridge.

From a rail services perspective, none of the route options would impinge on the usage of the line during the operational phase to any significant degree, with impacts being entirely limited to the construction phase (i.e. possible speed restrictions through the works area). Therefore, the operational phase impact can be considered Negligible.

Public Bus Services

As detailed in Section 5.8.5.3.2, there is a wide variety of public bus services that originate from and pass through Newry, utilising the A2, A28 and other roads which radiate from the south-side of the city centre. With implementation of any of the route options, it is unlikely that bus services would be significantly altered, as the city centre would remain the hub for routes in order to serve the local and wider community. This includes the inter-urban/cross-border services. The city itself is the population centre, and the origin/final destination for a number of services, with the central location being convenient for bus users.

Bus services would continue to utilise the existing road network, though the highway environment would improve for buses, as the southern relief road would achieve separation of a proportion of strategic and local traffic. Essentially, traffic through the city would become more regulated, less congested and bus services should benefit with the reduction in traffic flows; perhaps even resulting in marginally shorter journey times for a number of services. Overall, local public bus services and users would experience a Minor Beneficial impact.

Consultation with Translink has indicated that none of the route options would have a direct impact on the contracted bus network in terms of routes or existing bus stops. Translink also stated during consultation that it is unlikely that the relief road would become part of the bus network in the future. There was no indication given at this stage of a preference of route option from a public bus network perspective.

5.8.6.1.4 Pedestrian Facilities

In line with the first consideration of hierarchies of provision for pedestrians (i.e. traffic reduction), access for NMUs to a wide range of community facilities within the city centre would be slightly enhanced by the redistribution of a proportion of city through-traffic to any of the route options under consideration. The reduction in the volume of traffic passing through the city would result in a Slight Beneficial impact and perceptible amenity improvements for pedestrians within the city centre. In terms of traffic attraction, the Red Route is predicted to attract the most traffic, thus providing marginally greater benefits to NMUs within the city centre than the Yellow Route or Blue Route options.

In terms of predicting changes in journey lengths, it is necessary to calculate reductions in journey length for pedestrians and others using important routes which would be relieved of a significant proportion of their traffic. In the case of Newry City centre itself, no perceptible changes in journey length would be experienced, as although proximal traffic volume would reduce, there are no proposals to modify existing pedestrian facilities with this scheme. Some modification of the road network outside of the city centre may affect pedestrians, particularly in the vicinity of tie-ins of the scheme to the existing road network. This is discussed, below.

Carlingford Lough Greenway

The Red Route indirectly affects the Carlingford Lough Greenway, as the bridge would pass over it, north of Victoria Lock. Whilst the low-level bridge crossing would not have a direct impact on the greenway as a walking through route, it would have a slightly greater adverse impact upon amenity than the higher level crossing associated with the Blue Route options. Strategic traffic would be introduced to the mainline of the Red Route, running adjacent to the Greenway, an area currently dominated by local traffic movements. The impact is Minor/Slight, as the facility would remain open, without hindrance to users, but the setting and tranquillity of the area would be impacted adversely.

Whilst the Yellow Route would not affect the currently constructed elements of the Carlingford Lough Greenway, it has the greatest potential to adversely affect the future development proposals to link it with the existing greenway between Omeath and Carlingford. This may be much more detrimental than the indirect impacts expected with any of the other route options under consideration, and would be considered a Major impact. Elements of the link section between the existing and under construction greenways would be adjacent to the B79 Fathom Line. As the B79 Fathom Line would be locally upgraded, it is likely that traffic flows in the area would increase. Subsequently, the plans for a ‘totally off-road pedestrian link between Newry and Carlingford’ may be affected by the Yellow Route.

The Blue Route options would affect this cycleway by crossing over it at height, and whilst there would be impacts in terms of changes to amenity, the cycleway would be unaffected as a through route, and the impact is considered Slight Adverse.

Forest Service Trails (Fathom Forest)

As mentioned in Section 5.8.5.4, a number of Forest Service paths are accessible to the general public along the B79 Fathom Line. These paths zig-zag through Fathom Forest, with the most easterly of the paths being directly affected by the earthworks of the at-grade tie in to B79 Fathom Line, and the mainline of the climbing section of the Red Route. This would be a Major impact, as these paths would be lost, and the amenity/setting of nearby paths would be adversely affected by the proximity of this route.

The Yellow Route would also affect a number of the paths which zig-zag through Fathom Forest on the lower slopes of Fathom Mountain, resulting in a Major impact on these paths. In particular, the path running adjacent to the B79 Fathom Line would be affected by earthworks associated with the upgrade of the aforementioned road. The amenity setting of nearby paths would also be affected.

The Blue Route options would not affect these paths.

Ring of Gullion Way

The Red Route would traverse the Ring of Gullion Way on the Barracric Road, on a traffic-free section of the walking route, and also an on-road section along the old Dublin Road adjacent to the Belfast to Dublin railway line, north of the tie-in with Ellisholding Junction. It is envisaged that the walking route could be maintained as a through route for ramblers, but accommodation would be required to allow connection for walkers between Barracric Road and Upper Fathom Road, as the current route between these roads is online. With the introduction of a new strategic road link, increased traffic, and increased traffic speeds associated with a road upgrade, on-road pedestrian access would be more hazardous than at present. The impact on this walking route is likely to be Moderate/Major Adverse.

As the Yellow Route is congruent with the Red Route in the vicinity of Ellisholding Junction, the impact on the Ring of Gullion Way on the Barracric Road (traffic-free, green path section), and its existing on-road element which links to Upper Fathom Road via the old Dublin Road is also likely to be Moderate/Major adverse.

The Blue Route options would pass over the existing traffic-free, green path section of the Ring of Gullion Way, adjacent to the Belfast to Dublin railway line, immediately west of the associated at-grade junction with the old Dublin Road. As this crossing would be elevated, it is envisaged that the walking route could remain open at this location. However, as with both the Red and Yellow routes, the existing on-road element between Barracric Road and Upper Fathom Road, along the old Dublin Road is likely to be directly affected. With the introduction of a new strategic road link, increased traffic, and increased traffic speeds associated with a road upgrade, on-road pedestrian access would be unsafe. The impact is likely to be Moderate/Major Adverse.

Greenbank Trail

The Blue Route would traverse an alleged PROW, the Greenbank Trail, located on the Rampart adjacent to the Newry River on its eastern bank. In addition, the Blue Route would also traverse the new Carlingford Lough Greenway on the Middlebank, between the Newry Canal and Newry River. However, since the Blue Route options all pass over these routes at height as part of the bridge crossing of the river and canal, they would not be directly affected as walking through routes. However, each Blue Route option would have a similar localised Minor Adverse impact upon amenity.

Neither the Red nor Yellow Routes would affect the Greenbank Trail.

5.8.6.1.5 Cycling Facilities

National Cycle Network (NCN) Route 99

None of the route options under consideration would have a direct impact upon NCN Route 99, as it does not extend any further south than William Street in Newry City Centre. There may be a slight reduction in traffic flows close to NCN 99 with introduction of any of the route options, such as on William Street, which would have a Minor Beneficial impact.

Carlingford Lough Greenway

Consultation with DfI-Walking & Cycling Unit and Sustrans outlined that the road scheme should be cognisant of the plans and proposals for greenway schemes on either side of the Newry River and ensure continuity of the Carlingford Lough Greenway, which follows the canal alignment. In terms of cyclist provision, the Greenway includes a shared-use high quality off-road cycle and walking greenway of approximately 5.4km. All route options (except the Yellow Route) would affect this cycleway by crossing over it at height, and whilst there would be impacts in terms of changes to amenity, the cycleway would be unaffected as a through route, and the impact can be assessed as Slight/Moderate.

Whilst the Yellow Route would not directly affect the currently constructed/under construction elements of the Carlingford Lough Greenway, it has the greatest potential to adversely affect the future development proposals to link it with the existing greenway between Omeath and Carlingford. This may be much more detrimental than the indirect impacts expected with any of the other route options, and can be considered a Major impact, as elements of the linked section between the greenways proposed would be adjacent to the B79 Fathom Line, which would be locally upgraded as part of the relief road scheme.

Mourne Coastal Route (A2 Warrenpoint Road Cycle Lane)

In terms of local cycling routes, all route options would tie-in with the A2 Warrenpoint Road by way of an at-grade roundabout which in all cases would result in severance of the existing segregated cycle lane (Mourne Coastal Route) adjacent to both sides of this road. Whilst it is not envisaged that the junction would restrict the continuation of cycling movements, it would create new vehicular/cyclist interaction, particularly on the Newry-bound section of the route. This would obviously present a safety issue for cyclists, however in terms of impact, there is very little to differentiate between the route options, as traffic flows on the existing road network either side of the bridge crossing of the Newry River and Ship Canal do not show a large variation. The flows on the A2 immediately south of the Newry River bridge junction for both the Red and Yellow Routes are forecast for the assumed Opening year as 16,653 AADT. The A2 immediately south of the Blue Route options has a predicted traffic flow of 15,204 AADT. Based on these figures, the Red and Yellow routes may result in a slightly higher risk of vehicular/cyclist interaction.

As noted in the consultation response received from DfI – Walking & Cycling Unit, when considering schemes of this nature, there is a real danger that they become a barrier to the movement of people in directions lateral to the scheme while facilitating the movement of motor vehicles longitudinally. This has a risk of creating an obstacle that discourages active travel in the local area.

Greenbank Trail

In terms of impact upon cyclists that utilise the Greenbank Trail (on the Rampart), the Red or Yellow Routes would be preferred as their tie-in with the A2 would not directly affect movements along this route between Newry and Warrenpoint. These route options would also limit the potential for adverse impact upon Sustrans' proposals to improve the existing cycling provision on the A2 by creating a traffic-free, shared-use facility that could tie in to the existing segregated footway/cycleway route at River Street. To achieve this, utilising the Greenbank Trail would be the obvious route taken as it already connects directly to the existing segregated footway/cycleway route at River Street.

5.8.6.1.6 Equestrian Facilities

No equestrian facilities which are known to be open to the public would be directly affected by any of the route options under consideration. However, it is recognised that the potential remains for an impact on private equestrian facilities, particularly on the affected local rural road network, which is used for hacking routes by individuals. Routes may be stopped-up, diverted, or bridged by the route options. There is a similar impact with each route option. Overall, the impact on equestrians is likely to be Minor.

5.8.6.1.7 Angling Facilities

The Red and Blue routes would have an indirect impact on the Newry Ship Canal, as they pass over it at height, affecting the setting and amenity value of the Canal to some extent. Access would not be prevented under the bridge with either route. At this stage, it is envisaged that there would be no direct impact to any existing angling facilities along the Ship Canal, however there would be impacts in terms of changes to amenity, which can be assessed as Slight. The impact with the Yellow Route on angling facilities, although indirect, can also be assessed as Slight.

The Benson's Glen Fish Hatchery off Fathom Line may be indirectly affected, as each route option would either traverse the spring feeding the hatchery or pass close to it. The Red and Yellow routes are likely to have the least impact, and with mitigation measures the impact is considered 'Slight'. However, the Blue Route options, particularly Blue Route Option 1, are likely to have a greater effect, as it crosses the watercourse, resulting in a Moderate impact. Blue Route Options 2 and 3 would pass to the north of the watercourse and the impact is considered Slight.

5.8.6.1.8 Boating Facilities

The Stage 2 Community Consultation Event drew comments from various parties with an interest in boating, and those with a maritime interest, expressing concerns over the potential impacts on accessibility of the Newry Ship Canal and Albert Basin to sailing vessels. Tall ships can require a significant air draft. The vessels can be moored in the Basin during festivals, such as Newry City of Merchants, and *Iur Cinn Fleadh*. Concerns have been raised as to future proofing the Basin to allow such vessels, and privately-owned taller craft continued access. The plans to develop Albert Basin as a park with recreational and tourism potential also highlight the continued use of the ship canal as a feature.

The Red Route would traverse the Newry Ship Canal by way of a low-level bridge crossing, with a clearance of approximately 6m. Whilst the low bridge deck clearance would increase the potential to limit or restrict activities on the canal, it is still envisaged that the vast majority of boating or rowing activities which take place would be unaffected. Again, for the canal to remain navigable for tall ships there is also the requirement to provide a possible bascule section of bridge over the canal, which would provide unrestricted clearance when required. The bridge would also be clear-span with supports/abutments set back from the bank edge, resulting in minimal direct impact upon any angling activities on this section of the canal. The impact on the Newry Ship Canal as a community facility is dependent on whether a bascule section is provided. Without a bascule section, the impact is assessed as Major, but with a bascule section is assessed as Minor.

The Yellow Route only traverses the transitional reach of the Newry River, as the low-level bridge crossing (with a clearance of approximately 5.3m) would be downstream of Victoria Lock. Whilst this would remove any conflicts with rowing or angling activities, it would restrict the navigable passage of the channel to the canal. On this basis, a possible bascule section of bridge may be provided to facilitate unrestricted clearance when required. As with the Red Route, the impact on the Newry Ship Canal as a community facility is dependent on whether a bascule section is provided. Without a bascule section, the impact on the Canal is assessed as Major, but with a bascule section the impact is assessed as Minor.

Each of the Blue Route options would cross the Newry River and Ship Canal on its approach to the B79 Fathom Line, with each of the three options providing approximately 12m clearance of the latter. On this basis, it would not limit or restrict the vast majority of boating or rowing activities that take place on this waterbody. For the canal to remain navigable for tall ships there would be a requirement to provide a possible bascule section of bridge over the canal, which would provide unrestricted clearance when required, however at this stage a bascule section is not currently being considered for the Blue Route options. The bridge would be clear-span with supports/abutments set back from the bank edge, resulting in minimal direct impact upon any angling activities on this section of the canal. The impact on the Newry Ship Canal as a community facility without a bascule section is assessed as Moderate.

5.8.6.2 Construction

The construction phase of the various route options may result in four types of impact:

- Temporary impacts on local vehicle movements on the affected local road network, and particularly in the vicinity of the tie-in locations, as a result of construction activity;
- Temporary impacts upon community facilities and local businesses with regards to accessibility;
- Temporary impacts on the public rail and bus network; and
- Temporary severance or disruption to routes used by pedestrians and cyclists.

These impacts would typically be common to all options. As significant amounts of construction works would be offline, main impacts would be experienced at the tie-in locations to the existing road network. Each option would cause disruption to traffic movements during the construction period, particularly movements on the A2 Warrenpoint Road for all options, and on B79 Fathom Line with the Red and Yellow routes, due to the necessary upgrade of the existing carriageway. Traffic diversions and delays, would have implications on driver stress and travel costs due to possible temporary closures, diversions and increased journey times.

Even with mitigation measures, disruption to traffic movements in the area on a daily basis would have a knock-on effect throughout the wider urban network as traffic may divert away from the area. This may cause traffic flows to slow and build-up in other areas around the city.

Other impacts upon local vehicle movements during the construction phase may result from increases in heavy goods/machinery traffic and temporary traffic management arrangements on the existing road network.

Impact upon community facilities during the construction phase can be a particularly sensitive issue. From an air quality perspective, nuisance may be in the form of excessive dust, generated particularly during prolonged dry periods, and operation of construction machinery, which can emit higher than normal levels of airborne contaminants. These impacts could have significant effects on the usage of proximal community facilities (e.g. Carlingford Lough Greenway). During prolonged dry periods, higher than normal airborne dust levels may pose a problem. This is typical on any project which involves movement of large quantities of earthwork material for road construction. Dust can have several undesirable impacts:

- Health and safety - airborne dust can irritate the eyes and respiratory system;
- Road safety - reduced visibility if dust blows across roads; and
- Nuisance - settling on washing, windows and ledges of surrounding property etc.

Outdoor recreational activities are also sensitive to the impacts of dust. Earthworks are ideally carried out in the drier summer months, however this is the period when outdoor recreational facilities are likely to be used the most.

From a rail services perspective, impacts during construction phase (i.e. possible speed restrictions through the works area) are likely to be similar with any of the route options. At an advanced stage in the design, consultation will continue with Translink to mitigate any potential impacts. Therefore, the construction phase impact can be considered Minor to Moderate.

Bus services through the Newry area could be subject to minor disruption during construction, to a similar extent as other travellers, with associated diversions and traffic management arrangements. Where necessary, bus stops may be temporarily relocated during the construction phase.

Throughout the construction period, disruption to cyclist and pedestrian movements would largely be restricted to where the route options traverse the existing pedestrian and cyclist network, such as the A2 Warrenpoint Road, the Carlingford Lough Greenway and the Ring of Gullion Way in the vicinity of Barracric Road. As noted above, this would include temporary impacts caused by the generation of noise, mud and dust, and the reduced amenity and visual impacts associated with major roadworks.

5.8.7 Mitigation & Enhancement Measures

As the design proceeds, consideration will be given to provision of mitigation measures, which may include:

- facilities for pedestrians, such as at-grade crossings, underpasses, central reservations and footbridges;
- facilities for equestrians, such as crossing sites (where required);
- barriers separating pedestrians from traffic, (these may improve amenity but add to journey length and severance);
- an opening bridge structure should be considered so that the Newry Ship Canal remains navigable for tall ship vessels; and

- facilities for cyclists, such as cycle lanes, or clear signing of alternative routes for cyclists.

The consultation process thus far has also identified a range of proposed mitigation measures which will be given full consideration as the design proceeds.

5.8.8 Residual Effects

As noted earlier, it is not sufficient to assess the magnitude and probability of potential impacts; their significance should also be assessed. The level of significance is to be assigned after consideration of any proposed mitigation (i.e. significance is assigned with mitigation in place allowing for the positive contribution of all mitigation that is proposed). It is therefore the residual effects associated with the route options that are most reflective of what the overall predicted impact would be upon pedestrian, cyclist, equestrian and community facilities.

It must be noted that although the physical severance or alterations to an existing layout due to a road scheme is permanent, the perceived benefits or disbenefits from a new road diminishes with time, as people move in or out of the area affected. Thus, the disbenefits are most evident during construction and in the first few years of operation. As such, it is expected that the adverse and beneficial impacts described below would ameliorate with time in most cases.

5.8.8.1 Local Vehicle Movements (Proposed Road Network)

With scheme implementation, access for all properties in the vicinity of the scheme and users of local roads to community facilities would be maintained for all modes, during construction and operation. During construction some diversions may be utilised, but nevertheless access would be preserved.

Mixing of strategic and local traffic would be reduced, with a significant proportion of strategic traffic (including HGVs) bypassing the city centre, reducing the flow of traffic through Newry. This would make the city more accessible, improving amenity and reducing community severance caused by traffic congestion for Newry residents. Overall, for the strategic user and majority of local road users within the city, the significance of effect is likely to be Moderate Beneficial.

Existing access to Newry would be unaffected, and local traffic would be able to access the Southern Relief Road from B79 Fathom Line and the A2 Warrenpoint Road. However, some local roads would be permanently diverted, or stopped-up, and new access arrangements would be required to facilitate continued local vehicle movements throughout the study area. In terms of accessibility, future amenity and community severance, the significance of effect associated with these changes would be largely neutral.

5.8.8.2 Community Facilities

Potentially, one community facility (Gerry Brown Park) would be lost in its entirety with the Blue Route options as discussed below. In addition, two other community facilities (Victoria Lock Picnic Site & Amenity Area, and Carlingford Lough Greenway) would experience direct or indirect impacts as a result of the scheme; again these impacts are discussed in greater detail below. There is also the potential for impacts on community usage at these sites during the construction phase.

5.8.8.2.1 Victoria Lock Picnic Site & Amenity Area

With the Red Route, the introduction of a new bridge structure to a tranquil area would result in a Minor effect on the setting of Victoria Lock. As there would be no direct impact, a Moderate significance of effect would result.

The Yellow Route would also impact on the setting of this Picnic Area with the bridge visible to the south, as well as introducing a higher traffic flow to the upgraded Fathom Line, adjacent to the site. Although there would be no direct impact on the Victoria Lock Picnic & Amenity area, the bridge crossing would be visible to the south, causing a reduction in amenity. Subsequently the significance of effect to the site is assessed as ‘Slight’ adverse.

The Blue Route options would not impact directly or on the setting of Victoria Lock; therefore the effect is Neutral.

5.8.8.2.2 Gerry Brown Park

With implementation of any of the Blue Route options, the Newry Mitchels GAC facility at Gerry Brown Park would be lost in its entirety. If the facility could be provided at an alternative site, the significance of effect for the Club would be Large Adverse. Without mitigation of an alternative site, the effect would be Very Large Adverse.

5.8.8.3 Public Transport Network

As bus services would continue to use the existing road network, the highway environment would improve for buses, as any of the route options would achieve separation of some strategic and local traffic from the Newry City Centre. On this basis, the significance of effect is likely to be Slight/Moderate Beneficial.

Residual effects on the rail network with scheme implementation would be neutral.

5.8.8.4 Pedestrian Facilities

Whilst the various route options would have minimal impact on pedestrian facilities associated with the existing road network, access for NMUs to a wide range of community facilities within the city centre would be enhanced slightly by the redistribution of some city through traffic to the relief road. As this would result in a Slight Beneficial impact due to relief from existing severance and improved amenity, the significance of effect would be Moderate Beneficial.

5.8.8.4.1 Carlingford Lough Greenway

The Red Route would indirectly affect the Carlingford Lough Greenway, as the bridge would pass over it, north of Victoria Lock. The significance of effect would be Moderate, as the facility would remain open, without hindrance to users, but the setting and tranquillity of the area would be impacted adversely.

Whilst the Yellow Route would not affect the currently constructed elements of the Carlingford Lough Greenway, it has the greatest potential to adversely affect the future development proposals to link it with the existing greenway between Omeath and Carlingford. This can be considered as a Large Adverse significance of effect.

The Blue Route options would also traverse the new Carlingford Lough Greenway on the Middlebank, at a height of approximately 12m. As such, the Greenway would not be directly affected as a walking route; however each Blue Route option would have a similar localised Slight/Moderate Adverse effect.

5.8.8.4.2 Forest Service Trails (Fathom Forest)

The Forest Service paths which zig-zag through Fathom Forest would be lost, and the amenity setting of nearby paths would be adversely affected by the proximity of the Red and Yellow Routes. The amenity setting of nearby paths would also be affected. Both the Red and Yellow Routes would have a Very Large Adverse effect on these paths.

The Blue Route options would have a negligible effect on these paths.

5.8.8.4.3 Ring of Gullion Way

Each of the route options would impact on the Ring of Gullion Way. The significance of effect on this walking route is likely to be Large Adverse with implementation of any of the options. However, depending on mitigation measures as the more detailed design is developed, the impact could be Slight Beneficial, if a traffic-free link could be provided from Barracric Road to Upper Fathom Road.

5.8.8.4.4 Greenbank Trail

The Blue Route options would traverse an alleged PROW, the Greenbank Trail, located on the Rampart adjacent to the Newry River on its eastern bank. However, since the Blue Route options all pass over this route at height as part of the bridge crossing of the river and canal, it would not be directly affected as a walking through route. Each Blue Route option would have a similar localised Slight/Moderate adverse impact upon amenity.

5.8.8.5 Cycling Facilities

5.8.8.5.1 National Cycle Network (NCN) Route 99

None of the route options would have a direct impact upon NCN Route 99, as it does not extend any further south than William Street. There may be a slight reduction in traffic flows close to NCN 99 with introduction of any of the route options, which would have a Minor Beneficial impact.

5.8.8.5.2 Carlingford Lough Greenway

The Red Route would indirectly affect the Carlingford Lough Greenway, as the bridge passes over it, north of Victoria Lock. The significance of effect would be Moderate, as the facility would remain open, without hindrance to cyclists, but the setting and tranquillity of the area would be impacted adversely.

Whilst the Yellow Route does not affect the currently constructed elements of the Carlingford Lough Greenway, it has the greatest potential to adversely affect the future development proposals to link it with the existing greenway between Omeath and Carlingford. This can be considered as a Large/Very Large significance of effect.

The Blue Route options would also traverse the new Carlingford Lough Greenway on the Middlebank. As such, the Greenway would not be directly affected as a cycling route; however each option would have a similar localised Slight/Moderate Adverse effect as a result of the impact on setting.

5.8.8.5.3 Mourne Coastal Route (A2 Warrenpoint Road Cycle lane)

In terms of local cycling routes, all route options would tie-in with the A2 Warrenpoint Road by way of an at-grade roundabout which in all cases would result in severance of the existing segregated cycle lane (Mourne Coastal Route) adjacent to both sides of this road. There is little to differentiate between the route options at this stage, in terms of impact to cyclists on the A2 Warrenpoint Road, and the effect is predicted to be Moderate Adverse. However, at a more detailed design stage, mitigation measures can be developed to reduce the impact to cyclists.

5.8.8.5.4 Greenbank Trail

The effect of the Red or Yellow Routes on the Greenbank Trail would be Negligible, as neither would directly affect movements along this route between Newry and Warrenpoint. The Blue Route options may impact the setting of the trail, but overall the effect would be Slight Adverse, as there would be no direct impact to the facility.

5.8.8.6 Equestrian Facilities

It is recognised that equestrians are active within the study area; however there would be no direct impact upon any known public equestrian facilities. Implementation of any of the route options is likely to have some bearing on equestrian activity in the vicinity, particularly where roads may be stopped-up or diverted. Overall, the impact on equestrian facilities in the area is likely to be Slight Adverse with any of the route options.

5.8.8.7 Angling Facilities

The significance of effect upon angling facilities would be Slight/Moderate adverse with implementation of the Red or Blue Route options, due to the impact on the setting of Newry Ship Canal, and Slight Adverse with implementation of the Yellow Route.

The significance of effect on Benson’s Glen Fish Hatchery would also vary between Slight (for the Red, Yellow and Blue Route Options 2 and 3) and Moderate (Blue Route Option 1) adverse.

5.8.8.8 Boating Facilities

Although there would be no direct change to the Newry Ship Canal with any route option, the indirect impact with a non-opening bridge would be higher than with an opening (bascule) bridge, due to prevention of certain vessels from accessing Albert Basin. For either the Red or Yellow Routes the resulting significance of effect is therefore Slight/Moderate with an opening (bascule) bridge. In terms of the Blue Route options, a Moderate effect with a non-opening bridge would be expected. The higher bridge clearance of approximately 12m with the Blue Route options would cause less hindrance to taller vessels, even if the structure were fixed though the effect of a non-opening bridge would be Large Adverse for tall ships.

5.8.9 Presentation of Key Issues

The key issues associated with the various route options from a Pedestrians, Cyclists, Equestrians & Community perspective are listed below.

- Any of the route options would improve road safety for strategic and local road users, remove a bottleneck on the key network where a lack of capacity is causing serious congestion, and improve the environment by relieving (to some degree) the effects of heavy through traffic in the city centre.

- Any of the route options would result in a reduction of through-traffic in Newry. Hence local traffic, wishing to access facilities in the city centre, should benefit with the reduction in traffic flows, easier access onto and across the existing road network, possibly resulting in marginally shorter journey times.
- With any of the route options, the vast majority of roads affected would be maintained to facilitate through movements or subject to localised realignment.
- All route options would provide connection to the B79 Fathom Line, which although would hinder the free-flow movement of strategic traffic, would be of significant benefit from a local vehicle movement perspective, effectively opening-up a new connection between Newry, South County Down and North County Louth.
- The Red and Yellow Routes would have an adverse impact upon the amenity of Victoria Lock.
- The Blue Route options would result in the loss of Gerry Brown Park at its current location.
- With the Red and Yellow routes, a bascule (opening) bridge would allow the Newry Ship Canal to remain accessible to all boating (including tall ships), rowing and angling activities that takes place on it. The Blue Route options would have an air draft of approximately 12m, allowing a majority of boating traffic to access the Ship Canal.
- In the long-term, there would be no impact upon public rail services with any of the route options. Public Bus Services are likely to benefit with implementation of any of the route options, due to a reduction in strategic traffic using the local road network through the city centre.
- All route options would have an adverse impact on the Ring of Gullion Way in the vicinity of Barracric Road and old Dublin Road.
- The Yellow Route would have the greatest potential to adversely affect the future development proposals to link the Carlingford to Omeath Greenway (i.e. the Great Eastern Greenway) with the Carlingford Lough Greenway (at Victoria Lock) and would also affect a number of the paths which zig-zag through Fathom Forest on the lower slopes of Fathom Mountain.
- All route options would result in severance of the existing segregated cycle lane on the A2 Warrenpoint Road (Mourne Coastal Route).
- No equestrian facilities which are known to be open to the public would be directly affected by any of the route options under consideration.
- The Red and Blue routes would have an indirect impact on the Newry Ship Canal, as they pass over it, affecting the setting and amenity value of the Canal to some extent. However, it is envisaged that there would be no direct impact to any existing angling facilities within the study area.

On balance therefore, provided an alternative location for Gerry Brown Park can be accommodated, the Blue Route options would be preferred from a pedestrian, cyclist, equestrian and community perspective. The accommodation of Gerry Brown Park at an alternative location would likely be a matter for further discussion between the Department, NMDDC, Newry Mitchels GAC and the Down County Board, as part of the Stage 3 process.

5.9 Vehicle Travellers

5.9.1 Introduction

This section of the report addresses the impact of the various route options on vehicle travellers in a two-fold manner. Firstly, the section addresses their views from the road as they travel along, and secondly it addresses the predicted increase or decrease in driver stress levels, as a result of the route options under consideration.

The objective at this secondary stage is to undertake sufficient assessment of the variation in views from the road, landscape character and quality for vehicle travellers when selecting a preferred route. The objective is also to identify the variation in driver stress that would be experienced due to likely causes of frustration, fear of potential accidents, and uncertainty associated with each route option.

5.9.1.1 Views from the Road

'Views from the Road' is defined as the extent to which travellers, including drivers, are exposed to the different types of scenery. In accordance with the requirements of DMRB Volume 11, Section 3, Part 9, Chapter 2 (Stages in the Assessment of Impacts on Vehicle Travellers), aspects that are considered in the definition of 'Views from the Road' are:

- types of scenery or the urban landscape character;
- extent to which travellers may be able to view the scene;
- quality of the urban landscape, as assessed for baseline studies; and
- features of particular interest or prominence in the view.

5.9.1.2 Driver Stress

Driver stress is defined for the purposes of assessment as the adverse mental and psychological effects experienced by a driver traversing a road network. It is normally assessed in accordance with the requirements of DMRB 11.3.9.4 (Assessing Driver Stress) where new or improved routes are assessed against a three-point descriptive scale of driver stress (Low, Moderate and High), though available research suggests that a finely graded assessment of driver stress is rarely justified. Driver stress is caused by a number of factors which can result in discomfort, annoyance, frustration or fear, culminating in physical and emotional tension that detracts from the value and safety of a journey. These factors include road layout and geometry, junction frequency and flows and speeds per lane. The extent of the stress experienced depends on the drivers' ability to cope with such situations. A commuter will find busy rush hour traffic less stressful than a less experienced driver who may not know the route as well.

Frustration is caused by the drivers' inability to drive at their desired speed in comparison to the standard of road. The primary causes of these conditions are congestion (heavy traffic levels such as rush hour), road works causing delays, poor road standards and diversions and junctions. The layout of a junction will affect the driver's stress levels with poor visibility more likely to increase driver stress levels.

Fear is caused by a driver's lack of control in his surroundings. The presence of other drivers, inadequate sight distance and the potential for pedestrians (particularly children) to step onto the road all serve to increase driver stress levels. Bad weather, poor narrow roads, inadequate road surfacing and a high proportion of heavy goods vehicles on the road all contribute to the increasing stress levels. Poor road lighting, road improvement schemes and inadequate road signs for the driver's purposes increase the potential for confusion and increase levels of fear. Route uncertainty is caused primarily by inadequate signage.

5.9.2 Methodology

5.9.2.1 Views from the Road

The assessment of 'Views from the Road' is based on the requirements of DMRB Volume 11, Section 3, Part 9, Chapters 2 & 5. The various route options would be set within a largely rural landscape, the extent to which travellers perceive this landscape varies with the relative level of the road, surrounding ground, and adjacent structures/built form. Therefore the assessment also notes where views are restricted, making allowance for the cumulative effect of these features on the view from the road.

There are four categories, which are used in assessing traveller's ability to see the surrounding landscape:

1. No View – road in deep cutting or contained by earth bunds, environmental barriers or adjacent structures.

2. Restricted View – frequent cuttings or structures blocking the view.

3. Intermittent View – road generally at ground level but with shallow cuttings or barriers at intervals.

4. Open View – view extending over many miles, or only restricted by existing landscape features.

5.9.2.2 Driver Stress

An assessment is made of the various route options, taking into account the impact on driver stress through design characteristics (i.e. junction layouts and respective forecasted traffic and speed variations). Driver stress on the existing road network and with the various route options has been evaluated in accordance with the method outlined in DMRB Volume 11, Section 3, Part 9, Chapter 4 (Assessing Driver Stress). This is based on estimating average peak hourly flow (in flow units) per lane, and average journey speed for the route at that time. For comparison purposes, a car or light van is equal to 1 flow unit, and a commercial vehicle over 1½ tons unladen weight, or a public service vehicle, equals 3 flow units. Table 5.9.1 and Table 5.9.2 below provide a guide to driver stress levels for different levels of flow and speed on dual and single carriageway roads used in this assessment.

Table 5.9.1: Predicted Stress Levels for Dual-Carriageway Roads

Average peak hourly flow per lane (flow Units/1 hour)	Average Journey Speed (km/hr)		
	Under 60	60-80	Over 80
Under 1200	High*	Moderate	Low
1200-1600	High	Moderate	Moderate
Over 1600	High	High	High

*Source: DMRB 11.3.9.4, pp 4/2, Table 2 (*Moderate in urban areas)*

Table 5.9.2: Predicted Stress Levels for Single Carriageway Roads

Average peak hourly flow per land (flow Units/1 hour)	Average Journey Speed (km/hr)		
	Under 50	50-70	Over 70
Under 600	High*	Moderate	Low
600-800	High	Moderate	Moderate
Over 800	High	High	High

Source: DMRB 11.3.9.4, pp4/2, Table 3 (Moderate in urban areas)*

In accordance with DMRB requirements, the assessment has been made for the worst year (2037) in the first fifteen after the assumed 'Opening Year' (2023) for both the 'Do-Minimum' and 'Do-Something' scenarios. An assessment of the Base Year (2017) has also been made to give an indication of driver stress levels under existing conditions.

Traffic data for the driver stress assessment has been extracted from COBA Models prepared as part of the Traffic & Economic Assessment for the route options.

5.9.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. The following table outlines the responses from the Stage 2 consultation in relation to Vehicle Travellers. It should be noted that any relevant responses which were received during the Stage 1 consultation, although not recorded in this Stage 2 consultation table, are considered/addressed within the appropriate technical section.

Table 5.9.3: Summary of formal consultation responses in relation to Vehicle Travellers

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Disabled Drivers Association	10 April 2018 09 May 2018 30 May 2018	-	No response received.
Freight Transport Association	10 Apr 2018 09 May 2018	15 May 2018	FTA's preferred route is Blue Route Option 1 for two main reasons, shortest distance therefore lowest cost (£60m) and most likely to proceed on time and least Environmental impact avoiding ancient woodland thus avoiding likelihood of legal challenges and delays. The removal of up to 5,000 vehicles daily from the centre of Newry and improved journey times to and from Warrenpoint would be welcome to FTA members transporting goods to and from the Port and wider area of South Down. Some concerns surrounding the gradient and the bridge crossing over the Newry Ship Canal. The gradient of the proposed route when climbing the side of Fathom Mountain will be 6%, a gradient that TNI stressed they can just about achieve and within a reasonable gradient for HGVs. Several members have stressed the need for HGV's, especially those laden with max weight up to 44,000kg, to be able to build up momentum prior to the gradient climb, therefore any roundabout should not be situated at the base of any climb, but instead further back to enable HGVs to gain momentum engine speed in order to climb the hill at a safe and efficient speed. If HGVs struggled to climb Fathom Mountain efficiently and with increased fuel use (a key driver KPI in haulage sector), they could choose to drive through the current route via the city centre, something we wish to avoid at all costs. Also concerned that increased costs applying to Opening Bridge would place scheme in jeopardy.
PSNI – Road Policing Development Branch	10 Apr 2018 09 May 2018	-	Combined response received.
PSNI – Road Policing Unit	10 Apr 2018 09 May 2018	17 May 2018	Welcome NSRR plans due to benefits for pedestrians and cyclists. Would favour Blue Options as it provides ready access to the Industrial Estate and A1 bypass without a long detour. Feel that the longer Red and Yellow Options may dissuade hauliers from using the new road.
Road Haulage Association	10 April 2018 09 May 2018 30 May 2018	-	No response received.

5.9.4 Regulatory & Policy Framework

There is no legislation or local planning policy considered pertinent to the assessment of Views from the Road or Driver Stress. The assessment has therefore been undertaken entirely in accordance with the guidance described within DMRB 11.3.9 (Vehicle Travellers).

5.9.5 Baseline Environmental Conditions & Constraints

5.9.5.1 Views from the Road

The existing vehicle travellers' route from the A2 Warrenpoint Road (through to the A1) passes along A2 Kilmorey Street, A28 Bridge Street and A28 Dublin Road. When travelling north on the A2, the traveller achieves long distance and picturesque open views of the valley, which encompasses the Ring of Gullion Area of Outstanding Natural Beauty (AONB) to the west, and the Mourne AONB to the east. To the west, the Newry River and its associated mudflats are visible, with the woodlands on the flanks of Fathom Mountain rising beyond. Development is widely scattered on both sides on the valley, but becomes more visible on the approach to Newry itself, with a small cluster of houses approximately level with Green Island. Closer towards Newry, residential development becomes more prominent, particularly to the east from the junction with Old Warrenpoint Road.

As the vehicle traveller approaches Greenbank Roundabout, the views to the west become more medium in distance, and the view up the valley is distracted by the industrial and commercial units within the industrial estate. The Newry River can no longer be seen. Continuing north, the views gradually reduce in length as the vegetation is more established on both sides of the road, providing a barrier to views of the Greenbank Industrial Estate, and to housing developments to the east of the carriageway.

In the vicinity of the A2 Greenbank Roundabout, views once again open-up, but are dominated by short to medium distance views of commercial and industrial units, as well as stadium and sports infrastructure, the cemetery at St Mary's Church, and St. Mary's High School.

At A2 Kilmorey Street, the views become restricted and short distance. To the west, a small wall and scattered trees line the wide footway/cycleway, while to the east; office building developments are set back from the road. On the approach to Bridge Street, older terraced buildings front onto the road, and views to the west open-up towards the river.

Along Bridge Street, the views remain much more restricted and are mostly short distance and characterised by commercial properties which front onto the road. From A28 Dublin Road, the views for vehicle travellers open-up to a degree, and are again more suburban in nature, with a mix of individual residential and commercial properties, and some residential developments set back from the road. To the east, a wide range view opens-up across the valley over a short distance. There are areas of mature trees and gardens lining sections of the existing route.

The existing vehicle travellers' route through Newry when travelling in a general south-westerly direction (from Damolly Roundabout) is along the Downshire Road, Trevor Hill, Upper Water Street, Abbey Way, William Street, Bridge Street and then onto Kilmorey Street. The views along Downshire Road are typically short and medium distance and suburban in nature, characterised by a scattering of residential, commercial and occasional community facilities directly accessed from the road. There are areas of mature trees and gardens lining sections of the route.

From Sandy Street Roundabout at Trevor Hill, the views experienced from the main route through the city are restricted and are mostly short distance, characterised by commercial properties which front onto the eastern side of the road. To the western edge of this road is the Newry River, which allows longer views towards Basin Walk (and the City Hall). Along Upper Water Street, views are restricted by a wall to the east, and commercial properties to the west. The view widens towards Abbey Way, and views of Newry Cathedral and Bagenal's Castle are afforded from the road to the west and east respectively. At the William Street Junction, the view opens-up with Camlough Mountain, and the mixed development on Newry City to the west can be seen in the distance.

5.9.5.2 Driver Stress Levels

There are many factors contributing to driver stress on the existing road network through Newry, with significantly heightened stress levels likely to be experienced at various times of day, not just during peak hours.

In terms of frustration, there are a number of factors such as the driver's inability to achieve desired speed, high levels of congestion, high number of junctions and uncertain journey time duration. For traffic travelling to Warrenpoint from the Dublin direction, stress levels on the existing route from Cloghogue Roundabout through to the A2 Warrenpoint Road is deemed to be a mixture of 'High' and

‘Medium’ stress levels, resulting from the heavily trafficked and congested single carriageway A28 Dublin Road, where traffic regularly backs-up from a network of dense and closely spaced junctions in the city centre. This frequently causes long tailbacks on the A28 Dublin Road, with many local motorists seeking alternative routes (rat-runs) through residential areas to avoid prolonging their journey time. Once beyond the A28 Dublin Road, traffic on the existing route must negotiate four signalised junctions and one pedestrian controlled junction, not only facilitating access throughout the city centre, but also to the two main shopping centres (Buttercrane and The Quays). The convergence of traffic wishing to access the shopping centres contributes greatly to congestion and poses a major hindrance to through traffic. Beyond the shopping centres, through-traffic converges on the heavily congested William Street/Kilmorey Street junction (the main merging point of all A2 Warrenpoint Road bound traffic) and as a result, is an inherently a ‘High’ stress congested bottleneck on the road network. Although a major traffic management scheme upgraded this junction from a roundabout to a signalised junction and allocated Warrenpoint bound traffic two dedicated right turning lanes, congestion and consequently driver stress still remains a major issue, particularly as the two lanes quickly merge into a single lane just beyond the junction. Once past the Greenbank Roundabout, on the A2 Warrenpoint Road itself, stress levels are ‘Low’.

For traffic travelling from the Belfast direction, stress levels on the existing route from Damolly Roundabout to the A2 Warrenpoint Road is also deemed to be ‘High’, particularly at peak periods. However, the standard of road on this route, particularly on the dualled Abbey Way section, may reduce the severity of stress levels experienced, in comparison to the route from the Dublin direction. It is not until traffic converges on Abbey Yard and William Street/ Kilmorey Street signalised junctions, does congestion become a major issue, with long tailbacks typical from both junctions. As mentioned previously, a major traffic management scheme upgraded both junctions, particularly benefiting Warrenpoint bound traffic. The main route to the A2 Warrenpoint Road, through the William Street/Kilmorey Street junction, incorporates a dedicated filter lane for left-turning traffic which gives way to vehicles from the right. However, the filter lane is short in length and traffic build-up from the priority junction quickly blocks access to the lane, increasing driver frustration. The signalised Abbey Yard junction does offer an alternative, as traffic can turn left at this junction through a dedicated filter lane onto Boat Street and then onto Cronin Park or Quay Street to access the A2 Warrenpoint Road. Stress levels associated with this link would be deemed ‘Medium’, especially in regard to aggressive driving to beat other traffic onto the A2 Warrenpoint Road, and on-street parking hindering through movements.

Once traffic from either the Dublin or Belfast direction converges at the William Street/Kilmorey Street junction, traffic flows relatively smoothly towards the Greenbank Roundabout, although the volume of traffic is relatively high.

In the opposite direction, frustration for traffic from Warrenpoint (including traffic from the residential areas to the south of Newry) is also a significant issue, again particularly at the William Street/A2 Kilmorey Street junction. Mainly due to a lack of route alternatives (particularly for Dublin bound traffic), build-up of traffic at this junction, especially during peak hours, contributes significantly to high driver stress levels, with tailbacks onto the dual carriageway section of the A2 Warrenpoint Road a common feature of the morning rush hour period. High congestion levels during peak periods, forces motorists to seek alternative routes, particularly for Belfast bound traffic. This is a particular issue on the Old Warrenpoint Road, Chapel Hill, Chapel Street and Boat Street through to Abbey Yard. The Old Warrenpoint Road is not only utilised to provide an alternative access route to Abbey Yard, but also to provide priority access to Greenbank Roundabout over traffic on the dual carriageway, which again serves to further increase driver stress for dual carriageway users.

For Dublin bound traffic, the current route beyond the William Street/Kilmorey Street junction again must negotiate the heavily congested junctions in the vicinity of the two shopping centres. However, once on the A28 Dublin Road, a climbing lane in part allows for comparatively freer-flowing traffic and somewhat reduced levels of stress.

For Belfast bound traffic, the current route beyond the William Street/Kilmorey Street junction must also negotiate a series of relatively congested junctions, however, again the standard of road on this route, particularly on the dualled Abbey Way section reduces the severity of stress levels experienced, in comparison to the route to Dublin.

Heightened fear levels also contribute greatly to driver stress on the existing route, again particularly in the vicinity of the two shopping centres. Significant at-grade pedestrian movements take place across Bridge Street between the two centres, with high numbers typically congregating on the various islands in the junction, coupled with a heightened risk of pedestrians stepping onto the road out of turn. This is also an issue at some of the other junctions along the existing route, but particularly at this junction.

Route uncertainty is also a significant issue with the existing route, and contributes to higher stress levels for both local and non-local motorists. Unfamiliarity with the urban road network, confusing signage and the high number of intricate junctions all serve to increase driver stress, not only for the non-local but also the motorist who knows their route but are hindered by the activities of the uncertain road user.

5.9.6 Assessment of Environmental Impacts

5.9.6.1 Views from the Road

5.9.6.1.1 Red Route

The bridge structure associated with the Red Route would afford views both up and down the river corridor between both the Ring of Gullion and Mourne AONBs. The main view from the bridge when travelling in an east-west direction would be north towards Newry. There would be a direct view towards Fathom Mountain as the road bridges over the Fathom Line.

The main view from the bridge when travelling in a west-east direction would be downstream and beyond towards Carlingford Lough. There would also be a direct view straight ahead towards the Warrenpoint Road/Greenan Road Local Landscape Policy Area (LLPA) with the Mourne Mountains in the distance.

5.9.6.1.2 Yellow Route

The bridge structure associated with the Yellow Route would afford views both up and down the river corridor between both the Ring of Gullion and Mourne AONBs. The main view from the bridge when travelling in an east-west direction would be north towards Newry. There would be a direct view towards Fathom Mountain as the road bridges over the Fathom Line, and towards Narrow Water.

As with the Red Route, the main view from the bridge when travelling in a west-east direction would be downstream and beyond towards Carlingford Lough. There would also be a direct view straight ahead towards the Warrenpoint Road/Greenan Road Local Landscape Policy Area (LLPA) with the Mourne Mountains in the distance.

5.9.6.1.3 Blue Route Options

When travelling from east to west across the river, the forward view would be directly towards Fathom Line, the slopes of Fathom Mountain, and Drumalane Quarry. To either side of the bridge, the Greenbank Industrial Estate, the Newry River and Canal would be seen.

On the western valley side, the road would then travel south, before sweeping to the west, travelling on embankment and opening-up views of the Newry River valley to the east, and views of the mountainside and some ribboning development along Flagstaff Road.

When travelling from west to east, the main views would be of the Newry River Valley, and the Newry Estuary, before the road starts to orientate towards Newry City itself in the distance.

5.9.6.2 Driver Stress Levels

Each of the route options would provide a better connection from Warrenpoint Port to the Eastern Seaboard Key Transport Corridor. Moreover, it would provide Newry City Centre with further relief from through traffic, and on this basis, drivers either bypassing Newry, or driving through the city centre, would experience a less stressful journey. The increase in traffic flows from the Baseline (2017) condition to the Do-Minimum (2037) situation would result in some change to the driver stress experienced over some links within the city. In particular, there would be an increase in stress from ‘Moderate’ to ‘High’ along parts of Bridge Street, The Mall and Sugar Island.

5.9.6.2.1 Red Route

The Red Route is predicted to attract the most traffic to the Southern Relief Road than the other approved options. The mainline of the Red Route would have a 'Low' driver stress level over its entire length. As with the other route options, new junctions would be designed to appropriate standards and as such, would provide a comfortable transition between the southern relief road and the adjoining roads, again resulting in reduced driver stress. Driver stress levels for the associated minor roads (i.e. Fathom Line, Flagstaff Road), is unlikely to be significantly affected and therefore would continue to be assessed as 'Moderate' to 'Low'.

Within the City, the impact of the Red Route would be beneficial, with a reduction in stress levels from 'High' to 'Moderate' for a number of links, along the William Street, Bridge Street, Dublin Road route to the A1. Unlike the Yellow and Blue Route Options, there would be no perceived improvement in driver stress on Kilmorey Street.

5.9.6.2.2 Yellow Route

The Yellow Route is predicted to attract the least amount of traffic to the Southern Relief Road of all the route options. However, as with the other options, the reduction in traffic through the city with implementation of the scheme would result in a reduction in driver stress from 'High' (Do-Minimum situation) to 'Moderate' over a number of links, including Kilmorey Street and some sections of Bridge Street. Unlike the Red and Blue Route Options, the Yellow Route would not result in an improvement in Driver Stress along any section of the Dublin Road.

The Yellow Route itself would be designed to appropriate standards allowing driver stress to be classified as 'Low', including the tie-in locations to the existing road network.

5.9.6.2.3 Blue Route Options

Blue Route Options 1, 2 and 3, located closer to the City, are forecasted to remove more traffic from Newry urban area than the Yellow Route, due to their proximity to the main road network and residential areas. As with the other route options, new junctions would be designed to appropriate standards and as such, would provide a comfortable transition between the Southern Relief Road and the adjoining roads, again resulting in reduced driver stress. Therefore driver stress levels would be assessed as 'Low' for the Blue Route itself and for the main connecting roads, irrespective of the option chosen. Driver stress levels for the associated minor roads (i.e. Fathom Line, Flagstaff Road), is unlikely to be significantly affected and therefore would continue to be assessed as 'Moderate' to 'Low'. In terms of the Blue Route Options, there would be no significant differentiation between the three routes although subjectively, driver stress levels might be slightly higher with Blue Route Option 3 as it entails a slightly steeper gradient with a greater likelihood of 'platooning' on the hill climb section at 8%. The stress level at the tie-in to Ellisholding junction is predicted to be 'Low'.

Driver stress levels within the city would reduce but would remain between 'Moderate' and 'High' in some locations due to the high volumes of traffic that would continue to be attracted to the city centre, in combination with the road network (i.e. sequence of at-grade signal controlled junctions) that would be encountered. The introduction of a Blue Route would reduce Driver Stress on Kilmorey Street, as well as some sections of the Dublin Road and Bridge Street, from 'High' to 'Moderate'. Overall, the Blue Route options would marginally result in the greatest improvement in Driver Stress, when compared to the Red and Yellow Routes.

5.9.6.3 Construction

5.9.6.3.1 Views from the Road

In terms of views from the road during construction works, the structures, site clearance and earthworks are among the more visible operations. Some views could be deemed to be unsightly as it would take time for amenity planting on embankments and cuttings to establish. However, as the majority of works for the scheme would be offline, impacts to strategic vehicle travellers would be restricted mainly to the tie-ins with the existing road network. Nevertheless, any impacts to the vehicle traveller are transient, as they pass through the area to their destination.

Construction of any of the route options would result in a moderate transient alteration in views from the existing road as the works are mostly offline. Likewise, the concentration of workers, construction machinery and associated materials would all alter localised views in the short-term. The Temporary Traffic Management (TTM) measures at the tie-in points may also potentially impact upon views, as they may require routes through the scheme area to be altered during construction of various elements, varying the views available.

It is likely that the moving and changing elements would be of greatest visual interest during the construction period; as such, elements would potentially catch the attention of the vehicle traveller.

5.9.6.3.2 Driver Stress

During the construction phase, additional transient stress would be unavoidable as a balance is required between maintaining the flow of traffic and safely/efficiently constructing the scheme itself.

Aspects of construction activity would inevitably have an impact upon stress levels experienced, due to increased frustration for drivers, resulting from delays caused by traffic management measures, and uncertainty and fear for drivers caused by roadworks (narrow lanes, speed restrictions, signage etc.).

Traffic diversions and delays would have implications on driver stress and travel cost due to possible increased journey times. Principally, disruption would be created at crossover points and tie-ins with the local road network. In particular, the construction of the at-grade junction arrangement on the A2 Warrenpoint Road is likely to cause the greatest degree of disruption for strategic traffic with implementation of any of the route options. Other roads (e.g. Old Warrenpoint Road) may be indirectly disrupted by the scheme due to traffic diversions. For the local road user, the most significant impact would be accessibility across / to the strategic route during construction. As the bridge structure and the majority of road construction is predominantly offline, there is unlikely to be a major impact on existing roads at locations other than tie-ins.

The upgrades to the B79 Fathom Line, with both the Red and Yellow Routes, would affect mainly local traffic during the works. It may be necessary for local traffic to cross an active construction site which may require traffic control and temporary diversions. The impact on the B79 Fathom Line would be less significant in terms of traffic disruption with the Blue Route Options, as the existing road would be bridged, and an offline tie-in created between the new route and the existing road network.

In terms of construction of the scheme, substantial quantities of materials would need to be imported or repositioned throughout the construction site irrespective of route option. However, it would be greatest with the Yellow Route and then the Red Route. This would result in a significant increase in the number of heavy goods vehicles (HGVs) within this area. It is envisaged that during the construction phase even though there would be some change to the characteristics of traffic movements in the area, stress levels would be forecasted as ‘High’.

5.9.7 Mitigation & Enhancement Measures

5.9.7.1 Views from the Road

In terms of views from the road, typical mitigation for route options of this nature would involve rock cuttings being left with the natural rock as a feature. Views from the road would be retained and enhanced where appropriate. It would be desirable to have open parapets on the bridge crossing of the intertidal area to allow views from the road along the Newry River valley, and to reduce the mass of the structure. Signage and any overhead gantries should also be sensitively located in this rural environment.

5.9.7.2 Driver Stress

As all route options would provide a better connection from Warrenpoint Port to the Eastern Seaboard Key Transport Corridor and provide Newry City Centre with a certain degree of relief from through traffic, then drivers either bypassing Newry, or driving through the city centre, would experience a less stressful journey. This in itself is a form of mitigation. The scheme design would allow consistent speeds to be achieved, provide adequate sight distances, reduce interaction between the vehicle user, and non-vehicle user, and provide adequate signage. All of these are forms of mitigation to reduce driver stress.

With any of the route options, the negative impacts requiring mitigation would be primarily experienced during the construction phase. Adverse impacts on driver stress would be controlled by ensuring construction traffic uses routes identified in the Contract and adequate warning is provided to road users (through possibly the media and using signage) and this would help reduce driver stress by being aware of issues in good time, which would enable alternative planning of journeys if required.

Careful attention to traffic management would minimise the overall level of disruption. Mitigation measures may include:

- advanced publicity outlining the traffic management proposals and duration, and giving advance warning of specific Traffic Management Measures;
- reduced lane widths;
- efficient phasing of contra flow operations; and
- adequate advance signing of the works.

These measures, designed to reduce delays to strategic and local traffic, should reduce traffic rat-running on the local road network. During construction, all temporary road layouts would comply with the standards outlined in Chapter 8 of the Traffic Signs Manual and the DMRB.

5.9.8 Residual Effects

5.9.8.1 Views from the Road

In terms of views from the road, there is little to differentiate between the various route options, as each would open-up new and interesting views to the vehicle traveller, within a scenic area. However, the slightly more elevated position of the bridge structure associated with the Blue Route options would give a wider view over the Ring of Gullion and Mourne AONBs, and Newry City itself.

5.9.8.2 Driver Stress

In terms of impact upon Driver Stress with any of the route options under consideration, the significance of effect is likely to be Slight Beneficial to vehicle travellers. There is little to differentiate between the route options.

5.9.9 Presentation of Key Issues

The key issues associated with the route options from a Vehicle Travellers perspective are listed below:

- New and interesting views would be opened-up by any of the route options under consideration.
- Currently, driver stress levels through the affected part of Newry are assessed as ‘High’, and would be expected to reduce for those travellers that would utilise the new southern relief road. The removal of traffic from the existing route through Newry would be highest with the Red Route.
- Any of the route options should improve road safety, with a reduction in strategic traffic/pedestrian conflict.
- From a driver stress perspective, any of the Blue Route options would be preferred as they would reduce driver stress over a slightly wider network than the Red and Yellow Routes.

5.10 Road Drainage & the Water Environment

5.10.1 Introduction

Modern roads are designed to drain freely to prevent build-up of standing water on the carriageway whilst avoiding exposure to or causing flooding. Therefore contaminants deposited on the road surface are normally quickly washed off during rainfall. Pollution from road drainage can arise from a variety of sources, including accidents, general vehicle and road degradation, incomplete fuel combustion, small oil or fuel leaks and atmospheric deposition. Research has shown that pollution impacts from routine runoff on receiving waters appear to be broadly correlated with Annual Average Daily Traffic (AADT); however, the traffic flow below which potential pollution impacts are insignificant is not clear.

Where traffic levels are high, the level of contamination and hence the potential for unacceptable harm being caused to the receiving waters, increases. Although there are many circumstances in which runoff from roads is likely to have no discernible effect, a precautionary and best practice approach indicates the need for the assessment of the possible impact from proposed major road improvements, such as a relief road to the south of Newry.

Essentially, operation and construction of any of the approved route options should consider the potential for non-conformance with the EU Water Framework Directive (WFD) The Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU, established a new integrated approach to the protection of the water environment. The Directive is transposed in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. Directive 2013/39/EU is transposed through The Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015 and must ensure that:

- the need for the avoidance and reduction of impacts on the water environment is taken fully into account in the environmental evaluation; and
- the selection of appropriate means of preventing any significant predicted impact is made through modification of the drainage design, choice of discharge location(s) and/or adoption of runoff treatment methods, with the objective of designing-out potential adverse environmental impacts.

At this stage in the assessment process, the means by which avoidance and reduction of impacts on the water environment is taken fully into account in the environmental evaluation is through the preferred route selection process.

Designing-out potential adverse environmental impacts (i.e. through modification of the drainage design, choice of discharge location(s) and/or adoption of runoff treatment methods) is more relevant to the latter stages of the design and route refinement process, and is not considered in this assessment.

5.10.2 Methodology

The Design Manual for Roads and Bridges (DMRB) is the standard document for use in the UK for the assessment of impact from road schemes. This assessment has been carried out in accordance with DMRB 11.3.10 - Road Drainage and the Water Environment (HD 45/09).

Chapter 6 of DMRB 11.3.10 gives guidance on the appropriate level of assessment to be used when considering the potential impacts from routine runoff, spillages and flooding arising out of road construction, operation and maintenance projects. Following the overall approach (as set out in DMRB 11.2.5) the level of assessment is generally related to the risk, however, for this subject the four key areas of assessment (surface water, groundwater, spillage and flood risk) have different requirements for scoping, simple and detailed assessments.

The overall objective is to define the depth of assessment necessary to enable informed decision-making at as early a stage of the project as possible. The principal aim is to indicate whether there are likely to be significant impacts associated with the approved route options under consideration.

At this secondary stage, the undertaking of a Scoping level assessment is essential. The approach has been designed to be proportionate; consequently, the level of assessment also depends upon the potential for impacts to occur (i.e. routine runoff, spillages, flooding), and this in turn depends upon the scale of the proposed road project, the site and local circumstances, and the location of sensitive receptors (i.e. designated sites, salmonid fisheries, floodplains).

The procedure for assessing impacts within DMRB 11.3.10 does not identify a specific methodology for undertaking a Stage 2 assessment of the advantages/disadvantages and constraints associated with the route options under consideration. Accordingly, a methodology has been adapted from DMRB and other relevant guidance (i.e. NIEA – Water Management Unit (WMU) Guidance Note ‘Carrying out a Water Framework Directive (WFD) Assessment on EIA Developments’ (March 2012) and NIEA – Water Management Unit (WMU) Guidance Note ‘EIA Scoping Guidance for Road Schemes Likely to Impact upon the Water Environment’ (January 2012)). This has been tailored to the characteristics of the project at this stage and carried out to an appropriate level of detail, related specifically to the degree of environmental risk associated with each route option.

The assessment requires an appreciation of the proposed works and some knowledge of the landscape, hydrogeology and drainage pattern and process in which the approved route options are located. An assessment is required when there is potential for the scheme to adversely affect water quality, flood risk or spillage risk. Therefore with reference to DMRB 11.3.10.6, if the answer to any of the following is ‘yes’, some form of assessment is necessary:

- Will the scheme affect an existing watercourse or floodplain?
- Will the scheme change either the road drainage or natural land drainage catchments?
- Will the scheme lead to an increase in traffic flow of more than 20%?
- Will the scheme change the number or type of junctions?
- Will the scheme impact on an indicative floodplain?
- Will the scheme result in earthworks’ sediment being carried to watercourses? and
- Will the scheme allow drainage discharges to the ground?

Where these scenarios definitely are not the case, no further assessment will normally be required (after consultation with the relevant statutory bodies).

5.10.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints, or particular requirements during the assessment process. The following table outlines the responses from the consultation in relation to Road Drainage and the Water Environment.

Table 5.10.1: Summary of formal consultation responses in relation to Road Drainage & the Water Environment

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Marine and Fisheries Division	09 Apr 2018 09 May 2018	17 May 2018	Concerns with the proposal for a bridge over the Newry River particularly the yellow option very close to Narrow Water. Given the current discussions around the possible designation of Narrow Water as a SWPA. There were previous problems and issues with the Narrow Water Bridge that progressed to the stage where a marine licence was issued but construction never went ahead due to funding issues, there were problems with access for fishing vessels raised by DARD Fisheries colleagues at the time. The Yellow and Red Routes are within close proximity to the Newry Canal and the Newry River which are designated and are hydrologically connected to national, European and international

			designated sites, Carlingford Lough ASSI, which is declared under the Environment Order (Northern Ireland) 2002, Carlingford Lough MCZ which is designated under the Marine Act (Northern Ireland) 2013, Carlingford Lough SPA and Carlingford Marine pSPA which are designated under the EC Birds Directive (79/409/EEC on the conservation of wild birds) and, Carlingford Lough Ramsar Site which is designated under the Ramsar Convention. Recent advice, relating to SACs which have seals as a site selection feature, recommends the following ranges should be used when screening for either Harbour or Grey Seals, all SACs within 135km of the project should be screened for Grey Seals (*Halichoerus grypus*) and all SACs within 50km should be screened for Harbour Seals (*Phoca vitulina*).
DAERA – NIEA Water Management Unit	09 Apr 2018 09 May 2018	17 May 2018	Provided comments and advice on the key environmental considerations for the Environment, Marine and Fisheries Group within DAERA. Marine Plan Team stated that all four options under consideration, ‘affect or might affect’ the marine area. Therefore, the department should be aware that the body/bodies making the authorisation decisions in relation to this scheme are legislatively required to ensure that that they do so, in accordance with the UK Marine Policy Statement (UK MPS) and the Marine Plan for Northern Ireland (when adopted). Marine Licensing Team note that the Department should aware that all construction or deposition works below the Mean High Water Spring Tide (MHWST) mark are subject to licensing under the Marine and Coastal Access Act 2009, as elements of the construction in this proposal may be on/in or above the licensable area. Marine Strategy Team has concerns with the proposal for a bridge over the Newry River particularly the yellow option very close to Narrow Water. Given the current discussions around the possible designation of Narrow Water as a SWPA. Conservation & Reporting Team note that the Yellow and Red Route options are within close proximity to the Newry Canal and the Newry River which are designated and are hydrologically connected to national, European and international designated sites. In accordance with Regulation 43(1) of the Conservation (Natural Habitats, etc.) (Northern Ireland) 1995 (as amended), the Competent Authority will need to assess how these works, either alone or in combination, are likely to have a significant effect on the Natura 2000 sites, in particular Carlingford Lough SPA, Carlingford Marine pSPA and Murlough SAC. The HRA for this project will need to assess that there will be no significant impact on the site selection features of the Natura 2000 sites in particular Harbour seals. Inland Fisheries have no comment to make but advise that Loughs Agency should be consulted in relation to

			potential impacts on fisheries interests.
DfI – Rivers	09 Apr 2018	14 May 2018	Specific interest in ensuring that any works impacting on the water environment take note of best practice methods. It is important that the gradient, width and alignment of the current channel are maintained, and that the channel bed is designed to accommodate low flow, so that even in the driest of conditions, there is a low flow channel of sufficient depth to accommodate fish passage. The bed of the bridge should also be low enough to accommodate natural bed material, so that the channel rugosity does not change through the bridge. Creating a two stage channel through the bridge, using the internal shoulders to focus flow into the central third also permits mammal passage through the bridge in low to medium flow conditions. It is also important to ensure that any temporary works do not impinge on fish or mammal passage, and are carried out at the correct time of the year. Consideration should be given to a riparian buffer along the river edge if realignment of the watercourse will result in the removal of this feature. Sediment control during works is extremely important, and should be addressed through timing of works, and through suitable sediment control measures and plans. Liaison with NIEA and the Lough's Agency is recommended.
Environmental Protection Agency	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.
Inland Waterways Association of Ireland (IWAI)	10 Apr 2018	29 Apr 2018	IWAI consider that the preferred route should not impede access to Albert Basin for large vessels, irrespective of route choice. The clearance under any fixed bridge must be at least 37m. They note the difficulty in this and would suggest that there should be an opening span of at least the same width as the Victoria Lock. No route preference indicated as long as the above criteria are met. Also provided detailed supporting document.
Loughs Agency – Foyle, Carlingford and Irish Lights Commission	09 Apr 2018 09 May 2018	13 June 2018	Note that all proposed routes will involve a bridge and all will present challenges during the construction phase, particularly around the generation of suspended solids. Note that the bridge associated with the Blue Route will be a shorter span, but still concerned about instream works. Noted that bridge deck clearance of around 9m may result in marine tourism issues around sail boat access to Albert Basin. There are a few small watercourses not too far from the Blue Routes that discharge to the river via a siphon that flows under the canal. The siphon could possibly be used to minimise the discharge of suspended solids to the canal. Also all routes cross the watercourse that flows down Bensons Glen straight into the canal. Consider the blue route have the least potential impacts on fisheries.
Newry & District Anglers Association	09 Apr 2018 09 May 2018		Did not respond to the consultation.

	30 May 2018		
Newry Maritime Association	09 Apr 2018	23 Apr 2018	The view of NMA is that the Blue Route is the preferred option with regeneration aspects included in the budget from inception.
Warrenpoint Harbour Authority (WHA)	10 Apr 2018	17 Apr 2018	Confirmed that the Blue Route is still WHA's preferred route. Noted a concern regarding the 8% gradient on Blue Route Option 3, thus identifying Blue Route Options 1 & 2 as their preference. The chosen route should ensure that it is capable of allowing HGV, to use the road safely and without hindrance.
Ulster Angling Federation	09 Apr 2018 09 May 2018 30 May 2018		Did not respond to the consultation.

5.10.4 Regulatory & Policy Framework

The definition of a 'water body' or 'waterway', as defined under The Water (Northern Ireland) Order 1999 [as amended], includes:

"Any river, stream, watercourse, inland water (whether natural or artificial) or tidal waters and any channel or passage of whatever kind (whether natural or artificial) through which water flows but does not include:

1. the waters beyond 3 international nautical miles seaward from the baseline from which the breadth of the territorial sea adjacent to Northern Ireland is measured;
2. any public sewer or public sewage treatment works;
3. any main or service pipe within the meaning of the Water and Sewerage Services (Northern Ireland) Order 2006 which is vested in or under the control of a sewerage undertaker; and
4. any drain or road drain
5. constructed and laid by the Department for Regional Development under Article 45(1) of the Roads (Northern Ireland) Order 1993; or
6. Acquired by the Department for Regional Development under Article 45(6) of that Order.

In this Order any reference to a waterway includes a reference to the channel or bed of a waterway which is for the time being dry".

Water resource management in Northern Ireland is reflected through the following key legislation and government policy.

Table 5.10.2: Legislation and Planning Policy

Legislation or Policy	Relevance to the Scheme
The Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU, established a new integrated approach to the protection of the water environment. The Directive is transposed in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. Directive 2013/39/EU is transposed through The Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015.	Provides the framework to plan and deliver a better water environment across Europe, by setting ecological and water quality objectives to be met through activities contributed to by a number of actions. The WFD is fully effective and its key objectives provided for in River Basin Management Plans are to: prevent deterioration, enhance and restore bodies of surface water, achieve 'Good' chemical and ecological status of such water, and reduce pollution from discharges and emissions of hazardous substances; protect, enhance and restore all bodies of groundwater, achieve 'Good' chemical and quantitative status of groundwater, prevent the pollution and deterioration of groundwater, and ensure a balance between groundwater abstraction and replenishment; and preserve protected areas.

The Groundwater Directive – Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (the “daughter Directive” to the Water Framework Directive) implemented in Northern Ireland by The Groundwater Regulations (Northern Ireland) 2009 [as amended].	This Directive establishes a regime, which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. It requires the prevention of all inputs of hazardous substances into groundwater. It also requires the limitation of any inputs from all other pollutants into groundwater so as to prevent pollution, deterioration in status, or any significant downward trends in quality. The Groundwater Regulations (Northern Ireland) 2009 [as amended] require the prevention of entry of hazardous substances to groundwater and of non-hazardous pollutants from polluting groundwater.
The Priority Substances Daughter Directive (2008/105/EC) implemented in Northern Ireland via The Water Framework Directive (Priority Substances and Classification) Regulations (Northern Ireland) 2011 [as amended].	The purpose of the Directive is to eliminate pollution from List I substances and to reduce pollution from List II substances as established under the original Directives which this replaces. The Directive will work together with the WFD with regard to discharges of certain dangerous substances.
The Floods Directive (Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks) implemented in Northern Ireland by The Water Environment (Floods Directive) Regulations (Northern Ireland) 2009.	The Floods Directive is designed to help Member States establish a framework for managing flood risk that is aimed at reducing the adverse consequences of flooding on human health, the environment, cultural heritage, and economic activity.
Council Directive 98/83/EC (The Drinking Water Directive (DWD)) on the quality of water intended for human consumption.	The Drinking Water Directive aims to protect the health of consumers in the European Union and to make sure that water supplied as potable water reaches certain standards.
Northern Ireland Sustainable Development Strategy (2006)	This strategy represents a joined-up approach to meet the challenges of climate change and finite resources, which threaten well-being and future prosperity in Northern Ireland. Strategic Objective 2 imposes a requirement ‘to protect and enhance the freshwater and marine environment’. An important step in achieving this Objective and its Key Targets is the promotion of Sustainable Drainage Systems (SuDS) in future developments.
Regional Development Strategy 2035 (Building a Better Future)	The Strategic Guidance set out within the RDS 2035 deals directly with the economy, society and the environment. With regard to flooding, the RDS (p46) highlights the need to “minimise development in areas of flood risk from flooding from rivers, the sea and surface water run-off”. It goes on to seek that a precautionary approach to development in areas of flood risk, and all development should incorporate SuDS.
Planning Policy Statement (PPS) 15 - Planning & Flood Risk (September 2014)	Revised PPS 15 cites planning policies to minimise and manage flood risk to people, property and the environment. It adopts a precautionary approach to development and the use of land that takes account of climate change and emerging information relating to flood risk through implementation of the EU Floods Directive in Northern Ireland and implementation of Sustainable Drainage Systems. The policies in the PPS take precedence over the provisions of existing development plans in relation to flood risk. Planning Policy FLD 1 is the main planning policy associated with PPS 15 and states that development within floodplains will not normally be permitted unless the proposed scheme is an exceptional case or it is of overriding regional importance.

Banbridge / Newry and Mourne Area Plan 2015	The purpose of the Plan is to inform the general public, statutory authorities, developers, and other interested bodies of the policy framework and land use proposals that are being used to guide development decisions within the Banbridge / Newry and Mourne Area over the Plan period. The DfI - Rivers is responsible for drainage and will be consulted at an early stage to clarify flooding or floodplain issues that may affect particular sites, which are being considered for development.
Neagh Bann RBMP Summary (2015)	The RBMP provides the primary means of co-ordinating and integrating the management and protection of the water environment in the Neagh Bann River Basin District. It will have to link with other relevant plans and programmes and will have to be taken into account by other public bodies when carrying out their duties and functions. This integrated approach should provide benefits for all those involved in the protection and enhancement of the water environment.

5.10.5 Baseline Environmental Conditions & Constraints

5.10.5.1 Surface Waters

Under the WFD, River Basin Management Plans have been developed for all river, estuarine and coastal waters in the UK. In December 2009, NIEA published the first Neagh Bann River Basin Management Plan (RBMP). In line with the WFD, the RBMPs should be reviewed and updated every six years. On this basis, an update to the Neagh Bann RBMP was published in December 2015. The Plan identifies where our water environment is in a 'Good' or 'Excellent' condition, and sets out objectives for the improvement or the prevention of deterioration of individual river, lake, marine and groundwater bodies for the subsequent river basin planning cycles. A Programme of Measures was published as part of the Plan, setting out actions required to meet the objectives to improve the status of all water bodies.

With reference to the 'Neagh Bann RBMP' (NIEA 2015), the general study area is located within the Neagh Bann River Basin District (NB RBD) which covers an area of approximately 5740 km^2. It includes all of County Armagh, large parts of counties Antrim, Londonderry, Down and Tyrone, and a small area of County Fermanagh.

With reference to the 'Carlingford and Newry Local Management Area (LMA) Action Plan and Update' (2013), the Carlingford and Newry LMA drains predominantly into Carlingford Lough and Dundalk Bay, covering an area of approximately 823km^2. The largest river in the LMA is the Newry (Clanrye) River, which rises around Rathfriland and flows through Newry City to Carlingford Lough. Within the study area, the Newry River flows in a dramatic, steep-sided valley in which a network of minor watercourses flow quickly down the valley sides. Beyond the study area, there are a number of smaller river systems, which flow south towards the Republic of Ireland, including the Flurry River.

Centred to the south of Newry, the study area is essentially located within the transitional reach of the Newry River (estuary), where it then flows into Carlingford Lough. The river flows through Newry in a general south-easterly direction into the head of the lough, where extensive estuarine sediment deposits are exposed at low tide between Newry and Narrow Water.

The portion of the lough within the study area covers a transition from typically estuarine to more marine habitat and the waters are of both commercial and ecological importance. N.P. Although man-made, the Newry Ship Canal is also a major waterbody within the study area, which a number of the minor watercourses on the western valley side flow into. In essence, the canal can be considered a tributary of the Newry River, as it discharges at times of high water via a spill weir direct to the river, thus is hydrologically connected.

The range of tributaries located on the eastern and western banks of the Newry River/Canal within the study area are detailed within Table 5.10.3 and shown on Figure 5.10.1.

Table 5.10.3: Existing Watercourses

Name	Location	Description and comments	Outfall Location

Newry River	Through Newry City	Significant designated regional river	Carlingford Lough, to the Irish Sea
Newry Canal/Ship Canal	Through Newry City	Significant summit level canal	Newry River (via spill weir)
Newry River/Canal Tributaries – (Western part of study area)			
Drumalane Stream Extension	In the vicinity of the A28 Dublin Road	Minor watercourse flowing parallel to the north of A28 Dublin Road. Culverted from the Quays Shopping Centre towards Newry Canal	Newry Canal
Omeath Road Drain Extension	In the vicinity of B79 Fathom Line	Minor watercourse flowing between B79 Fathom Line and Drumalane Road	Newry Canal
Un-named tributary	In the vicinity of B79 Fathom Line/Drumalane Road priority junction	Minor watercourse flowing between the Hillhead Road and developments at Cloghogue Roundabout	Newry Canal
Benson's Glen Stream	In the vicinity of Barracric Road, close to the A1 Newry Bypass flowing eastwards through Benson's Glen (located approximately 1.7km south of B79 Fathom Line/Drumalane Road junction).	Minor watercourse flowing through the steep-sided and mature Benson's Glen. Feeds a fish hatchery within its lower reach.	Newry Canal
Un-named tributary	Located approximately 2.7km south of B79 Fathom Line/Drumalane Road priority junction	Minor watercourse flowing through a wooded area (Fathom Forest)	Newry Canal
Un-named tributary	Located approximately 2.9km south of B79 Fathom Line/ Drumalane Road priority junction	Minor watercourse flowing through a wooded area (Fathom Forest)	Newry Canal
Newry River/Canal Tributaries – (Eastern part of study area)			
Knox-Peebles Drain	In the vicinity of the Greenbank Industrial Estate, between Ballynacraig Way and the A2 Warrenpoint Road	Minor watercourse flowing parallel in a ditch on the east side of the A2 Warrenpoint Road, outfalling at the end of the Rampart.	Newry River
Commons Stream	In the vicinity of the Old Warrenpoint Road junction with the A2 Warrenpoint Road	Minor watercourse that flows parallel to the west of the A2 Warrenpoint Road	Newry River
Un-named tributary	300m south of Old Warrenpoint Road junction with A2 Warrenpoint Road	Minor watercourse flowing through a wooded area (Narrow Water Wood)	Newry River
Un-named tributary	750m south of Aghnamoira Road junction with A2 Warrenpoint Road	Minor watercourse flowing through a wooded area (Narrow Water Wood)	Newry River
Un-named tributary	950m south of Aghnamoira Road junction with A2 Warrenpoint Road	Minor watercourse flowing through a wooded area (Narrow Water Wood)	Newry River

Un-named tributary	1.2km south of Aghnamoira Road junction with A2 Warrenpoint Road	Minor watercourse flowing through a wooded area (Narrow Water Wood)	Newry River

5.10.5.2 Water Quality

With reference to the 'Recommendations on Surface Water Classification Schemes for the purposes of the Water Framework Directive Report' (UKTAG, 2007), Member States are required to classify the 'status' of surface water bodies. This is determined by whichever is the lower of a water body's 'ecological' or 'chemical' status. To achieve the overall aim of 'Good' surface water status, the Directive requires that surface waters be of at least 'Good' ecological and 'Good' chemical status. 'Good' surface water status is one of the principal objectives for surface water bodies not designated as heavily modified or artificial. The other principal objective is to prevent deterioration of surface water status.

With reference to the 'Neagh Bann RBMP' (NIEA 2009), the ecological quality of surface waters is an expression of the quality of the structure and functioning of surface water ecosystems, as indicated by the condition of a number of 'quality elements'. The Directive uses the term 'quality elements' to refer to the different indicators of ecological quality comprising its ecological status classification schemes. The quality elements used to assess ecological status are:

- Biological quality elements (invertebrates, plants, fish, phytobenthos and phytoplankton);
- General chemical and physiochemical quality elements (phosphorous in rivers and lakes, nitrogen in transitional and coastal waters, dissolved oxygen and pH); and
- Hydromorphological quality elements (water flow and physical modifications).

For each water body, the ecological quality elements are classified individually, and chemical quality is determined by the levels of certain hazardous and dangerous substances. The ecological and chemical results are then combined to give an overall status in one of five classes:

- High Ecological Status (HES);
- Good Ecological Status (GES);
- Moderate Ecological Status (MES);
- Poor Ecological Status (PES); and
- Bad Ecological Status (BES).

As noted above, the Directive requires that the overall ecological status of a water body be determined by the results for the biological or physiochemical quality element with the worst class (i.e. the quality element worst affected by human activity).

This is called the 'one out - all out' principle. If a water body is classified as 'High' or 'Good' status, then it has a healthy ecology, which deviates only slightly from natural conditions, is an important natural asset, and can support a wide range of uses such as recreation, fishing and drinking supply. If a water body is classified as 'Moderate', 'Poor' or 'Bad', then the ecology is adversely affected and the range of uses that can be supported is reduced.

With reference to the 'North Eastern RBMP' (NIEA 2009), some water bodies have been modified to such an extent that they can no longer be restored to their original condition without compromising their current use (heavily modified water bodies). Other water bodies have been created where no water body previously existed (artificial water bodies). There are four classes for the status of heavily modified and artificial water bodies:

- Good Ecological Potential or better (GEP);
- Moderate Ecological Potential (MEP);
- Poor Ecological Potential (PEP); and
- Bad Ecological Potential (BEP).

The classification system for heavily modified and artificial water bodies takes into account the modified nature of these water bodies; thus instead of the aim of achieving 'GES', these surface waters must aim to meet ‘GEP’. Their ecological potential is assessed for water quantity, water flow and physical habitat, depending on whether reasonable effort has been made to maximise the quality of the ecology and habitats. The ecological potential classification also reflects the chemical quality of the water.

The ‘Carlingford and Newry LMA Action Plan 2009 – 2015’ (2012), and the 2013 update were developed to detail local measures to improve the water environment. At the time of publication, 95% of surface water bodies in the Carlingford and Newry LMA were classified as less than ‘Good’ ecological status. Many of the rivers failed to achieve this due to suppressed invertebrate populations and morphological alterations.

As shown on Figure 5.10.2, in terms of waterbody catchment areas, the study area is split between the artificial waterbody of the Newry Canal (ID: UKGBNINB060604048) to the west, and the transitional waterbody of the Newry Estuary (ID: UKGBNI5NB030010) to the east.

In the most recent monitoring period (2015), Newry Canal was identified as being of Moderate Ecological Potential (MEP), and has consistently achieved this ecological status over the last six monitoring periods. This is in line with the 2015 Objective set within the 2009 ‘Neagh Bann RBMP’. The 2021 objective for the Newry Canal is GEP.

The Newry Estuary (transitional waterbody), classified as being heavily modified, has consistently achieved Moderate Ecological Potential (MEP), over the last six monitoring periods. In terms of objectives for the Newry Estuary, the aim of NIEA is to prevent deterioration in 2021 and move to achieving ‘Good’ by 2027. This extended deadline objective has been set for the Newry Estuary due to reasons of technical feasibility.

5.10.5.3 Floodplain

With reference to the DfI Rivers Strategic Flood Map for Northern Ireland, which provides a strategic overview of flood risk in Northern Ireland, the Newry River has an associated Q_{100} floodplain which encroaches into the study area (as shown on Figure 5.10.3). The Strategic Flood Map illustrates areas throughout Northern Ireland that have flooded from rivers and the sea in the past, and those predicted to be prone to flooding now and in the future. As the study area is located close to Carlingford Lough, it is also located within a coastal [sea] Q_{200} floodplain, and thus vulnerable to sea surge (as shown on Figure 5.10.3).

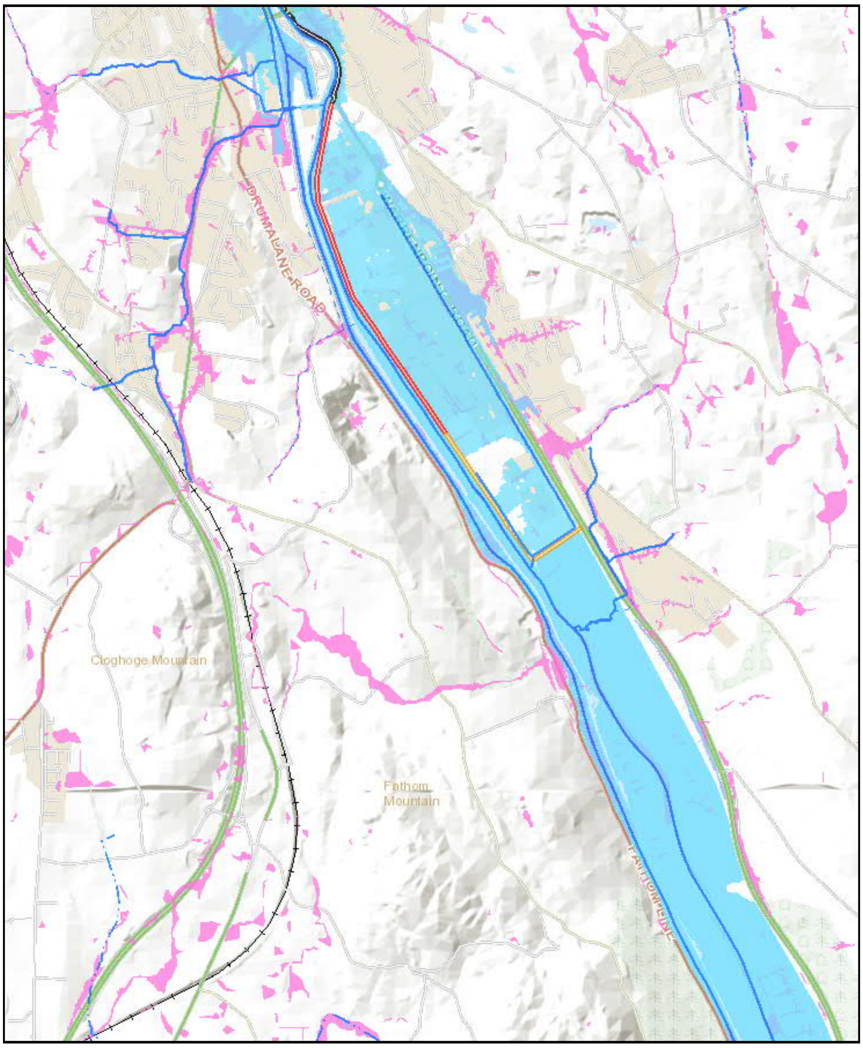


Figure 5.10.3: Q_{100} River and Surfaces Water Floodplain (accounting for Climate Change 2030)

The River Flood Map provides an illustration of the approximate extents of river floodplains. The outlines of floodplains highlighted in the map identify areas that in any year have a 1-in-100 or greater chance (1% Annual Exceedance Probability (AEP)) of flooding from a river. The extents of floodplains have been estimated using predictive computer modelling techniques that are commonly used as a decision support tool by flood defence authorities throughout the UK, Ireland and beyond. As the predictive models cover the whole of Northern Ireland, there are clear limitations associated with the methodology and data used. These inevitably have an impact on the accuracy of the floodplain outlines.

The map also provides information on areas likely to experience localised surface water flooding during extreme rainfall events (i.e. land naturally vulnerable to surface water or “pluvial” flooding). Surface water flooding occurs as a result of rainfall which overwhelms natural or man-made drainage systems, resulting in water flowing overland and ponding in depressions in the ground.

In July 2012 and November 2014, there were severe flooding events in Newry. High tide levels combined with heavy rain led to flooding in the city centre and surrounding areas. The heavy rain over the previous days led to saturated ground which intensified the run-off as there was little infiltration.

The unprecedented levels of rain had little chance to dissipate, as many of the drains outfall into the Newry River/Canal which had risen due to high tides created by a low pressure storm system that was in progress.

Within the study area, Newry River/Canal is prone to flooding and the strategic flood map for the area gives an indication of the likely future flooding patterns as a result of climate change. These levels show a large area in the city centre at risk and throughout Greenbank Industrial Estate. Further south of Greenbank Industrial Estate, flooding is generally contained within the banks of the Newry River/Canal which may be due to the expansive floodplain area available (i.e. the mudflats associated with the estuary).

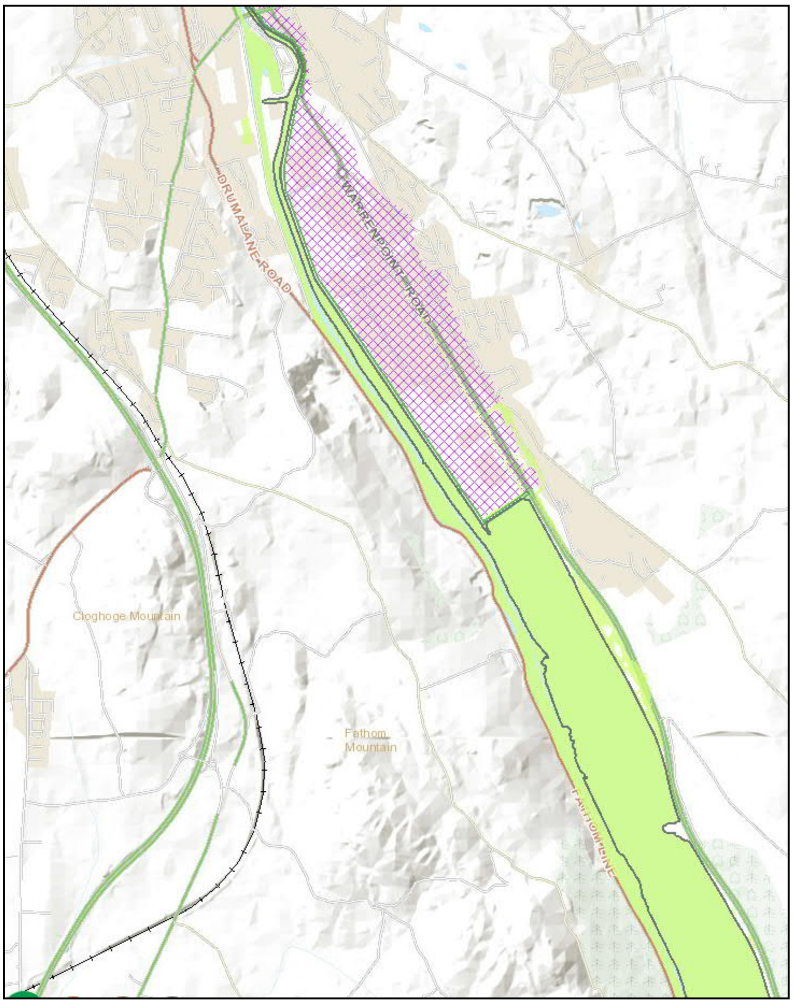


Figure 5.10.4: Q_{200} Sea Floodplain (accounting for Climate Change 2030) – including areas benefitting from flood defences (hatched areas)

Source: http://riversagency.maps.arcgis.com/

The Sea Flood Map provides an illustration of the approximate extent of the coastal floodplains which are the relatively flat areas of land around the shoreline subject to periodic coverage by the sea. The outlines of floodplains highlighted in the map identify areas that in any year have a 1-in-200 or greater chance (0.5% Annual Exceedance Probability (AEP)) of flooding from the sea. DfI - Rivers developed this floodplain using a computerised coastal model that simulates how extreme tides combine with storm surges and onshore waves to produce high water levels at 48 locations around the coastline. As the model is strategic in nature, the flow characteristics of inundation during a tidal cycle were not taken into account by DfI - Rivers in the predictions, and therefore it is assumed that all areas below the predicted high water levels are inundated. It should be noted that the original DfI - Rivers flood model was based on aerial LiDAR data of limited accuracy and so, only provides indicative guidance on general areas estimated to be prone to flooding.

The Sea Flood Map assesses two distinct scenarios, namely Present Day (2009) and Climate Change (2030). The Present Day scenario considers the 2009 extents of the coastal floodplains that have been estimated by the predictive model using input data that is representative of the current climate conditions and sea levels. It is an accepted scientific fact that sea levels are rising and that this would increase the coastal flood risk. Therefore, the Climate Change map scenario considers the estimated coastal floodplain outlines for the year 2030, and has been based on the best available predictions for sea levels and storm surges at that time.

5.10.5.4 Protected Areas

The WFD requires that a register of protected areas be identified to help ensure that the management of relevant water bodies is geared towards achieving protected area objectives. Protected areas are identified as those requiring special protection under existing National or European legislation, either to protect their surface water or groundwater, or to conserve habitats or species that directly depend on those waters. The purpose of the protected area register is to bring all EC water-related legislation under one umbrella. With reference to the 'Neagh Bann RBMP' (NIEA 2009), the RBD has important habitats and wildlife living in areas identified as needing special protection under existing laws. These protected areas include:

- areas designated for the abstraction of water intended for human consumption under the WFD;
- areas designated for the protection of economically significant aquatic species. For example, this may include waters designated under the Shellfish Directive (codified version) 2006/113/EC, or the Fish Directive (consolidated) 2006/44/EC. Both of these directives have now been revoked by the WFD;
- bodies of water designated as bathing waters under the Bathing Waters Directive 2006/7/EC;
- nutrient-sensitive areas, including areas designated as Vulnerable Zones under the Nitrates Directive (consolidated) 91/676/EEC, and areas designated as Sensitive Areas under the Urban Waste Water Treatment (UWWT) Directive (consolidated) 91/271/EEC; and
- areas designated for the protection of habitats or species under the Habitats Directive 92/43/EEC or the Birds Directive 2009/147/EC, where the maintenance or improvement of the status of water is an important factor in their protection.

5.10.5.4.1 Areas designated for the abstraction of water intended for human consumption

This is a new category of protected area which replaces the system of drinking water protection previously provided by the Drinking Water Abstraction Directive 75/440/EEC and also incorporates groundwaters. With reference to the LMA Information Leaflet, there are five surface drinking water protected areas within the LMA, though none are known to be present within the study area.

5.10.5.4.2 Areas designated to protect economically significant aquatic species

All waters designated under the Fish Directive (consolidated) 2006/44/EC (now revoked) are included as or within water bodies under the WFD and placed on the Protected Areas register. Water quality standards and monitoring requirements to ensure the protection of coarse and game fisheries are covered by the standards and procedures of the WFD.

Rivers and lakes are still designated into two categories of water: those suitable for Salmonids (mainly salmon and trout), and those suitable for Cyprinids (coarse fish including carp, tench, bream, roach, chub and minnows). With reference to the 'Carlingford and Newry Local Management Area (LMA) Action Plan 2009-2015', there are 244km of rivers within the LMA designated as Salmonid, and 18km or canal designated as Cyprinid.

With reference to Figure 5.10.5, only the Newry Canal is designated (as a Cyprinid waterbody) to protect economically significant aquatic species within the study area. The Newry River is only designated as a Salmonid waterbody upstream of Bridge Street within the city centre.

Existing designations under the Shellfish Waters Directive 2006/113/EC (now revoked) have also become 'areas designated to protect economically significant aquatic species' under the WFD and placed on the Protected Areas register. With reference to the 'Carlingford and Newry Local Management Area (LMA) Action Plan 2009-2015', Carlingford Lough is the only designated shellfish water within or close to the study area.

Mariculture is an important industry within Carlingford Lough, particularly in the large intertidal areas, with a range of sites extending around both sides of the lough; oyster and mussel culture dominate fishery activities with some traditional winkle picking, cockle raking and razor clam fishing taking place. With reference to the Sea Fisheries Protection Authority (SFPA) website (Republic of Ireland), the southern half of Carlingford Lough is classified as a Bivalve Mollusc Production Area, for production of razor clams, oysters, and mussels.

5.10.5.4.3 Bathing Waters

Bathing Waters are areas protected for recreational and bathing use and must meet mandatory and guideline standards for microbiological quality in order to protect human health. With reference to the 'Carlingford and Newry Local Management Area (LMA) Action Plan and Update' (NIEA 2013), there are two identified bathing waters within the LMA; Cranfield and Cranfield (Nicholson's Strand). These lie approximately 17km south-east of the study area.

5.10.5.4.4 Nutrient Sensitive Areas

Nutrient Sensitive Areas comprise nitrate vulnerable zones, polluted waters designated under the Nitrates Directive, and areas designated as sensitive areas under the Urban Waste Water Treatment Directive in relation to nutrient enrichment. With reference to the 'Carlingford and Newry Local Management Area (LMA) Action Plan and Update' (NIEA 2013), a total territory approach has been adopted in Northern Ireland under the Nitrates Directive. With regards to the Urban Waste Water Treatment Directive, one area (Newry River) has been designated within the study area as being sensitive in relation to phosphorous.

5.10.5.4.5 Areas designated for the protection of habitats or species

The objective for Natura 2000 Protected Areas identified in relation to relevant areas designated under the Habitats Directive 92/43/EEC is to:

"Protect and, where necessary, improve the status of the water environment to the extent necessary to achieve the conservation objectives that have been established for the protection or improvement of the site's natural habitat types and species of Community Importance in order to ensure the site contributes to the maintenance of, or restoration to, favourable conservation status (i.e. to protect and, where necessary, improve the water or water-dependent environment to the extent necessary to maintain at or restore to favourable conservation status, the water-dependent habitats and species for which the Protected Area is designated)".

The objective for Natura 2000 Protected Areas identified in relation to relevant areas designated under the Birds Directive 2009/147/EC is to:

"Protect and where necessary improve the water environment to the extent necessary to achieve the conservation objectives that have been established for the protection or improvement of the site in order to ensure that the site contributes to the conservation (survival and reproduction in their area of distribution) of bird species listed in Annex I of the Birds Directive".

Where a Natura 2000 Protected Area forms part of a water body, or where a water body lies within such an area, the WFD status objectives apply in addition to the requirement to maintain at favourable conservation status or restore it to that status.

With reference to the 'Carlingford and Newry Local Management Area (LMA) Action Plan and Update' (NIEA 2013), there is one water-dependent Special Protection Area (SPA), Carlingford Lough, located approximately 10km south-east of the study area around Killowen Point. There are four SACs within the Carlingford and Newry LMA (Derryleckagh, Slieve Gullion, Rostrevor Wood and Eastern Mournes).

Carlingford Lough was also designated an ASSI in 1997 by reason of its flora, fauna and earth science interest. The study area covers the upstream extent of the ASSI and includes the narrow channel of the Newry River and associated deep mud banks. With reference to NIEA's 'Carlingford Lough - Views About Management' document, the mudflats are an important habitat for wildlife, supporting a wide variety of marine invertebrates that represent an important food source for many fish and bird species. They also support beds of seagrass and a rich algal and sponge assemblage which are sensitive to habitat disturbance and water and sediment quality.

5.10.5.5 Groundwater

Groundwater occurs everywhere beneath the ground across Northern Ireland. It plays a significant role in supporting surface water flows and levels through natural discharge from the ground to rivers, lakes, streams and wetlands. This contribution to surface waters can also act to dilute pollutant concentrations in the surface water; therefore, helping support the overall ecological and amenity value of these systems.

With reference to the 'Characterisation of groundwater bodies within Northern Ireland' (June 2012), there are two groundwater bodies within the study area. The first is the Newry groundwater body (UKGBNI4NB009), which covers the majority of the study area and is currently classified as 'Poor', with 'Poor' remaining as the 2021 objective and 'Good' the future objective for the 2027 WFD cycle, as shown on the NIEA River Basin Plan Map Viewer. The second is the Louth groundwater body (UKGBNI4NB019) situated to the south-western extent of the study area, in the vicinity of Ellisholding, which is currently classified as 'Good' status, with 'Good' remaining as its future objective for both 2021 and 2027.

5.10.5.5.1 Groundwater Vulnerability

A new methodology for groundwater vulnerability assessment has also been developed by the GSNI and BGS, in accordance with WFD guidance to help characterise and assess risk to groundwater bodies. In order to carry out risk assessments, knowledge of the vulnerability of groundwater is necessary. Typically, groundwater is of High quality and often requires little treatment prior to use. However, it may be vulnerable to contamination from both diffuse and point source pollutants, from direct discharges into groundwater, and indirect discharges into or onto land. Groundwater decontamination is difficult, prolonged, and expensive, and therefore the prevention of pollution is important.

With reference to 'A groundwater vulnerability screening methodology for Northern Ireland Report' BGS (2005), groundwater vulnerability is defined as the tendency and likelihood for general contaminants to reach the water table after introduction at the ground surface. All groundwater is to some degree vulnerable, and the groundwater vulnerability screening methodology is designed to reflect the ability of contaminants to reach the water table surface.

The screening methodology applies to the situation where contamination from the land surface leaches vertically downwards to the water table within the uppermost aquifer at a particular locality. The groundwater vulnerability assessment is, therefore, influenced by several factors that relate to the pathway element of a typical Source – Pathway – Receptor risk assessment. In this case, the pathway is characterised by the hydrogeological and geological characteristics of the top soil layer, the underlying superficial deposits and bedrock.

The pathway between the ground surface and the water table can affect the degree of attenuation of contaminants. It can be influenced by the:

- permeability and clay content of the superficial deposits;
- thickness of the superficial deposits;
- mode of groundwater flow in bedrock aquifers (fracture or inter-granular flow);
- permeability and clay content of inter-granular bedrock aquifers; and
- depth to the water table in both superficial and inter-granular bedrock aquifers.

It is the above factors that determine the vulnerability classification. Vulnerability has been divided into five categories, with Class 1 areas having the lowest risk of groundwater pollution, and Class 5 the highest. Class 4 is further subdivided according to the nature of the pathway:

- 4a – sand and gravel cover;
- 4b – moderate permeability cover;
- 4c – low permeability cover;
- 4d – thin soil over bedrock; and
- 4e – where superficial aquifers are present.

As shown in Figure 5.10.6, to the west of the Newry River, the study area is dominated by high vulnerability conditions of classes 4a, 4c and 5. Areas of highest vulnerability (5) are associated with bedrock close to, or at surface, generally located west of Fathom Line, and in the vicinity of Fathom Road in a general north-westerly direction towards Cloghogue. A localised area of Class 5 vulnerability is associated with shallow bedrock in the vicinity of Greenan Wood, east of Newry.

Due to the scale (1:250,000) of the digital geological mapping available, the classification of these areas is generalised and whilst this information provides an overall understanding as to how vulnerable the groundwater is to contamination, detailed geological information garnered from the Geotechnical Investigation is utilised to establish the actual site-specific risk to groundwater with scheme implementation.

5.10.5.5.2 Hydrogeology

A new aquifer classification system has been developed by the Geological Survey of Northern Ireland (GSNI) and British Geological Survey (BGS) in accordance with WFD guidance to assess and manage all waters within Member State boundaries in a unified manner. With reference to the 'Water Framework Directive – Aquifer Classification Scheme for Northern Ireland' GSNI (2005), the WFD describes a groundwater body as a "distinct volume of water within an aquifer or aquifers". For the purposes of WFD analysis, the aquifer classification scheme considers the following elements in defining aquifer type/category:

- Strata type (Bedrock or Superficial);
- Relative 'productivity' with respect to exploitation history/well yields (where data is available); and
- Flow Type (intergranular, fractured, karstic or combination).

With reference to Figure 5.10.7, the Raised Beach Deposits of the south-eastern end of the study area (surrounding Warrenpoint) and small isolated alluvial deposits associated with watercourses throughout the study area, are identified as 'potential superficial aquifers'. It follows that the vast majority of the superficial deposits in the study area are not considered as having potential to store or transmit significant amounts of groundwater.

Bedrock underlying the study area comprising Silurian and Ordovician lithologies, and igneous intrusions, is classified as Bl(f), possessing limited potential productivity fracture flow. The Silurian and Ordovician lithologies include greywackes, siltstone, mudstones and sandstones. Some groundwater may occur in shallow cracks and joints in the near-surface zone. Rare springs and shallow boreholes provide small quantities of weakly mineralised water.

The intrusive igneous rocks (granites/granodiorites) may have ground water associated with shallow cracks and joints opened-up by weathering. Due to the scale (1:250,000) of the digital geological mapping available, the classification of these areas is generalised, however it provides an overall understanding as to the bedrock aquifer type/category throughout the study area.

5.10.6 Assessment of Environmental Impacts

5.10.6.1 Surface Waters and Floodplain

5.10.6.1.1 Red Route

As with the Yellow Route, the Red Route would also affect a number of minor tributaries of the Newry River/Estuary at its tie-in with the A2 Warrenpoint Road Dual Carriageway. This network of minor watercourses flows quickly down the eastern valley side from Narrow Water Wood/Forest, flowing under the A2 before outfalling directly into the estuary.

Although the scheme would be designed with respect to flood protection requirements, the Red Route would not be located within the Q_{100} river and surface water floodplain associated with the Newry River (Figure 5.10.3) or the Q_{200} Sea Floodplain associated with the Newry Estuary (Figure 5.10.4). This is important as the road is highly likely to remain functional in its entirety during such extreme events (however would require modelling to verify).

From the tie-in towards the western valley side, the Red Route would also cross the estuarine reach of the Newry River which although within the floodplain of this waterbody, its extent is no wider than the tidal inundation area and thus the impact would be negligible, particularly as the crossing would be entirely on bridge structure and would not require infilling, other than for construction of the bridge piers. The vertical alignment of the route at low-lying locations would need to have sufficient elevation to ensure that drainage can be accommodated above flood levels. The crossing of the Newry River would be on a straight fixed bridge structure. The Red Route requires a crossing of the canal immediately adjacent to the river crossing, potentially via a straight bascule opening bridge structure.

On the western valley side, the Red Route would also affect a number of minor tributaries of the Newry River/Estuary/Canal, which flow quickly down the slopes of Fathom Mountain through Fathom Forest, under the B79 Fathom Line before outfalling to these waterbodies.

On the climb up the western valley side, the Red Route would cross the middle reach of Benson's Glen Stream on a skewed alignment, which would elongate the required culverting structure. This would be upstream of the fishery, which presents an obvious construction-related issue (i.e. potential sediment release) to its operation during the works.

To the north of Fathom Mountain, the Red Route would also cross several minor watercourses/drainage ditches which feed the upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Figure 5.10.3, this watercourse does have localised surface water flooding issues in its upper reach (as a result of a localised depression) which would be directly affected. This aspect would obviously require further consideration as part of any subsequent Flood Risk Assessment.

5.10.6.1.2 Yellow Route

The Yellow Route would affect a number of minor tributaries of the Newry River/Estuary at its tie-in with the A2 Warrenpoint Road Dual Carriageway. This network of minor watercourses flows quickly down the eastern valley side from Narrow Water Wood/Forest, flowing under the A2 before outfalling directly into the estuary.

Although the scheme would be designed with respect to flood protection requirements, the Yellow Route is not likely to be located within the Q_{100} river and surface water floodplain associated with the Newry River (Figure 5.10.3) or the Q_{200} Sea Floodplain associated with the Newry Estuary (Figure 5.10.4). This is important as the road is highly likely to remain functional in its entirety during such extreme events (however would require modelling to verify).

From the tie-in towards the western valley side, the Yellow Route would cross the estuarine reach of the Newry River which although within the floodplain of this waterbody, its extent is no wider than the tidal inundation area and thus the impact would be negligible, particularly as the crossing would be entirely on bridge structure and would not require infilling, other than for construction of the bridge piers. The vertical alignment of the route at low-lying locations would need to have sufficient elevation to ensure that drainage can be accommodated above flood levels. The crossing of the Newry River would likely be on a straight bascule opening bridge structure.

On the western valley side, the Yellow Route would also affect a number of minor tributaries of the Newry River/Estuary/Canal, which flow quickly down the slopes of Fathom Mountain through Fathom Forest, under the B79 Fathom Line before outfalling to these waterbodies. The partial realignment of Fathom Line to tie into the roundabout at the bridge crossing would also result in the partial infilling of a tidal lagoon within Rough Island.

On the climb up the western valley side, the Yellow Route would cross the middle reach of Benson's Glen Stream on a skewed alignment, which would elongate the required culverting structure. This would be upstream of the fishery, which presents an obvious construction-related issue (i.e. potential sediment release) to its operation during the works.

To the north of Fathom Mountain, the Yellow Route would also cross several minor watercourses/drainage ditches which feed the upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Figure 5.10.1, this watercourse does have localised surface water flooding issues in its upper reach (as a result of a localised depression) which would be directly affected. This aspect would obviously require further consideration as part of any subsequent Flood Risk Assessment.

5.10.6.1.3 Blue Route

At the tie-in with the A2 Warrenpoint Road, the Blue Route options would immediately traverse the Knox-Peebles Drain (a minor tributary of the Newry River) which flows in a south-easterly direction between Ballynacraig Way and the A2 Warrenpoint Road Dual Carriageway.

Although the Blue Route options would be designed with respect to flood protection requirements, the alignment would be located within the Q_{100} floodplain (in the Greenbank Industrial Estate area) through to its crossing of the Newry River (Figure 5.10.1). The vertical alignment of the route would need to have sufficient elevation to ensure that drainage can be accommodated above flood levels. However, compensatory flood areas may be required to replace areas of floodplain lost to embankment associated with this route option. The design would also need to be cognisant of the existing Q_{200} sea flood defences (the Rampart) in this area, to ensure there is not a potential breach.

At the Rampart, the Blue Route options would then cross the Newry River and Ship Canal, with potentially a fixed bridge over both waterbodies via a straight structure.

As the Blue Route options climb up the western valley, they would cross the middle reach of Benson's Glen Stream on a skewed alignment, which would elongate the required crossing structure. This would be upstream of the fishery, which presents an obvious construction-related issue (i.e. potential sediment release) to its operation during the works. Blue Route Option 1 would likely require a bridge structure at the crossing point due to topographical constraints, whereas Blue Route Options 2 & 3 would likely require a culvert due to more favourable topography at the crossing point. On this basis, Blue Route Option 1 is likely to be more favourable as it would minimise the potential for adverse hydromorphological impacts within the watercourse.

To the north of Fathom Mountain, the Blue Route options would also cross several minor watercourses/drainage ditches which feed the upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Figure 5.10.1, this watercourse does have localised surface water flooding issues in its upper reach (as a result of a localised depression) which would be directly affected. This aspect would obviously require further consideration as part of any subsequent Flood Risk Assessment.

5.10.6.2 Pollution Impacts from Accidental Spillages

The DMRB assessment of pollution impacts from accidental spillages is used to provide an indication of the risk of a spillage causing a pollution impact upon receiving waterbodies. The risk is defined as the probability that there will be an accidental pollutant spillage and that the pollutant will reach and impact the water body to such an extent that a serious pollution incident occurs. The probability is the product of two separate risks:

- The probability that there will be a spillage with the potential to cause a serious pollution incident; and
- The probability, assuming such a spillage has occurred that the pollutant will cause a serious incident.

The risk is expressed as the probability of an incident in any one year and calculated using Road Length (km), Design Year AADT, and percentage of HGVs. It is initially assessed without any mitigation measures. If measures are required, a pollution risk reduction factor is applied, specific to that type of mitigation.

In most circumstances, the acceptable risk of a serious pollution incident occurring is where the annual probability is predicted to be less than 1% (or a return period of 1-in-100 years). The result of a pollution event such as an accidental spillage on the road could lead to a reduction in surface water quality that could also affect the quality of groundwater.

At this stage, an assessment of the probability of a serious spillage incident occurring in receiving surface waters has not been carried out, as there would be little to differentiate between the route options in terms of the risk of an accident causing a serious spillage within the Newry River catchment area.

5.10.6.3 Fisheries Impacts

There are no known or designated shellfishery beds within the transitional reach of the Newry River. However, it has been established that there is one designated shellfish water within the study area at Carlingford Lough (Carlingford Lough Shellfish Waters), which may be susceptible to damage from suspended solids and accidental spills for example. In terms of impact, the Yellow Route and to a lesser extent the Red Route would have the greatest potential to affect the shellfishery, as they are located closest to it and would require physical works within the estuary. This would present the greatest risk during construction due to the potential for establishment of preferential pathways. The Blue Route options would have the least potential for impact as a consequence of their greater distance from the designated shellfish water and reduced potential for works directly within the affected waterbody.

At this stage, it is expected that the crossing of the Ship Canal by any of the routes would be out with the wetted area, so there is little to differentiate in terms of fisheries impacts within this cyprinid waterbody. Though obvious, the overhead works associated with the Blue and Red routes increase the potential for adverse impacts, whereas the Yellow Route does not require any such works over the canal.

The fisheries habitat of the minor watercourses within the study area is unknown at this stage; however, it is evident that Benson's Glen Stream currently sustains a fish hatchery, thus is reliant upon good water quality. The skewed crossings of possible alignments within all of the route options have the potential to result in upstream hydromorphological changes, which present a significant risk of sediment release during construction, though Blue Route Option 1 would minimise the potential for long-term adverse impacts.

5.10.6.4 Areas designated for the protection of habitats or species

As detailed in Sub-Section 5.10.4.3.5 and illustrated on Figure 5.4.1, Carlingford Lough ASSI has the potential to be directly or indirectly affected by any of the route options. The predicted impact as a result of each route is discussed below.

5.10.6.4.1 Red Route

The Red Route would traverse Carlingford Lough ASSI for an approximate distance of 360m, south of Green Island. As with the Yellow Route the degree of impact on the river and its associated designation would depend on the bridge design, in terms of the frequency, diameter and shape of the bridge piers. The degree of impact therefore again requires careful consideration.

5.10.6.4.2 Yellow Route

The Yellow Route is at a natural local narrowing of the river channel which would result in a relatively shorter bridge traversing Carlingford Lough ASSI for an approximate distance of 250m. The degree of impact on the river and its associated designation would depend on the bridge design, in terms of the frequency, diameter and shape of the bridge piers. The degree of impact therefore requires careful consideration.

5.10.6.4.3 Blue Route

The Blue Route would not directly affect Carlingford Lough ASSI, as it crosses the river at a more northerly location. Nevertheless, the degree of impact on the river and its associated designation would depend on the bridge design, in terms of the frequency, diameter and shape of the bridge piers, however the significantly fewer number of piers would reduce the risk of adverse impact. As the route is proximal to the ASSI, there remains the risk of a pollution incident affecting the river, either during construction or long-term operation of the relief road.

5.10.6.5 Construction

As mentioned previously, there are a number of watercourses within the study area. The Newry River itself would be traversed by the Blue routes, with the estuarine section being traversed by the two other routes (Red and Yellow routes). Other minor watercourses in the study area would also be affected. The Red and Blue Route also pass over the Newry Ship Canal. Each watercourse in the area should be protected from construction-related pollution incidents.

During construction of the relief road, pollution from mobilised suspended solids is generally 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. Other risks include:

- Water abstraction, which may cause contamination if, for example, saline groundwater migrates to replace what is abstracted or reduced flows leads to a reduction in dissolved oxygen;
- Pollution due to vandalism of stores or plant;
- Pollution due to waste materials, dust or residues from handling contaminated land;
- Pollution from pumped discharges, for example, de-watering. These can also cause erosion; and
- Pollution from the build-up of dirt on road surfaces, caused by lorries and other plant entering and exiting the site.

Any construction activities carried out close to watercourses involve a risk of pollution due to accidental spillage. While liquids such as oils, lubricants, paints, bituminous coatings, preservatives and weed killers present the greatest risk, other materials such as cement can also have serious environmental effects. The activities most likely to result in contamination include; any in-stream works, painting parapets, concreting for culverts, and fuel spillages from machinery operating close to watercourses. 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.

5.10.7 Mitigation & Enhancement Measures

As mentioned previously, it is not feasible to speculate on the degree of impact on the estuarine section of the Newry River until a more detailed design stage, as it is dependent on bridge design (e.g. frequency, diameter and shape of bridge piers); this would determine the extent of mitigation required. It is possible that scour protection may be necessary to minimise sediment movements in the intertidal area. Indeed, should either the Red or Yellow routes be taken forward, a more detailed assessment of likely impacts on sediment movements would be required, which may include some degree of sediment modelling.

The protection of the water intake for Benson's Glen fish hatchery from pollution will be paramount during construction. In their consultee response of 20th December 2016, Loughs Agency provided a range of prescriptive mitigation measures which much be adhered to, to prevent adverse impacts occurring in the water environment during construction.

The Newry Ship Canal and Newry River are of interest to various bodies including the Ulster Angling Federation Ltd. During consultation, they have stressed the need to protect the waterway from contamination during and after the construction phase of the scheme, and that adequate measures, such as pollution traps, should be put in place to protect fisheries interests. The tidal reach of the Newry River is a migratory route for salmon and sea trout and must be protected from pollution both during construction and long-term operation and maintenance of the road.

To ensure that no damage occurs to the Carlingford Lough Shellfish Waters, consideration should be given to undertaking a shellfish impact assessment as part of the final Environmental Statement to address these issues. This would outline any control measures to be implemented during the construction and operational phase of the scheme to ensure that no damage occurs to this economic resource.

5.10.7.1 Proposed Road Drainage

In terms of pollution mitigation measures, only would the assessment of risk determine the degree of mitigation required, which will take place at a later design stage. However, suitable methods preventing contaminated water from road drainage entering the watercourses in the area will have to be considered as part of the drainage design. Conventional road drainage in the past normally entailed discharging untreated surface water from carriageways directly into adjacent watercourses, with no form of filtration or attenuation. Modern Sustainable Drainage features however, help treat and attenuate discharges into watercourses, and such features would be considered as part of the drainage design for this scheme.

5.10.8 Presentation of Key Issues

The key issues associated with the approved route options from a Road Drainage & Water Environment perspective are listed below:

- There are no designated or known shellfishery beds within the immediate study area. The closest shellfish beds are in the main body of Carlingford Lough. A shellfish impact assessment may be necessary at the next assessment stage.
- There are likely to be impacts on sediment movements within the Newry River channel with all route options, although potential impacts on the water environment would be greatest with the Red Route as it necessitates the greatest length of river crossing. The degree of impact would depend on the frequency, diameter and shape of the associated bridge piers.

- Although floodplains would be traversed by all routes, the main issue in terms of functionality of the road in relation to floodplain impacts would be associated with the Blue Route options, though these would benefit from existing flood defences.
- The feeder stream to Benson's Glen fish hatchery would be traversed by all of the route options. Protection of this water intake from pollution would be paramount irrespective of which option is taken forward.

Overall and on balance, the Blue Route options would have the least potential for adverse impact on the water environment due to the reduced potential for direct interference with waterbodies.

5.11 Geology & Soils

5.11.1 Introduction

Geology and soils play an important part in determining the environmental character of an area. The nature and alignment of rocks has a major influence on landform and subsequent road development. Northern Ireland has approximately 97 soil parent materials, making it the most geologically diverse area of its size in the British Isles. The nature of the geology as a parent material will influence the character of the soil of a region. Soil chemistry and physical structure will influence the type of vegetation native to that area. Soil type is a major determining influence on the agricultural worth of an area of land. Road schemes can have an impact on both the geology and soils of an area, and it is therefore important that the potential impacts of development on these environmental factors are considered fully.

Geological or geomorphological features, which are considered to be of significant national importance, are designated as Areas of Special Scientific Interest (ASSI), meaning that they have a certain degree of statutory protection against operations which might cause damage or loss of that important feature, and consideration should be given to the impact of any scheme on these. In Northern Ireland, other sites of geological importance are classified by the Northern Ireland Environment Agency (NIEA) - Natural Environment Division (NED) as Earth Science Conservation Review (ESCR) sites.

The objective at this secondary stage is to consider the impact of the route options under consideration upon the geological and soil assets/constraints within the affected area and the significance of effects associated with those impacts.

5.11.2 Methodology

Assessment of the route options at this secondary stage will address the following areas:

- impact on important geological mineral deposits;
- impact on agricultural soil;
- impact on any sites that have educational or scientific interest due to their rarity; and
- the possibility of hazardous materials being exposed.

In accordance with the requirements of DMRB Volume 11, Section 3, Part 11 (Geology & Soils) Chapter 7 (Stages of Assessment), the steps taken include consultation with:

- Geological Survey of Northern Ireland (GSNI), and NIEA – NED to confirm and update information on the location and nature of any designated or undesignated sites of geological interest in the vicinity of the route options and to confirm and update information on solid and superficial geology, and the nature of soils in the study area;
- Department of Agriculture, Environment and Rural Affairs (DAERA) – Countryside Operational Management Branch to check and confirm agricultural land quality in the study area;
- NIEA – Resource Efficiency Division (RED) to obtain information on any known or potential areas of contaminated land within the study area; and
- Newry, Mourne & Down District Council (NMDDC) – Local Development Plan Team to confirm and update information on the location of any areas licenced for mineral development and quarrying activities in the study area.

5.11.3 Consultations

An important element in the assessment process is liaison and data collection, giving opportunity for relevant interested bodies to register concerns, constraints or particular requirements during the assessment process. The following table outlines the responses from the consultation in relation to Geology and Soils.

Table 5.11.1: Summary of formal consultation responses in relation to Geology and Soils

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Countryside Operational Management Branch	09 Apr 2018	18 Apr 2018	Collective response received.
DAERA- Planning Response Team (collective response, including RED)	09 Apr 2018 09 May 2018	17 May 2018	Advise to consult the NIEA Historic Land Use Layer (available on DAERA digital download page) and other information to identify current and previous industrial land uses which may have caused contamination. Should potentially contaminating activity be identified then a contaminated land risk assessment should be provided to identify issues for the site. Management of waste materials onto or off site should be authorised thought the Waste and Contaminated Land Northern Ireland) Order 1997, the Waste Management Licensing Regulations (Northern Ireland) 2003 and the Water Order (Northern Ireland) 1999.
GSNI	09 Apr 2018	25 Apr 2018	All routes avoid the top edge of Drumalane Quarry which continues to show evidence of instability. The northwest-southeast orientated, southwest dipping fault, that is the cause of most of the problems at Drumalane, projects and cuts Benson's Glen, 250m downhill of Flagstaff Road. If the Blue Route options are not in cutting in this area, they shouldn't pose a problem as they cross it perpendicular and possibly other similarly orientated faults. The instability issues in Drumalane came about because the fault plane was undercut from the northeast, so the only section of route GSNI are concerned about is the Red and Yellow Routes, between Fathom Mountain and Green Island, where these routes would be in cutting parallel to faults in the region. Care will be needed to ensure that if northwest-southeast orientated faults are encountered in this cutting, they are not undercut.
NMDDC – Local Planning	09 Apr 2018 09 May 2018		Collective response received.
NMDDC – Local Development Plan Team	14 Feb 2018 09 Apr 2018 09 May 2018	18 May 2018	No Comment on two variants of the Blue Route. All Blue Route options cross the Newry River and pass through an area of open space identified in the Banbridge, Newry and Mourne Plan 2015. Currently, both the Strategic Planning Policy Statement for NI (SPPS) and Planning Policy Statement 8: Open Space, Sport and Outdoor Recreation (PPS8) Policy OS1 afford protection to existing areas of open space with a presumption against development that would result in their loss. However both policy documents allow for an exception to this presumption against development where the redevelopment would bring 'substantial community benefits that decisively outweigh the loss of open space.' I can advise that the LDP team in bringing forward the Council's new Planning Policy on protection of Open Space will be guided by the SPPS. At this stage in the LDP process, following a

preliminary review of operational policy, the Plan team propose that existing policy as contained within PPS8 is carried forward in its current form with some clarification and changes to reflect the SPPS.

5.11.4 Regulatory & Policy Framework

The following key legislation and planning policy is pertinent to the assessment of the scheme in relation to impacts upon geology and soils.

5.11.4.1 The Environment (Northern Ireland) Order 2002

This legislation requires NIEA to identify and designate ASSIs, which are nationally important sites designated for their important flora, fauna and/or geological features. The Order replaces the original ASSI provisions contained in the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 [as amended].

5.11.4.2 The Waste and Contaminated Land (Northern Ireland) Order 1997 (Part III)

The Waste and Contaminated Land Order was made in November 1997, came into force in March 1998 and implements the EC Framework on Waste in Northern Ireland. The Order makes a number of provisions, such as:

- transfer of responsibility for waste regulation from the district councils to the DAERA, focused within the NIEA (Part II Waste on Land section of the Order);
- introduction of measures designed to increase control over the processing and handling of waste including Waste Management Licensing, Duty of Care, Registration of Carriers, Special Waste and Producer Responsibility (Part II Waste on Land section of the Order); and
- introduction of measures relating to the identification of contaminated land, designation of special sites, duties of enforcing authorities to require remediation, determination of appropriate persons to bear responsibility for remediation, liability of contaminating substances which escape to other land, and contaminated land registers (Part III Contaminated Land section of the Order).

Some parts of the Order with respect to waste management have yet to be implemented; for example, waste licensing is operating under the provisions of the Pollution Control and Local Government (Northern Ireland) Order 1978 until regulations for the transfer of responsibility to DAERA can be introduced.

Part III of the Order contains the main legal provisions for the introduction of a contaminated land regime in Northern Ireland. The Order was enacted in 1997 but the regime is not yet in operation. This regime is very similar to that provided in Part IIA of the Environmental Protection Act 1990 in England, Scotland and Wales.

5.11.4.3 The Waste Management Regulations (Northern Ireland) 2006 and The Water Order (Northern Ireland) 1999

The management of all materials onto and off a scheme construction site should be suitably authorised through the Waste Management Regulations (Northern Ireland) 2006 and/or the Water Order (Northern Ireland) 1999. This should be demonstrated through a Site Waste Management Plan (SWMP) (see http://www.netregs.gov.uk).

5.11.4.4 The Plant Health Order (Northern Ireland) 2006 [as amended]

Under Articles 10 to 12 of this Order, certain relevant material shall not be removed from an area of plant health control (defined in Article 10(2)) until the Department is satisfied as to the matters specified in Article 12, unless an inspector has discharged that relevant material, or the removal of that relevant material is permitted under Part 6 (measures to control the landing of relevant material and prevent the spread of plant pests).

5.11.4.5 Planning Policy Statement 2 (PPS 2) Natural Heritage

This Planning Policy Statement, PPS 2, sets out DfI's planning policies for the conservation, protection and enhancement of our natural heritage. From a geology and soils perspective, key policy objectives are:

- to further sustainable development by ensuring that biological and geological diversity are conserved and enhanced as an integral part of social, economic and environmental development;
- to assist in meeting international (including European), national and local responsibilities and obligations in the protection and enhancement of the natural heritage; and
- to protect and enhance biodiversity, geodiversity and the environment.

In essence, any planning decision should ensure that appropriate weight is attached to designated sites of international, national and local importance; priority and protected species; and to biodiversity and geological interests within the wider environment.

5.11.4.6 International Atomic Energy Agency (IAEA) Safety Standards

The IAEA's Safety Standards are not legally-binding on Member States but may be adopted by them, at their own discretion, for use in national regulations in respect of their own activities. In the case of clearance, the Safety Guide RS-G-1.7 defines radiological criteria as a basis for determining clearance levels but leaves the establishment of clearance levels to national authorities. There are no firm clearance levels and it is understood that the intention is for agreement to be reached on appropriate levels with the relevant Environment Agency based on risk, on a case-by-case basis.

5.11.4.7 Guidance on the Regulation of Greenfield Soil in Construction and Development 2015

This is a guidance document produced by the NIEA and the Construction Employers Federation (CEF), in order to promote the sustainable re-use of greenfield soil. The NIEA take the view that if excess uncontaminated greenfield soils are generated during development works, as long as this material is put to an agreed, suitable end use, the soil will not be subjected to waste regulatory controls (i.e. a waste management licence or a registered exemption will not be required). In terms of road construction, examples of suitable end use include, the road itself, hardshoulders, footpaths or embankments on which any of these elements are placed.

Producers and users are not obliged to comply with the guidance, but if they do not, the greenfield soil would be classified as a waste and would be subject to the requirements of waste legislation. Consequently, the storage, treatment, transportation, deposit or disposal of such material without the requisite licences or permits may constitute an offence.

5.11.4.8 NIEA Regulatory Position Statement – Low Risk Construction Activities (May 2016)

The NIEA Regulatory Position Statement – Low Risk Construction Activities provides details of the various construction activities which will now, not be subject to formal waste management authorisation. Maximum quantities are included within the statement and involve activities such as:

- re-use of topsoil, subsoil, clay;
- storage of asphalt road planings;
- re-use of asphalt road planings for the construction, repair or maintenance of tracks, roads and car parks;
- storage of waste road chippings (not planings), pending their recovery; and
- storage of waste kerb and paving stones to be subjected to manual cleaning destined for re-use.

5.11.5 Baseline Conditions

The only available published geological mapping is the regional 1:250,000 Solid edition (1997) and the 1:250,000 Quaternary [Drift] (1991) edition mapping. The area has not been re-mapped in modern times and as such, there are no specific modern memoirs available. Field slips (original base maps used during field work) from 1880 are available to cover some of the study area.

5.11.5.1 Solid Geology

Based on the 1:250,000 Solid Edition Geological Map for Northern Ireland (Figure 5.11.1), the underlying geology is dominated by the Gala & Red Shale (Hawick Group) (Lower Palaeozoic Ordovician - Silurian), the Newry Granodiorite Complex, and the Slieve Gullion Complex (Palaeogene Intrusive Igneous), together with other minor intrusions.

The Gala & Red Shale (Hawick Group) has very similar characteristics and comprises mainly greywacke and shales but has various igneous intrusions of dolerite and basalt. They have been deformed and subjected to low-grade metamorphic alteration. The metamorphism and deformation has resulted in the formation of the folds, cleavages and joints, which now determine the physical characteristics of the rock and can lead to extreme local variability of hardness and strength.

As summarised in Table 5.11.1, GSNI has commented that the bedding, fold structures and related cleavage(s) in the Silurian rocks have broadly parallel orientations and are steeply inclined (70 to 80 degrees) towards the north-west and south-east. There may be some local deviation from this trend as a result of faulting or the effects of doming, due to the emplacement of the major igneous intrusions.

The Newry area is generally underlain by igneous intrusive granodiorites (both 2nd and 3rd phase), of the Newry Granodiorite Complex from the Devonian Period (Figure 5.11.1). Postdating this, the granodiorites contain several dolerite & basalt dyke intrusions, including four underlying the Newry River, south of the Rampart.

A band of Palaeogene igneous intrusive felsite, part of the Slieve Gullion Complex, cuts through the granodiorites on the western flanks of the river valley, on the slopes of Fathom Mountain. The Slieve Gullion Complex represents the ‘root’ zone of a now deeply eroded volcanic caldera that intruded the south-west end of the Caledonian Newry Igneous Complex.

Several major faults are evident on available mapping, shown in Figure 5.11.1. The Newry Fault, trends north-west to south-east down towards Carlingford Lough. Additionally, there are several minor faults trending locally N-S and ENE-WSW. Other unmapped fault lines are likely to be present in the vicinity.

Surveying carried out by GSNI in 2016 records a potential fault zone on the western backwall of the quarry. This has been described as the likely contact between granodiorite and greywacke. This area of the quarry is considered to be ‘very high risk’ due to the potential for landslide and rock fall.

Fault gouge and breccia has also been observed locally within granodiorite to the east of the quarry, within 100m of the Newry River.

5.11.5.2 Drift Geology

Based on the 1:250,000 Quaternary Edition Geological Map for Northern Ireland, the study area is predominantly underlain by glacial till deposits (Figure 5.11.2). The glacial tills generally consist of clay and silty clay based boulder clay type deposits, containing cobbles and boulders mainly of local bedrocks (greywacke sandstone and shale, granodiorite and various other igneous rocks).

Much of the study area consists of steep to moderate slopes with bedrock relatively close to the surface. Consequently, rather than form the typical “drumlin” topography, the till is likely to be thin and form a thin carapace over parts of the bedrock. This is most notable on the slopes of Fathom Mountain around Fathom Forest, and on the slopes of Cloghogue Mountain. Areas of rock at or near surface can be defined as rock being within 3 metres of existing ground level.

The Quaternary mapping identifies areas of recent marine deposits along the line of the canal and Newry River, which comprise mainly estuarine clays with some sands and silts.

Early geological mapping (c. 1880) and subsequent ground investigations indicate that much of the floor of the Newry River valley is filled by a complex sequence of river alluvium, and estuarine alluvium deposits. These deposits, which in central parts of the valley can be in excess of 20 metres thick, consist of clays and silts, fine and coarse stratified sand & gravel with variable organic content including rootlets, shells and buried peat layers. These are underlain by glacial deposits, which may extend to depths of greater than 50 meters.

Made ground is anticipated at various locations within the study area, most obvious in the former railway embankments either side of the Newry River/Newry Ship Canal, existing road construction, and in backfilled excavations for example in former quarries. It is anticipated that there are areas of made ground and reclaimed fill associated with the suburbs of Newry, the Greenbank Industrial Estate, and areas adjacent to the Newry River. Along the A1 and the Belfast to Dublin railway, areas of engineered fill are likely to be present.

GSNI has confirmed that made ground or fill material can be expected to occur along parts of the flat-lying floor of the Newry River valley between Newry and where reclamation has taken place on the shore at the head of Carlingford Lough. Various materials have been used to reclaim the former tidal mudflats.

5.11.5.3 Soils

With reference to the 1:50,000 Soils Map for the area (Sheet 29), a range of soil profile types are present within the study area, all with their own individual drainage and nutrient characteristics (Figure 5.11.3). Soils reflect the character of the underlying rocks, as well as being heavily influenced by the prevailing climatic conditions.

Newry City, as far south as Cloghogue and across to the old Warrenpoint Road is classified as ‘Urban’, with no associated soil classification. Similarly, Fathom Line and the A2 Warrenpoint Road are classified as ‘Disturbed’. Fathom Mountain is dominated by Brown Ranker soils on a granite parent material. On the more southern slopes of Fathom Mountain, where deposits are thinner, soils are dominated by Brown Rankers on a felsite parent material with pockets of Humic Rankers on felsite.

On the eastern flanks of the Newry valley, soils are dominated by Brown Podzols on a granite parent material though other soil types constitute this complex. Further south, soils are dominated by Brown Podzols on a shale parent material and Brown Rankers on shale till complex.

5.11.5.4 Agricultural Land

Consultation with DAERA returned no response in relation to agricultural land. It is assumed at this stage that there are no issues in terms of soil or land quality, as previous consultation confirmed that no areas within the study area were infested with either Potato Cyst Nematode (PCN) or Potato Wart Disease (PWD). In fact, Northern Ireland is now regarded as a PWD free zone, according to the Northern Ireland Executive, following a ten-year plan of systematic sampling and testing of land (from 2000-2011) by the Agri-Food and Biosciences Institute (AFBI) and DAERA.

5.11.5.5 Minerals

As noted within the Banbridge / Newry & Mourne Area Plan 2015, mineral resources within Banbridge and Newry & Mourne Districts comprise greywacke/gritstones which are quarried at a number of locations. All supplies of sand & gravel in the area originate from the superficial deposits located along the coastal lowlands south of the Mourne Mountains. There are no restrictions within the Area Plan for mineral extraction. The Area Plan states that, “the minerals produced from the hard rock and sand and gravel quarries are used to produce building and roadstone aggregates for the construction industry for Banbridge, Newry and Mourne and the wider Belfast markets.”

Records of current quarry mining information for the study area were accessed from “BGS - The Directory of Mines and Quarries”, dated 2014. Two notable quarries have been identified in the area, along with a number of historical quarries (Figure 5.11.4).

Drumalane Quarry (Fathom Line) is within the study area, although consultation with the DfI Newry Section Office has indicated that it is no longer in operation for mineral extraction. It was used to extract Greywackes for the production of crushed rock aggregate and bituminous macadam. Drumalane Quarry has a history of instability which has resulted in a section of Hillhead Road that runs along the top of the quarry being closed and has not been re-opened. Land to the west of Hillhead Road has also been affected. As detailed in the response received from GSNI dated 25th April 2018, Drumalane Quarry continues to show evidence of instability.

The second licensed mineral extraction area, Bigwood Quarry (Sandstone) is located east of the A2 Warrenpoint Road, within the Narrow Water Forest area (Figure 5.11.4).

5.11.5.6 Contaminated Land

Where land has been impacted by waste and residues from former or current industrial processes, the presence of toxic or other hazardous material may pose threats to human health or impose other constraints, should it require excavation or avoidance. A review of available historic Ordnance Survey plans, along with NIEA Land Use Database information, has confirmed that there are a multitude of locations within the general study area where potentially contaminated land may be present (Figure 5.11.5).

Through the consultation process, concerns were raised regarding the potential for radionuclides to be present within the waters of Carlingford Lough and its associated near-shore intertidal sediments.

Carlingford Lough is a shallow estuary approximately 13km in length and 5km at its widest, with a relatively narrow stretch of approximately 1.7km at the entrance. The lough itself straddles the border, with the northern shore of the lough in Northern Ireland, and the southern shore in the Republic of Ireland. It is primarily a sedimentary lough but where rocky shores occur, they are dominated by boulders which act either as a band around high water or as a relatively widely dispersed zone at around low water spring (Irish Sea Study Group Report, 1990). Where fine sediments occur, they are composed of muddy sand as reflected within the sediments of the estuary and within the study area.

Fine-grained sediments have an affinity for the accumulation of radionuclides more so than coarse-grained sediments because they have a larger capacity to absorb radionuclides. This is due to the greater specific surface areas of the smaller grains, thus clay minerals are usually considered to be the most highly enriched particles with respect to radionuclides (Hamilton, 1998). This should mean in theory that gamma-ray activity will therefore be enhanced in these areas.

The presence of radionuclides within underlying lithology is a natural occurrence. In geology and geophysics, the most important natural radionuclides are uranium-238 and thorium-232 and their radioactive decay products (daughters) and potassium-40 (Ayres and Theilen, 2001).These three isotopes dominate the natural radioactivity of sediments with potassium dominating the most due to its abundant presence in sediments even though it has a low radioactive emission, as the potassium-40 isotope is relatively stable. The concentrations of uranium and thorium are generally low so they are considered to be trace elements and are rarely concentrated in sediments to more than 10ppm (Ruffell and Wilson, 1998). The reason why they are so important is that they are both unstable and due to their individual atomic mass being so high, they have a higher radioactive emission than potassium (Ruffell and Wilson, 1998). In the hinterland that surrounds the sediment traps of Carlingford Lough, the uranium content underlying the soil is considered to be high with the Mourne Mountain granites being the most uranium-enriched tertiary granites in the British Isles, so it is expected that natural radiation of theses sediments should also be high. This is because potassium and uranium are both soluble in aqueous solution, thus being prone to the processes of erosion. It is expected that these radionuclides should gather in these sediment traps due to erosion and the ability of fine sediments to accumulate and maintain radionuclides.

The activities of mankind have been responsible for a variety of releases of radionuclides to the environment, both planned and accidental. On a global scale, the most dominating form of radionuclide release to the marine environment can be attributed to global fallout from weapons testing but in the Irish Sea; the most significant form of anthropogenic radionuclide contamination is linked to the ongoing activities of the Sellafield Nuclear Reprocessing facility.

5.11.5.7 Designated and Non-Designated Sites

With reference to the ‘Countryside Assessment (Vol. 2) Technical Supplement of the Banbridge / Newry & Mourne Area Plan 2015’, Dublin Road Bridge Site of Local Nature Conservation Importance (SLNCI), designated for its earth science interest, is within the general study area, located immediately north of Cloghogue Roundabout (Figure 5.11.4). Also immediately west of this roundabout is Carrivemaclone ASSI, which is designated for its earth science interest. This site comprises two sections:

- a roadside section immediately north of the Cloghogue Roundabout on the western [northbound] side of the A1 Newry bypass; and
- a roadside section at the south-western side of the A1 onslip at Cloghogue.

Both sites are essentially designated to protect the same geologically important features, which show evidence in the variety and relative timing of intrusion of igneous rocks (granodiorite) and access to an exposed contact between two plutons of the late Caledonian Newry Igneous Complex, amongst other features. There is also an exposure of granophyre rock adjacent to Cloghogue Roundabout.

Fathom Mountain forms part of the Slieve Gullion Ring, a site recognised by the Earth Science Conservation Review (ESCR) as being an earth science locality, within Northern Ireland, which achieves at least national significance. With reference to the ESCR database, the Ring of Gullion is considered the most spectacular example of a ring-dyke intrusion in the British Isles. According to Northern Ireland Environment Agency (NIEA) records, the oldest rocks in the area formed more than 400 million years ago, in an ancient ocean, during the Silurian period. Masses of molten granitic rock were later intruded into these rocks, which underlie Newry City and much of the Slieve Gullion area. These granites are approximately 390 million years old and date from a major period of mountain building in Ireland. Some 65 million years ago, in the Tertiary period, the area once again became a centre for volcanic activity. The sequence of events is complex but probably began with the development of a very large volcano of which little now remains. In more recent times, the landscape has been shaped by the action of glaciers during successive Ice Ages. Glaciers exploited existing weakness in the rocks, eroding deep valleys through the Ring of Gullion. The upstanding hills were glacially scoured leaving craggy outcrops, boulder strewn slopes and rocky ridges and hollows. The valley bottoms were in-filled with glacial deposits forming rounded drumlins, streamlined by the flowing ice.

5.11.6 Assessment of Environmental Impacts

5.11.6.1 Solid Geology

In terms of constraints associated with the structural geology of the area affected by the approved route options under consideration, all routes would avoid the area of geological instability associated with the western extent of Drumalane Quarry, which continues to show signs of instability.

As noted in the consultation response from GSNI summarised in Table 5.11.1, the northwest-southeast orientated, southwest dipping fault, that is the cause of most of the problems at Drumalane Quarry, projects and cuts Benson's Glen, 250m downhill from Flagstaff Road. As the Blue Route options would largely be on embankment in this area, they should not pose a problem as they cross the fault perpendicular to it and possibly other similarly orientated faults.

The instability issues at Drumalane Quarry is thought to have come about because the fault plane was undercut from the northeast, so the only section of route GSNI is concerned about is the Red and Yellow routes, between Fathom Mountain and Green Island, where these routes would be in cutting parallel to faults in the region. Care will be needed to ensure that if northwest-southeast orientated faults are encountered in this cutting, they are not undercut.

With reference to Figure 5.11.1, the Yellow and Red routes would be underlain by greywackes and red shales (sandstone) from the Hawick Group in the vicinity of the A2 Warrenpoint Road and on the Fathom Line (essentially covering the valley floor). However, at Rough Island, the landing point of the bridge crossing associated with the Yellow Route would be on a dolerite & basalt dyke intrusion.

Along the lower slopes of Fathom Mountain, both the Red and Yellow routes would largely traverse granodiorites, passing over a number of dyke intrusions adjacent to the Newry Ship Canal, though as both routes sweep round the northern flank of Fathom Mountain, they would traverse felsites in a northwest-southeast orientation.

There is very little to separate the Blue Route options in terms of structural geology traversed. From the A2 Warrenpoint Road to the lower slopes of the western valley side, all Blue Route options would be underlain by the greywacke and shales, then traversing felsites on the slopes of Fathom Mountain before traversing granodiorites towards the A1 Dublin Road.

5.11.6.2 Drift Geology

With reference to Figure 5.11.2, the Red and Yellow routes generally traverse thin superficial deposits where the bedrock is at or near the surface on the lower slopes of Fathom Mountain and between Barracric Road and Ellisholding Junction. Between Barracric Road and Benson’s Glen, both routes would traverse an area of glacial till. The piers associated with each bridge crossing would directly affect recent marine deposits, with the Red Route requiring the greater number of piers.

Blue Route Options 1, 2 and 3 would generally be underlain by glacial till on the lower slopes of the western valley side, through Benson's Glen and west of Flagstaff Road. On the northern flank of Fathom Mountain, it is expected that bedrock at or near the surface would be encountered, before again encountering glacial tills in the vicinity of old Dublin Road through to Ellisholding Junction. The shorter bridge crossing with the Blue Route options would limit the number of piers affecting marine deposits, though the marine deposits would still likely be encountered in the area of reclaimed land between the Rampart and the A2 Warrenpoint Road.

5.11.6.3 Soils

East of the Newry River, the Yellow and Red routes would traverse 'Disturbed' ground associated with the A2 Warrenpoint Road, and infringe slightly on Brown Ranker soils on a shale parent material, with associated free drainage. West of the Newry River, the routes would initially traverse Brown Ranker soils on a felsite parent material on the lower slopes of Fathom Mountain, in the vicinity of Fathom Line. They would then traverse Brown Rankers on a granite parent material from Fathom Forest through to Ellisholding Junction, though would infringe on a small area of alluvium, north of Barracric Road.

Blue Route Options 1, 2 and 3 would traverse 'Urban' ground in the vicinity of Greenbank Industrial Estate. To the west of the Newry River, these route options would primarily traverse Brown Ranker soils on granite parent material.

The various route options would largely traverse similar soil types, due to their relative juxtaposition.

5.11.6.4 Agricultural Land

As with any proposed major rural road scheme, agricultural land will inevitably be lost to accommodate the infrastructural development. To this end, agricultural land of varying quality would be traversed to the south of Newry.

The Red and Yellow Routes are more likely to impact on agricultural land, due to their location within a more rural setting, on the western slopes of the Newry River Valley. Blue Route Options 1, 2 and 3, would affect a combination of urban land on the southern fringes of Newry itself, and agricultural land on the western flank of the valley.

Consultation with DAERA returned no response in relation agricultural land, Potato Cyst Nematode (PCN) or Potato Wart Disease (PWD). It is assumed that there are no issues in terms of soil or land quality, as previous consultation with the then DARD confirmed that no areas within the study area were infested with either PCN or PWD. In fact, Northern Ireland is now regarded as a PWD free zone, according to the Northern Ireland Executive, following a ten-year plan of systematic sampling and testing of land (from 2000-2011) by the Agri-Food and Biosciences Institute (AFBI) and DARD.

5.11.6.5 Minerals

As shown on Figure 5.11.4 all Blue Route options would directly affect the Drumalane quarry area, however the area affected has shown limited signs of being actively or historically quarried based upon a review of available aerial photography. The route options would however directly affect an internal access lane which leads to an area where quarried rock was crushed, with evidence of quarry fines remaining in this area. It is not envisaged that the area of instability would affect this area.

Bigwood Quarry (Sandstone) is located east of the A2 Warrenpoint Road, within the Narrow Water Forest area (Figure 5.11.4). It is unlikely that this would be directly affected by any of the route options under consideration.

A number of other historical quarries have been identified (Figure 5.11.4). On the approach to Ellisholding Junction, all route options would potentially encroach into an old quarry [C] located between the old Dublin Road and the Belfast/Dublin Railway. A review of available aerial photography would suggest that there may also be possible encroachment into a worked (assumed quarried) area on the northern flank of Fathom Mountain. Blue Route Options 2 & 3 would have the greatest potential to encroach into this area.

5.11.6.6 Contaminated Land

The potentially contaminated areas are indicated on Figure 5.11.5. The source locations have been identified from the NIEA Land Use Database, and both historic and current maps. Sensitive receptors include the following groups:

- Human health from future road users, which include on-site construction workers, maintenance workers, off-site workers and residents;
- The water environment which may be impacted from contaminated groundwater within superficial deposits and bedrock. The Newry River, Newry Ship Canal and local streams are also potential receptors;
- Road construction materials; and
- Ecological receptors, including vegetation and wildlife.

The potential contaminated land sources which fall within or close to the route options have been identified below.

Red Route may affect the following potentially contaminated land sources:

- Mineral workings near the B79 Fathom Line (Source No. 7);
- Mineral workings and a possible quarry (Source Nos. 81,82 & 90); and
- The current Belfast – Dublin railway line at the western section of the route and two historical railway lines running either side of the Newry River (Newry to Greenore Railway; Newry to Warrenpoint Railway) (Source Nos. 2, 5, 12 & 80).

Yellow Route may affect the following potentially contaminated land sources:

- Mineral workings near the B79 Fathom Line (Source Nos. 3 & 7);
- Dockyards & docklands (Source No.4);
- Mineral workings and a possible quarry (Source Nos. 81, 82 & 90); and
- The current Belfast – Dublin railway line at the western section of the route and two historical railway lines running either side of the Newry River (Newry to Greenore Railway; Newry to Warrenpoint Railway) (Source Nos. 2, 5, 12 & 80).

Blue Route Options 1, 2 and 3 may affect the following potentially contaminated land sources:

- Factory/works (Source No. 26);
- Waste recycling: landfills & other waste disposal sites (Source No. 24);
- Drumalane Quarry (Source No. 69);
- Mineral workings (Source Nos. 81 & 90);
- The current Belfast –Dublin railway line at the western section of the route and two historical railway lines running either side of the Newry River (Newry to Greenore Railway; Newry to Warrenpoint Railway) (Source Nos. 12, 27, & 80); and
- A garage and fuel station on the A2 Warrenpoint Road (Source No. 25);

In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land and infilling, may also give rise to potential contaminated sites.

Table 5.11.2 below identifies the radionuclides of interest, their half-life, and the measurements taken from the silt at Newry in 1990, taken from Table 7 contained within Radioactivity Monitoring of the Irish Marine Environment 1991 and 1992, (A McGarry *et al*., Radiological Protection Institute of Ireland). The 1990 measurements have been decay-corrected to reflect the values today, now that 28 years have passed since originally analysed, as some of the radionuclides have relatively short half-lives. The decay-corrected specific activities can then be compared with the limits identified for clearance levels, be it from regulatory guidance (Safety Guide RS-G-1.7) and those in use by close neighbouring countries (e.g. the UK's 'out of scope' limits).

Table 5.11.2: Radioactivity Data

Radionuclide	Symbol	Half-life Value	1990 Specific Activity Silt Values[2]		Decay Corrected Silt Value at 2018	Clearance Limit (Bq/g)	
			Bq/kg	Bq/g	Bq/g	RS-G-1.7[4]	UK OOSOR[5]
Americium-241	Am241	433 y	8.84	0.009	0.009	0.1	0.1
Caesium-134	Cs134	2.1 y	4.4	0.004	0.0000004	0.1	0.1
Caesium-137	Cs137	30.2 y	179	0.179	0.094	0.1	1

Source: Radioactivity Monitoring of the Irish Marine Environment (Table 7)

Safety Guide RS-G-1.7 notes that where activity concentrations exceed its stated values by several times (e.g. up to ten times), the regulatory body may decide (where the national regulatory framework so allows) that the optimum regulatory option is not to apply regulatory requirements to the legal person responsible for the material. In many cases, a decision will be made by the regulatory body on a case-by-case basis, following notification, and will take the form of an exemption.

With reference to Table 5.11.2, the silt data does not exceed the limits identified by the Safety Guide RS-G-1.7 criteria, once decay-corrected, and is far below the "*greater than 10 times*" criteria. The silt data is well within the limit for "out of scope" and therefore would not require any special controls and would be exempt from radioactive substance regulation in Northern Ireland.

Whilst it is obvious that a route with the shortest crossing would minimise the risk of interfering with inter-tidal sediments, it is not envisaged that there would be a risk to humans or the environment in terms of radionuclides from any of the route options under consideration.

5.11.6.7 Designated and Non-Designated Sites

Given the sensitivity of the designated sites, effort would be made to minimise the impact. The Carrivemaclone exposure was created due to the A1 Beech Hill to Cloghogue dualling scheme. It is therefore possible that any future construction may also uncover interesting geological features. A new exposure could enhance geodiversity and geological interest in the area.

The Red, Yellow and Blue route options would potentially have an impact on the Ring of Gullion Complex due to the direct impacts on Fathom Mountain. On the climb up the lower slopes of Fathom Mountain, it is likely that cutting would be required by an alignment within each of these route options, thus creating fresh exposures of the underlying lithology. However, there remains the possibility, as stated above, that creation of fresh exposures may reveal certain features of geological interest.

5.11.7 Mitigation & Enhancement Measures

It is unlikely that there would be a significant impact on the solid or drift geology. It is therefore unlikely that mitigation would be necessary (apart from geotechnical stabilisation (if necessary)). Similarly, as there would be no significant impact on licensed areas of mineral extraction, it is unlikely that mitigation would be necessary.

Potentially contaminated land would be investigated further, possibly as part of the geotechnical investigation at a later design stage. Remediation measures (if necessary) would be determined following this ground investigation.

Any impact on designated areas, such as the ASSI or SLNCI in the vicinity of Cloghogue Junction may be offset by the uncovering of other important geological features in the area.

5.11.8 Presentation of Key Issues

The key issues associated with the five route options from a Geology & Soils perspective are listed below:

- There is a history of instability at Drumalane Quarry which has resulted in a section of Hillhead Road that passes along the top of the quarry being closed and has not re-opened.
- The study area contains one area (Bigwood Quarry) currently licensed for mineral extraction.

- Potential contaminated land sources have been identified within each route option. Further investigation of the ultimately selected route will be required to determine the likely impact it may have on the suspected contaminated land sources.
- It is not envisaged that there would be a risk to humans or the natural environment in terms of radionuclides from any of the route options under consideration.
- Being the shortest in length, Blue Route Options 1, 2 or 3 would be preferred in terms of minimising impacts upon the underlying lithology. The Red and Yellow Routes would however be preferred from a contaminated land perspective.
- There would be no direct impacts on designated sites of geological interest with any of the route options. Each route option has the potential to reveal certain features of geological interest.
- Due to fault line orientation in the area, GSNI has expressed concern about the stability of the Red and Yellow Routes between Fathom Mountain and Green Island.
- On balance, from a geology & soils perspective, any of the Blue Route options would be preferred as they minimise impact on the underlying lithology and avoid an area of potential instability associated with the Red and Yellow routes.

6. Traffic and Economic Assessment

6.1 Introduction

The objective of the Stage 2 Traffic and Economic Assessment is to describe existing traffic conditions in the Newry area, to outline the indicative costs, risks and optimism bias associated with the Proposed Route Options and to describe the modelling work undertaken to develop the computer models. This report also considers future traffic conditions over the economic life of the route options and presents the results of an operational and economic assessment of the route options.

The study area for the traffic and economic assessment encompasses Sheepbridge junction in the north to the Ellisholding junction and Warrenpoint Harbour in the south.

A detailed programme of data collection surveys was undertaken within the study area to assist in establishing current traffic volumes and vehicle proportions at key locations within the corridor, to quantify variations in traffic demand during a typical weekday, and to estimate current vehicle speeds and journey times along the route. Through the collection and analysis of this information, the prevailing traffic demand and operating conditions in the study area have been established.

A COBA (Cost Benefit Analysis) computer model has been developed to examine the costs and benefits of the Proposed Route Options. This is the standard computer model for the economic assessment of major road improvement schemes in Northern Ireland. A general location plan of the study area is shown in Figure 6.1.1. All figures in this section of the report will be contained in Appendix A.

6.2 Traffic Surveys and Data Collection

6.2.1 Introduction

A detailed programme of data collection surveys was undertaken within the study area to assist in establishing current traffic volumes and vehicle proportions at key locations within the corridor, to quantify variations in traffic demand during a typical weekday, to define current vehicle speeds and journey times along key routes and to estimate vehicle trip patterns in the area. Through the collection and analysis of this information, the prevailing traffic demand and operating conditions in the study area have been established.

The surveys included Manual Classified Counts (MCCs), Automatic Traffic Counts (ATCs), measurement of journey times and a vehicle registration survey. These surveys were undertaken during June 2017 to collect information on typical operating conditions during a neutral month.

Full details of the data collection surveys are described in the DMRB Stage 2 Traffic Survey and Data Report, dated September 2017. The key findings and results of the relevant data collected during these surveys are presented in this report.

6.2.2 Manual Classified Counts

6.2.2.1 Methodology

Manual Classified Counts (MCCs) were undertaken at twenty locations around Newry on Tuesday 6 June 2017 and Tuesday 13 June 2017 to define current traffic volumes and turning movements.

The MCCs were undertaken at the following locations on Tuesday 6 June 2017:

- M1 – Dublin Road / The Glen / Dominic Street / Bridge Street / Drumalane Road Junction;
- M2 – Bridge Street / Buttercrane Shopping Centre / The Quays Junction;
- M3 – Bridge Street / Buttercrane Quay / William Street / Albert Basin Junction;
- M4 – William Street / River Street / St Marys Street Junction;
- M5 – William Street / Kilmorey Junction;

- M6 – Abbey Way / Boat Street / William Street Junction;
- M7 – Abbey Way / High Street Junction;
- M8 – Trevor Hill / Abbey Way / Kildare Street / Sugar Island Junction;
- M9 – Trevor Hill / New Street / Downshire Road / Sandys Street Double Roundabout;
- M10 – A27 Canal Street / A27 New Street / Canal Street Junction;
- M11 – A2 Greenbank Roundabout;
- M12 – A2 Old Warrenpoint Road Junction;
- M13 – A2 / Warrenpoint Harbour Docks Junction;
- M14 – Ellisholding Grade-Separated Junction;
- M17 – Damolly Roundabout;
- M18 – Drumalane Road / Albert Basin Road Junction;
- M19 – Flagstaff Road / Barracric Road Junction; and
- M18 – M20 – A1 Link Count at Ellisholding Grade-Separated Junction.

The MCCs were undertaken at the following locations on Tuesday 13 June 2017:

- M15 – B113 Dublin Road / Upper Fathom Road / Brogies Road Junction; and
- M16 – Cloghogue Grade-Separated Junction.

The MCC data for all sites were collected in 15-minute intervals between 07:00 hours and 19:00 hours over the survey period to provide a 12-hour record of turning movements.

The standard COBA 5-vehicle classification was adopted for the surveys, which includes the following vehicle types:

- Cars;
- Light Goods Vehicles (LGV);
- Other Goods Vehicles 1 (OGV1);
- Other Goods Vehicles 2 (OGV2); and
- Buses and Coaches (PSV).

6.2.2.2 MCC Locations

The locations of the MCCs are shown in Figure 6.2.1.

Full turning counts of all movements were undertaken at each MCC site, as well as a mainline count on the A1 at MCC Site 20.

6.2.2.3 MCC Survey Results

A summary of the MCC data for the existing route from Warrenpoint Road to the A1 at Cloghogue Roundabout is shown in Table 6.2.1.

Table 6.2.1 Summary of Observed 12-Hour Traffic Volumes: A2 Warrenpoint Road to A1 at Cloghogue Roundabout

MCC Site	Road	Section	Two-Way 12-Hour Flow
M13 – M12	A2 Warrenpoint Road	Narrow Water to Old Warrenpoint Road	12,430
M12 – M11	A2 Warrenpoint Road	Old Warrenpoint Road to Greenbank Rbt	11,780
M11	Kilmorey Street	Greenbank Rbt to River Street	18,000
M5	Kilmorey Street	Kilmorey Street to Dublin Road	13,300

M4	River Street	Kilmorey Street to Dublin Road	4,430
M5 – M4	Dublin Road	Kilmorey Street to River Street	16,190
M4 – M3	Dublin Road	River Street to Albert Basin	18,250
M3 – M2	Dublin Road	Albert Basin to Buttercrane/Quays	12,420
M2 – M1	Dublin Road	Buttercrane/Quays to Drumalane Road	12,340
M1 – M16	Dublin Road	Drumalane Road to Cloghogue Rbt	13,230 – 12,630

The following overall vehicle proportions were derived from the 12-hour MCC counts observed in June 2017:

- 82.6% Cars;
- 10.3% Light Goods Vehicles (LGV);
- 2.7% Other Goods Vehicles 1 (OGV1);
- 3.6% Other Goods Vehicles 2 (OGV2); and
- 0.9% Buses and Coaches (PSV).

Examination of the survey data identifies 08:15 hours – 09:15 hours as the AM Peak Hour and 17:00 hours – 18:00 hours as the PM Peak Hour for the study area.

The results of the June 2017 surveys indicate that 34,260 vehicles passed through the double roundabout on Downshire Road, 22,770 vehicles passed through the signalised junction at Bridge Street / Buttercrane Quay and 20,140 vehicles passed through Greenbank Roundabout. This level of traffic demand leads to significant delays and congestion in and around the city centre.

Examination of the MCC data also indicates that the most heavily trafficked section of road in the city centre was located on Abbey Way to the south of Sandyford Roundabout which carried 23,170 vehicles. Other sections of road network in the city centre which experience significant traffic demand include the A2 Warrenpoint Road / Kilmorey Street, which carried 18,000 vehicles and William Street, which carried 18,250 vehicles.

The traffic volumes on these road sections are comparable to traffic volumes on the A1 mainline at Ellisholding junction which varied between 18,860 and 23,070 vehicles during the 12-hour period.

Examination of the survey data by direction also indicates a pattern of tidality during the AM and PM peak hours.

The observed two-way 12-hour mainline and side road flows recorded for all vehicles are shown in Figure 6.2.2.

6.2.3 Automatic Traffic Counts

6.2.3.1 Temporary Automatic Traffic Count Locations

Automatic Traffic Count (ATC) data was collected at six temporary sites to provide a record of variations in daily traffic flows within the study area over a two week period between Monday 5 June 2017 and Sunday 18 June 2017.

The Temporary ATCs were undertaken at the following locations:

- ATC 1 – A2 Warrenpoint Road, northbound;
- ATC 2 – A2 Warrenpoint Road, southbound;
- ATC 3 – Fathom Line;
- ATC 4 – Dublin Road;
- ATC 5 – A28 Downshire Road; and
- ATC 6 – A2 Warrenpoint Road.

Data from the ATCs were recorded in 15-minute intervals for each direction of travel.

Where necessary, any partial data has been infilled using the available information to derive a reasonable estimate of the total traffic flow.

The locations of the temporary ATC sites are shown in Figure 6.2.3.

6.2.3.2 Temporary Automatic Traffic Count Results

The 12-hour, 16-hour, 18-hour and 24-hour traffic flows recorded by the ATCs during the two survey weeks are summarised in Table 6.2.2 and Table 6.2.3.

Table 6.2.2 Two-Way ATC Traffic Volumes: ATC 1 / 2 to ATC 4

Weeks 1 & 2	ATC 1 / 2		ATC 3		ATC 4	
	5-Day Average	7-Day Average	5-Day Average	7-Day Average	5-Day Average	7-Day Average
12-Hour	12,489	12,185	2,479	2,772	5,532	5,350
16-Hour	15,033	14,676	2,997	3,334	6,720	6,435
18-Hour	15,565	15,237	3,096	3,442	6,958	6,675
24-Hour	16,019	15,758	3,155	3,525	7,206	6,933
16/12	1.20	1.20	1.21	1.20	1.21	1.20
24/12	1.28	1.29	1.27	1.27	1.30	1.30
24/16	1.07	1.07	1.05	1.06	1.07	1.08
24/18	1.03	1.03	1.02	1.02	1.04	1.04

Table 6.2.3 Two-Way ATC Traffic Volumes: ATC 5 to ATC 6

Weeks 1 & 2	ATC 5		ATC 6	
	5-Day Average	7-Day Average	5-Day Average	7-Day Average
12-Hour	14,157	13,014	11,903	11,647
16-Hour	16,809	15,479	14,330	14,031
18-Hour	17,388	16,051	14,846	14,569
24-Hour	17,924	16,629	15,284	15,066
16/12	1.19	1.19	1.20	1.20
24/12	1.27	1.28	1.28	1.29
24/16	1.07	1.07	1.07	1.07
24/18	1.03	1.04	1.03	1.03

Comparison of the MCC data and temporary ATC 12-hour flows recorded on the day of the MCC survey on Tuesday 6 June 2017 is shown in Table 6.2.4.

Table 6.2.4 Comparison of Two-Way 12-Hour Traffic Flows on Day of MCC Survey

ATC Site	ATC Flow	MCC Site	MCC Flow	MCC / ATC
ATC 1 (Nb)	6,223	MCC 12 (to South, Nb)	6,448	+3.6%
ATC 2 (Sb)	6,170	MCC 12 (to South Sb)	6,459	+4.7%
ATC 3 (Nb)	1,317	MCC 18 (to South, Nb)	1,327	+0.8%
ATC 3 (Sb)	1,182	MCC 18 (to South, Sb)	1,170	-1.0%
ATC 4 (Nb)	-	No Direct Comparison	-	-

ATC 4 (Sb)	-	No Direct Comparison	-	-
ATC 5 (Nb)	7,282	MCC 17 (to South, Nb)	7,165	-1.6%
ATC 5 (Sb)	6,702	MCC 17 (to South, Sb)	6,617	-1.3%
ATC 6 (Nb)	5,895	MCC 13 (to North, Nb)	6,061	+2.8%
ATC 6 (Sb)	5,767	MCC 13 (to North, Sb)	5,893	+2.2%
Total	40,538		41,140	+1.5%

Comparison of the ATC flows, excluding ATC Site 4, indicates that these are within 1.5% of the MCC flows recorded at the neighbouring junctions.

A comparison of the two-way 12-hour ATC and MCC flows is shown in Figure 6.2.4.

6.2.3.3 Permanent Automatic Traffic Count Locations

DfI Roads maintains a system of permanent ATCs across the road network, one of which was located on the A2 Warrenpoint Road to the south of Newry and is a suitable source of historic long-term traffic flow data. This counter is referred to as Permanent ATC 421. This ATC was discontinued in February 2016.

The location of this permanent ATC is shown in Figure 6.2.5.

6.2.3.4 Permanent Automatic Traffic Count Results

The information collected from Permanent ATC 421 represents the most continuous data from which variations and trends in traffic flows on the A2 can be derived.

The latest ATC data available for a full calendar year from Permanent ATC 421 extends from January 2015 to December 2015.

To provide an indication of the reliability of the traffic data collected, the number of days in which traffic data was available in each calendar month has been determined as shown in Table 6.2.3 Two-Way ATC Traffic Volumes: ATC 5 to ATC 6. This information has been used to estimate the Annual Average Daily Traffic (AADT) flow in 2015.

Table 6.2.5 Permanent ATC 421: Count of Full Days Contributing to Annual Average Daily Traffic Flow

Month	Number of Full Days of Data Available
January 2015	30 / 31
February 2015	27 / 28
March 2015	26 / 31
April 2015	30 / 30
May 2015	31 / 31
June 2015	30 / 30
July 2015	31 / 31
August 2015	31 / 31
September 2015	28 / 30
October 2015	30 / 31
November 2015	30 / 30
December 2015	31 / 31
2015 Total	355 / 365 (97%)

Examination of the ATC data indicates that the raw data segregated by lane is partially fragmented for Lane 1 southbound for periods during March 2015 and May 2015 through to August 2015. As a result the data has been infilled using 2014 data to estimate a 2015 AADT flow.

A summary of the estimated two-way average daily traffic flows for each month in 2015 is shown in Table 6.2.6.

Table 6.2.6 Permanent ATC 421: Summary of 2015 Two-Way Monthly Average Daily Traffic Flows

Month	Two-Way Traffic Flow	Factor Relative to AADT
January 2015	12,957	0.92
February 2015	12,998	0.92
March 2015	13,828	0.98
April 2015	14,497	1.03
May 2015	14,619	1.04
June 2015	14,985	1.06
July 2015	14,791	1.05
August 2015	15,120	1.07
September 2015	14,187	1.01
October 2015	14,076	1.00
November 2015	13,692	0.97
December 2015	13,382	0.95
AADT	14,101	-

Examination of the average monthly traffic flows recorded in 2015 on the A2 Warrenpoint Road indicates the peak traffic volumes occur in August when the traffic flow is approximately 7% higher than the AADT flow.

The 2015 daily flow profile derived from the permanent ATC is shown in Figure 6.2.6.

6.2.3.5 2017 Derived Permanent ATC Data

As the Permanent ATC counter was discontinued in February 2016, an estimated 2017 AADT has been derived from the growth in traffic between the 2015 and 2017 derived from the temporary ATC data collected at ATC Site 1 / 2 on A2 Warrenpoint Road. The comparison between the 2015 and 2017 temporary ATC data is shown in Table 6.2.7.

Table 6.2.7 Comparison of 2015 and 2017 Temporary ATC Data at Site 1 / 2 A2 Warrenpoint Road

Date	Day	NB 24-Hour Flows			SB 24-Hour Flows			Two-Way 24-Hour Flows			
		May 2015	June 2017	Diff.	May 2015	June 2017	Diff.	May 2015	June 2017	Diff.	Diff. (%)
11/5/15 & 6/6/17	Mon	7,500	7,866	366	7,526	7,620	94	15,026	15,486	460	3.1%
12/5/15 & 7/6/17	Tue	7,421	7,818	397	7,774	7,949	175	15,195	15,767	572	3.8%
13/515 & 8/6/17	Wed	8,065	7,876	-189	8,374	8,062	-312	16,439	15,938	-501	-3.0%
14/5/15 & 9/6/17	Thu	7,991	8,222	231	8,299	8,298	-1	16,290	16,520	230	1.4%
15/5/15 & 10/6/17	Fri	8,212	8,293	81	8,746	8,696	-50	16,958	16,989	31	0.2%

16/5/15 & 11/6/17	Sat	7,135	7,675	540	7,652	8,081	429	14,787	15,756	969	6.6%
17/5/15 & 12/6/17	Sun	5,798	6,665	867	5,798	6,198	400	11,596	12,863	1,267	10.9%
Week 1		7,446	7,774	328	7,738	7,843	105	15,184	15,617	433	2.8%
18/5/15 & 13/6/17	Mon	7,329	7,619	290	7,509	7,466	-43	14,838	15,085	247	1.7%
19/5/15 & 14/6/17	Tue	7,559	7,694	135	7,838	7,422	-416	15,397	15,116	-281	-1.8%
20/5/15 & 15/6/17	Wed	7,896	8,016	120	8,247	7,988	-259	16,143	16,004	-139	-0.9%
21/5/15 & 16/6/17	Thurs	8,140	8,013	-127	8,352	7,978	-374	16,492	15,991	-501	-3.0%
22/5/15 & 17/6/17	Fri	8,569	8,456	-113	9,498	8,839	-659	18,067	17,295	-772	-4.3%
23/5/15 & 18/6/17	Sat	8,007	8,440	433	8,665	8,510	-155	16,672	16,950	278	1.7%
24/5/15 & 19/6/17	Sun	7,856	7,804	-52	7,905	7,043	-862	15,761	14,847	-914	-5.8%
Week 2		7,908	8,006	98	8,288	7,892	-395	16,196	15,898	-297	-1.8%
Overall		7,677	7,890	213	8,013	7,868	-145	15,690	15,758	68	0.4%

Examination of the 2015 and 2017 Temporary ATC data at Site 1 / 2 indicates a variation in the levels of traffic growth in week 1 and week 2 data between 2015 and 2017, with an overall 2.8% increase in two-way traffic flows in week 1 between 2015 and 2017 and an overall 1.8% decrease in two-way traffic flows in week 2 between 2015 and 2017. The overall 2 week comparison between the 2015 and 2017 ATC Site 1 / 2 data indicates a 0.4% increase in two-way traffic flows.

The 2015 AADT has therefore been increased by 0.4% to derive an estimated 2017 AADT to represent 2017 baseline conditions. The 2015 AADT and derived 2017 AADT based on the 0.4% adjustment is shown below in Table 6.2.8.

Table 6.2.8 Permanent ATC 421: Estimated 2017 AADT

Year	AADT
2015	14,101
2015 to 2017 Adjustment Factor	1.004
Estimated 2017 AADT	14,157

6.2.4 Journey Time Surveys

6.2.4.1 Methodology

A survey of current journey times was undertaken in Newry and the local network to assist in defining current operating conditions within the study area.

The surveys were carried out on Tuesday 6 June 2017 and Wednesday 7 June 2017 over two routes, namely the Blue Route and the Red Route. Due to a traffic accident on Tuesday 6 June 2017, additional surveys were carried out on Tuesday 20 June 2017.

Various runs were carried out for the Blue Route and Red Route surveys between 07:00 hours and 19:00 hours to record variations in journey times throughout the day. The survey periods were 07:00 hours to 10:00 hours (AM Peak period), 11:00 hours to 15:00 hours (Inter-Peak period) and 16:00 hours to 19:00 hours (PM Peak period).

The survey was based on the standard moving observer technique to record journey times at each of the predefined measurement points along the route.

6.2.4.2 Journey Time Survey Locations

The limits of the journey time survey and the locations of the measurement points along the Blue Route and Red Route are shown in Figures 6.2.7 and 6.2.8 respectively.

6.2.4.3 Journey Time Survey Results

Weather conditions during the Journey Time Surveys were generally good.

The results from the Blue Route and Red Route journey time surveys are shown in Table 6.2.9 and Table 6.2.10 respectively.

The following colour code has been adopted to highlight junctions where significant queues were observed during the survey:

- Journey time speeds of 0 to 9 mph are coloured red;
- Journey time speeds of 10 to 19 mph are coloured amber; and
- Journey time speeds of 20 mph or more are coloured green.

Table 6.2.9 Summary of Journey Time Survey Results (Blue Route)

Measurement Point	JTS Survey Length (km)	Speed Limit (mph)	Avg. AM Peak Time	Avg. AM Peak Speed (mph)	Avg. Inter-Peak Time	Avg. Inter-Peak Speed (mph)	Avg. PM Peak Time	Avg. PM Peak Speed (mph)
B1 - B2	5.194	70	00:03:19	59	00:03:20	58	00:03:16	59
B2 - B3	2.194	70	00:01:44	47	00:01:27	56	00:01:25	58
B3 - B4	0.182	60	00:00:27	15	00:00:25	16	00:00:19	21
B4 - B5	0.591	30	00:01:06	20	00:01:25	16	00:00:54	24
B5 - B6	0.207	30	00:00:35	13	00:01:12	6	00:00:22	21
B6 - B7	0.096	30	00:00:24	9	00:00:51	4	00:00:37	6
B7 - B8	0.145	30	00:00:23	14	00:01:02	5	00:00:51	6
B8 - B9	0.199	30	00:00:22	20	00:00:20	22	00:00:45	10
B9 - B10	0.663	30	00:00:50	29	00:00:51	29	00:00:52	29
B10 - B11	1.309	40	00:01:33	32	00:01:28	33	00:01:47	27
B11 - B12	1.542	70	00:01:22	42	00:01:25	41	00:01:26	40
B12 - B13	0.263	60	00:00:32	18	00:00:31	19	00:00:31	19
B13 - B14	5.587	70	00:03:29	60	00:03:21	62	00:03:20	63
B14 - B15	5.020	70	00:03:11	59	00:03:06	60	00:03:04	61
B15 - B16	2.278	60	00:01:56	44	00:01:56	44	00:01:55	44
B16 - B17	0.089	40	00:00:07	27	00:00:08	25	00:00:12	16
B17 - B18	0.091	40	00:00:14	15	00:00:13	15	00:00:17	12
B18 - B19	0.091	40	00:00:06	32	00:00:06	32	00:00:06	34
B19 - B20	2.196	60	00:01:43	48	00:01:45	47	00:01:47	46
B20 - B21	4.810	70	00:03:03	59	00:03:01	59	00:02:58	60
B21 - B22	5.593	70	00:03:31	59	00:03:23	62	00:03:25	61
B22 - B23	0.263	60	00:00:31	19	00:00:32	19	00:00:33	18
B23 - B24	1.630	70	00:01:15	49	00:01:15	49	00:01:17	48
B24 - B25	1.311	40	00:01:51	26	00:01:46	28	00:02:41	18

B25 - B26	0.615	30	00:02:18	10	00:02:18	10	00:08:34	3
B26 - B27	0.172	30	00:00:43	9	00:01:22	5	00:01:35	4
B27 - B28	0.149	30	00:00:49	7	00:00:47	7	00:01:14	5
B28 - B29	0.169	30	00:01:20	5	00:01:14	5	00:01:31	4
B29 - B30	0.201	30	00:00:23	20	00:00:28	16	00:00:29	15
B30 - B31	0.558	30	00:00:51	24	00:00:57	22	00:00:51	24
B31 - B32	0.173	60	00:00:15	26	00:00:16	24	00:00:14	27
B32 - B33	2.189	70	00:01:29	55	00:01:29	55	00:01:29	55
B33 - B34	5.192	70	00:03:12	60	00:03:09	61	00:03:09	62
Overall	**50.960**		**00:44:56**	**42**	**00:46:49**	**41**	**00:45:11**	**42**

Table 6.2.10 Summary of Journey Time Survey Results (Red Route)

Measurement Point	JTS Survey Length (km)	Speed Limit (mph)	Avg. AM Peak Time	Avg. AM Peak Speed (mph)	Avg. Inter-Peak Time	Avg. Inter-Peak Speed (mph)	Avg. PM Peak Time	Avg. PM Peak Speed (mph)
R1 – R2	0.182	60	00:00:25	16	00:00:35	12	00:00:16	25
R2 – R3	0.591	30	00:01:08	19	00:01:20	17	00:01:14	18
R3 – R4	0.164	30	00:00:44	8	00:01:27	4	00:01:01	6
R4 – R5	0.161	30	00:00:42	9	00:01:11	5	00:01:27	4
R5 – R6	1.178	30	00:01:29	30	00:01:34	28	00:01:33	28
R6 – R7	0.350	40	00:00:19	40	00:00:22	36	00:00:25	32
R7 – R8	4.151	60	00:04:04	38	00:03:59	39	00:03:47	41
R8 – R9	0.000	60	00:00:25	0	00:00:24	0	00:00:24	0
R9 – R10	4.164	60	00:04:09	37	00:04:05	38	00:03:44	41
R10 – R11	0.339	40	00:00:18	42	00:00:22	34	00:00:23	34
R11 – R12	1.175	30	00:02:24	18	00:02:44	16	00:02:44	16
R12 – R13	0.162	30	00:00:28	13	00:00:54	7	00:01:00	6
R13 – R14	0.120	30	00:00:36	7	00:00:33	8	00:00:25	11
R14 – R15	0.268	30	00:00:22	27	00:00:25	24	00:00:25	24
R15 – R16	0.355	30	00:00:58	14	00:01:22	10	00:02:04	6
R16 – R17	0.211	30	00:00:29	17	00:00:32	15	00:00:37	13
R17 – R18	0.056	30	00:00:10	12	00:00:10	13	00:00:10	12
R18 – R19	0.294	30	00:00:50	13	00:00:55	12	00:00:46	14
R19 – R20	1.368	30	00:02:07	24	00:02:08	24	00:02:49	18
R20 – R21	0.207	40	00:00:23	20	00:00:24	19	00:00:45	10
R21 – R22	1.160	40	00:01:22	32	00:01:19	33	00:01:22	32
R22 – R23	0.138	40	00:00:17	18	00:00:17	18	00:00:17	19
R23 – R24	1.096	40	00:01:17	32	00:01:23	30	00:01:24	29
R24 – R25	0.319	40	00:00:46	16	00:00:31	23	00:00:27	26
R25 – R26	1.364	30	00:02:54	18	00:02:38	19	00:02:35	20
R26 – R27	0.289	30	00:00:33	20	00:00:32	20	00:00:56	12
R27 – R28	0.869	30	00:01:18	25	00:01:39	20	00:01:31	21
R28 – R29	0.977	40	00:01:10	31	00:01:13	30	00:01:09	32
R29 – R30	0.962	50	00:01:05	33	00:01:08	32	00:01:06	33
R30 – R31	0.379	50	00:00:31	27	00:00:38	23	00:00:40	21
R31 – R32	0.197	50	00:00:22	20	00:00:24	18	00:00:22	20
R32 – R33	0.384	50	00:00:32	27	00:00:31	28	00:00:29	29
R33 – R34	0.958	50	00:01:05	33	00:01:09	31	00:01:14	29

R34 – R35	1.044	40	00:01:36	24	00:02:26	16	00:01:24	28
R35 – R36	0.888	30	00:01:51	18	00:02:14	15	00:01:52	18
R36 – R37	0.061	30	00:00:14	10	00:00:22	6	00:00:27	5
R37 – R38	0.202	30	00:00:36	13	00:00:36	13	00:00:41	11
R38 – R39	0.361	30	00:00:31	26	00:00:33	24	00:00:48	17
R39 – R40	0.255	30	00:01:05	9	00:00:52	11	00:01:07	9
R40 – R41	0.128	30	00:00:27	11	00:00:54	5	00:01:11	4
R41 – R42	0.151	30	00:00:23	15	00:00:24	14	00:00:21	16
R42 – R43	0.596	30	00:00:49	27	00:00:57	24	00:00:53	25
R43 – R44	0.127	60	00:00:15	19	00:00:12	24	00:00:10	28
Overall	**28.403**		**00:43:29**	**24**	**00:46:06**	**23**	**00:45:49**	**23**

The average directional speeds observed during the journey time surveys for the Blue and Red routes are also shown in Figures 6.2.9 and 6.2.10 respectively.

The variation in overall journey speeds throughout the day for the Blue and Red routes are shown in Figures 6.2.11 and 6.2.12 respectively.

The corresponding variation in journey speeds between the measurement points along the Blue route and Red route are shown in Figures 6.2.13 and 6.2.14 respectively.

GPS data for each survey along the Blue Route has been processed to provide an indication of variations in speeds in both directions of travel.

The variations in speeds during the AM Peak, Inter-Peak and PM Peak time periods are shown in the following figures:

- Run Start Time 07:00 Early Morning – Figure 6.2.15;
- Run Start Time 08:25 AM Peak – Figure 6.2.16;
- Run Start Time 13:14 Typical Inter-Peak – Figure 6.2.17;
- Run Start Time 16:57 PM Peak – Figure 6.2.18; and
- Run Start Time 18:07 Late Evening – Figure 6.2.19.

Examination of the information shown in the Figures, which has been colour-coded to indicate the variations in speed along the Blue route, highlights the contrasting conditions between rural and local sections and the effects of delays on the approaches to junctions within the city centre.

The journey time data also indicates that there is a significant reduction in speeds within Newry city centre as expected which is due in part to the presence of strategic traffic passing through the city in addition to the local traffic movements within the city.

6.2.5 Vehicle Registration Surveys

6.2.5.1 Methodology

Automatic Number Plate Recognition (ANPR) surveys were undertaken at 10 locations around Newry on Tuesday 6 June 2017 to define trip patterns between key points on the network.

The ANPR data for all sites was collected between 07:00 hours and 19:00 hours to provide a 12-hour record of trip patterns within the study area.

Cameras were positioned at each survey location to record the vehicle registration number passing through the ANPR site.

Analysis of the ANPR data allows individual vehicles to be matched based on the vehicle registration number and the time recorded at each survey point, from which the trip duration between each pair of survey points can be derived.

6.2.5.2 Vehicle Registration Survey Locations

The ANPR surveys were undertaken at the following locations:

- Site 1 – A2 / Warrenpoint Harbour Docks Junction;
- Site 2 – Greenbank Roundabout (A2, Warrenpoint Road);
- Site 3 – Greenbank Roundabout (Industrial Estate);
- Site 4 – Greenbank Roundabout (Old Warrenpoint Road);
- Site 5 – Dublin Road at Cloghogue Roundabout;
- Site 6 – A25 Camlough Road at Camlough Junction;
- Site 7 – A28 at Carnbane Junction;
- Site 8 – Belfast Road at Sheepbridge Junction;
- Site 9 – McCann's Corner Roundabout; and
- Site 10 – Drumalane Road.

The information was recorded by two vehicle classes, namely Light Vehicles which includes Cars and LGVs, and Heavy Vehicles which includes OGV1s, OGV2s and PSVs.

The locations of the ANPR survey sites are shown in Figure 6.2.20.

The primary survey cordon around the city is defined by Sites 2, 3, 4, 5, 6, 7, 8 and 10.

Site 1 was included in the survey to allow an analysis of trips to and from Warrenpoint Harbour.

Site 9 was included in the survey to assist in identifying the internal routes within Newry between Sites 2, 3 and 4 and Site 7. Site 9a was positioned on the A28 (Fairlawns Way) north of McCann's Corner Roundabout and Site 9b was positioned on the A28 between McCann's Corner Roundabout and Carnbane Roundabout on the old A1 bypass. It is likely that trips which passed through Site 9a only would have used the A27 Armagh Road and trips which passed through Site 9a and Site 9b would have used the A28 Downshire Road.

The routes between each of the survey points are shown in Figure 6.2.21, in Appendix A.

As shown in the above Figure, there are two key route options between Sites 2, 3 and 4 and Site 7.

6.2.5.3 Vehicle Registration Survey Results

The sampling results from the vehicle registration number surveys and percentage matches for each survey location for all vehicles are shown in Table 6.2.11.

In the below Table, the terms Entry and Exit refer to trips travelling to and from the city centre respectively.

For the purpose of the initial analysis, all matched trips over any duration have been included in the dataset.

Table 6.2.11 ANPR Achieved Survey Sample Rates All-Vehicle: Any Duration, 12-Hour Period (07:00 hours – 19:00 hours)

ANPR Site	12-Hour Traffic Flow	ANPR Sample %	Matched ANPR Count	ANPR Matched %
Site 1 Entry	612	100.0%	278	44.6%
Site 1 Exit	596	100.0%	338	54.9%
Site 2 Entry	5,867	100.0%	4,090	69.5%
Site 2 Exit	5,914	100.0%	4,350	73.6%
Site 3 Entry	3,025	99.3%	2,003	66.7%

Site 3 Exit	2,941	97.0%	1,812	63.5%
Site 4 Entry	2,052	100.0%	1,468	69.2%
Site 4 Exit	2,204	100.0%	1,484	67.1%
Site 5 Entry	6,227	100.0%	3,986	64.0%
Site 5 Exit	5,967	99.8%	4,007	67.3%
Site 6 Entry	8,898	100.0%	5,717	64.3%
Site 6 Exit	8,054	99.2%	5,533	69.3%
Site 7 Entry	3,170	100.0%	1,783	56.2%
Site 7 Exit	3,726	99.1%	2,044	55.4%
Site 8 Entry	4,846	100.0%	2,367	48.8%
Site 8 Exit	4,743	99.7%	2,291	48.4%
Site 9a Entry	3,697	99.3%	-	-
Site 9a Exit	4,205	99.0%	-	-
Site 9b Entry	4,709	99.7%	-	-
Site 9b Exit	5,503	99.9%	-	-
Site 10 Entry	1,327	99.8%	899	67.9%
Site 10 Exit	1,170	99.7%	792	67.9%
Total	89,453	99.8%	45,242	63.5%

Note 1: Sites 9a and 9b are internal route choice points and have been excluded from the ANPR matched analysis.

Note 2: At ANPR Sites 5 to 9 inclusive, the 12 hour traffic flows are based on the ANPR survey data.

Examination of the results from the ANPR survey indicates that a complete or partial registration number was recorded for approximately 99.8% of all vehicles that passed the survey points.

A total of 45,242 trips were matched between the survey points during the full 12-hour survey period, which represents 63.5% of all recorded trips. The remaining unmatched trips were due to trips which extended beyond the 12-hour survey period or trips which passed through only one survey point.

The matched trips based on any trip duration are shown in Table 6.2.12. The strategic movements through the city from Sites 2, 3 and 4 at Greenbank Roundabout on the A2 Warrenpoint Road to the A1 at Sites 5, 6, 7 and 8 are highlighted in blue.

Table 6.2.12 ANPR Matched All-Vehicle Trips by Entry Point: Any Duration, 12-Hour Period (07:00 hours – 19:00 hours)

ANPR Site	Site 2 Exit	Site 3 Exit	Site 4 Exit	Site 5 Exit	Site 6 Exit	Site 7 Exit	Site 8 Exit	Site 10 Exit	Total Trips
Site 2 Entry	1,282	396	226	766	477	339	470	134	**4,090**
Site 3 Entry	457	287	370	322	253	110	157	47	**2,003**
Site 4 Entry	220	311	382	245	170	48	58	34	**1,468**
Site 5 Entry	833	245	201	1,945	444	102	114	102	**3,986**
Site 6 Entry	509	250	190	352	3,755	333	209	119	**5,717**
Site 7 Entry	372	97	35	94	150	902	108	25	**1,783**
Site 8 Entry	520	178	49	137	150	168	1,103	62	**2,367**
Site 10 Entry	157	48	31	146	134	42	72	269	**899**
Total Trips	**4,350**	**1,812**	**1,484**	**4,007**	**5,533**	**2,044**	**2,291**	**792**	**22,313**

Note 1: The strategic movements through Newry between Sites 2, 3 & 4 and Sites 5, 6, 7 & 8 are highlighted in blue.

Note 2: Matched trips through Site 1 are excluded.

Analysis of the above ANPR data indicates that:

- 3,415 (15%) vehicles were matched between Sites 2, 3 and 4 and Sites 5, 6, 7 and 8; and
- 3,479 (16%) vehicles were matched between Sites 5, 6, 7 and 8 and Sites 2, 3 and 4.

6.2.5.4 ANPR Results for Duration Less Than 30 Minutes

Analysis of the journey time information derived from the ANPR data indicates that trips which pass through the city between the strategic measurement points would typically take less than 30 minutes.

As the primary objective of the vehicle registration number survey is to assist in the identification of strategic trips which pass through Newry, rather than local trips which stop in Newry, the matching of registration plates was restricted to matches with a trip duration of 30 minutes. Where matched trips pass through multiple ANPR sites, the trip duration has been restricted to a 30 minute travel time between each pair of survey points.

The matched trips with a duration of less than 30 minutes are shown in Table 6.2.13.

Table 6.2.13 ANPR Matched All-Vehicle Trips by Entry Point: Duration Less Than 30 Minutes, 12-Hour Period (07:00 hours – 19:00 hours)

ANPR Site	Site 2 Exit	Site 3 Exit	Site 4 Exit	Site 5 Exit	Site 6 Exit	Site 7 Exit	Site 8 Exit	Site 10 Exit	Total Trips
Site 2 Entry	157	352	161	685	346	277	396	109	**2,483**
Site 3 Entry	412	131	355	270	175	71	122	34	**1,570**
Site 4 Entry	122	296	176	212	114	29	39	30	**1,018**
Site 5 Entry	725	219	148	516	129	31	30	57	**1,855**
Site 6 Entry	333	180	120	85	997	52	38	79	**1,884**
Site 7 Entry	323	83	24	21	22	239	35	16	**763**
Site 8 Entry	431	151	27	29	23	49	207	46	**963**
Site 10 Entry	120	43	24	99	99	31	51	43	**510**
Total Trips	**2,623**	**1,455**	**1,035**	**1,917**	**1,905**	**779**	**918**	**414**	**11,046**

Note: The strategic movements through Newry between Sites 2, 3 & 4 and Sites 5, 6, 7 & 8 are highlighted in blue.

Analysis of the above ANPR data indicates that:

- 2,736 (25%) vehicles were matched between Sites 2, 3 and 4 and Sites 5, 6, 7 and 8; and
- 2,764 (25%) vehicles were matched between Sites 5, 6, 7 and 8 and Sites 2, 3 and 4.

The corresponding distribution of trips entering the study area, based on the all vehicle matched trips within a 30 minute period, is shown in Table 6.2.14.

Table 6.2.14 ANPR Matched All-Vehicle Trips by Entry Point: Duration Less Than 30 Minutes, 12-Hour Period (07:00 hours – 19:00 hours)

ANPR Site	Site 2 Exit	Site 3 Exit	Site 4 Exit	Site 5 Exit	Site 6 Exit	Site 7 Exit	Site 8 Exit	Site 10 Exit	Total Trips
Site 2 Entry	6%	14%	6%	28%	14%	11%	16%	4%	**100%**
Site 3 Entry	26%	8%	23%	17%	11%	5%	8%	2%	**100%**
Site 4 Entry	12%	29%	17%	21%	11%	3%	4%	3%	**100%**

Site 5 Entry	39%	12%	8%	28%	7%	2%	2%	3%	**100%**
Site 6 Entry	18%	10%	6%	5%	53%	3%	2%	4%	**100%**
Site 7 Entry	42%	11%	3%	3%	3%	31%	5%	2%	**100%**
Site 8 Entry	45%	16%	3%	3%	2%	5%	21%	5%	**100%**
Site 10 Entry	24%	8%	5%	19%	19%	6%	10%	8%	**100%**

Note: The strategic movements through Newry between Sites 2, 3 & 4 and Sites 5, 6, 7 & 8 are highlighted in blue.

Examination of the ANPR data indicates that the strategic two-way all vehicle movements are as follows:

- Between Sites 2, 3 and 4 and Site 5 accounts for 2,259 (20%) of the matched trips;
- Between Sites 2, 3 and 4 and Site 6 accounts for 1,268 (11%) of the matched trips;
- Between Sites 2, 3 and 4 and Site 7 accounts for 807 (7%) of the matched trips; and
- Between Sites 2, 3 and 4 and Site 8 accounts for 1,166 (11%) of the matched trips.

The trip pattern desire lines derived from the ANPR survey data are shown diagrammatically in Figure 6.2.22. This Figure indicates the combined two-way movements observed between ANPR Site 1 at Warrenpoint Harbour, ANPR Sites 2, 3 and 4 at Greenbank Roundabout and ANPR Sites 5, 6, 7, and 8 at the A1.

In addition to the strategic two-way all vehicle movements described above, an additional 360 matched trips were identified between Sites 2, 3 and 4 and Site 10 on Fathom Line.

The overall traffic movements are shown in Figure 6.2.23.

6.2.5.5 ANPR Route Choice for Site 7

Trips that passed through the city centre between Sites 2, 3 and 4 to / from Site 7 have a choice between two principal routes, namely the A27 Armagh Road or the A28 Downshire Road. Analysis of the ANPR data at Site 9a and Site 9b can therefore be used to determine the route choice.

The matched all vehicle trips passing through Site 9a only and Site 9a / 9b from Sites 2, 3 and 4 to Site 7 are shown below in Table 6.2.15.

Table 6.2.15 ANPR Matched All-Vehicle Trips To Site 7: Duration Less Than 30 Minutes, 12-Hour Period (07:00 hours – 19:00 hours)

ANPR Site	Site 7 Exit Flows			Site 7 Exit %		
	Via Site 9a Only	Via Site 9a / 9b	Total Trips	Via Site 9a Only	Via Site 9a / 9b	Total Trips
Site 2 Entry	196	81	277	71%	29%	100%
Site 3 Entry	49	22	71	69%	31%	100%
Site 4 Entry	26	3	29	90%	10%	100%
Total Trips	271	106	377	72%	28%	100%

Examination of the ANPR data indicates that the route choice distribution patterns for all vehicles are as follows:

- 72% of trips travel via Site 9a only (A27 Armagh Road); and
- 28% of trips travel via Site 9a and Site 9b (A28 Downshire Road).

The matched all vehicle trips passing through Site 9a only and Site 9a / 9b travelling from Site 7 to Sites 2, 3 and 4 is shown below in Table 6.2.16.

Table 6.2.16 ANPR Matched All-Vehicle Trips From Site 7: Duration Less Than 30 Minutes, 12-Hour Period (07:00 hours – 19:00 hours)

ANPR Site	Exit Flows				Exit Flows %			
	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 7 Entry via Site 9a	228	77	20	325	71%	93%	83%	76%
Site 7 Entry via Site 9a/9b	95	6	4	105	29%	7%	17%	24%
Total Trips	323	83	24	430	100%	100%	100%	100%

Examination of the ANPR data indicates that the route choice distribution patterns for all vehicles are as follows:

- 76% of trips travel via Site 9a only (A27 Armagh Road); and
- 24% of trips travel via Site 9a and Site 9b (A28 Downshire Road).

6.2.6 Accident Data

6.2.6.1 Methodology

To assist in assessing conditions within the study area, information on all road traffic collisions / accidents within the Newry study area involving personal injury over the five year period between April 2012 and March 2017 was obtained from DfI Roads.

The accident analysis study area is shown in Figure 6.2.24.

6.2.6.2 Accident Trends

Examination of the road traffic accident data for the NSRR study area indicates that 373 accidents occurred on the road network over the five year period between April 2012 and March 2017. The total number of Personal Injury Accidents (PIAs) has increased from 62 accidents between April 2012 and March 2013 to 84 accidents between April 2015 and March 2016. There have been 3 fatal accidents recorded in the study area during the five year period, all of which occurred in 2014, on the A2 Warrenpoint Road, Dublin Road and the A1 Newry Bypass.

This information and the local severity ratio, which expresses the number of fatal and serious accidents relative to the total number of accidents, is shown in Table 6.2.17.

Table 6.2.17 Total Number of Accidents by Severity: 2012 to 2017

Year	Fatal Accidents	Serious Accidents	Slight Accidents	Total Accidents	Severity Ratio
2012 – 2013	0	6	56	62	0.097
2013 – 2014	0	7	62	69	0.101
2014 – 2015	3	4	69	76	0.092
2015 – 2016	0	9	75	84	0.107
2016 – 2017	0	6	76	82	0.073
Total	3	32	338	373	0.094
Percentage	0.8%	8.6%	90.6%	100.0%	-

Analysis of road traffic accidents between 2012 and 2017 within the study area indicates that there have been a total of 373 personal injury accidents with 0.8% recorded as fatal accidents, 8.6% recorded as serious accidents and 90.6% recorded as slight accidents.

Based on the above information, the local accident severity ratio for the five year period between 2012 and 2017 is 0.094.

The locations of the road traffic accidents recorded between 2012 and 2017 are shown in Figures 6.2.25 to 6.2.29 respectively.

A cluster analysis of the 2012 to 2017 five year accident data was undertaken to identify specific locations within the study area that experience a higher concentration of accidents. The results of this analysis are shown in Figure 6.2.30.

Analysis of the five year accident data indicates that the highest concentration of accidents occurred at A27 / Downshire Road / Sandy's Street double roundabout and McCann's Corner Roundabout where 24 accidents were observed over the five year period.

The junctions with the highest concentration of accidents are as follows:

- A24 / Downshire Road / Sandy's Street double roundabout – 24 accidents;
- McCann's Corner Roundabout – 24 accidents;
- Bridge Street / Buttercrane Quay / William Street / Albert Basin Junction – 23 accidents;
- Sugar Island Junction – 12 accidents;
- Dublin Road / John Mitchell Place / William Street / Kilmorey Street – 12 accidents; and
- Camlough Roundabout – 11 accidents.

6.3 Indicative Costs, Risks and Optimism Bias

6.3.1 Basis of Cost Estimates

Cost estimates were prepared for each of the proposed route options. These costs were used to define both the total construction cost and total land cost for the five route options.

In accordance with the procedures established by DfI Roads policy and procedure guide RSPPG E058; an appropriate allowance for risk was determined for the proposed route options. These risk allowances are included in the estimated scheme costs.

A breakdown of the estimated costs of the proposed route options in Quarter 2, 2017 prices is shown in Table 6.3.1 and Table 6.3.2.

Table 6.3.1 Proposed Route Options Estimated Scheme Cost Summary Excluding Optimism Bias: Red Route and Yellow Routes

Item	Scheme Cost (£m's)	
	Red Route	Yellow Route
Total Construction Cost	£71.739	£66.232
Total Land Cost	£1.245	£1.523
Preparation (9% of Total Construction & Land Costs)	£6.569	£6.098
Supervision (5% of Total Construction & Land Costs)	£3.649	£3.388
Total Scheme Cost	£83.201	£77.241

Note: All costs are in Quarter 2, 2017 prices and exclude VAT.

Table 6.3.2 Proposed Route Options Estimated Scheme Cost Summary Excluding Optimism Bias: Blue Route Options

Item	Scheme Cost (£m's)		
	Blue Route		
	Option 1	Option 2	Option 3
Total Construction Cost	£34.298	£45.607	£37.116
Total Land Cost	£1.026	£1.040	£1.014
Preparation (9% of Total Construction & Land Costs)	£3.179	£4.198	£3.432
Supervision (5% of Total Construction & Land Costs)	£1.766	£2.332	£1.906
Total Scheme Cost	£40.269	£53.177	£43.468

Note: All costs are in Quarter 2, 2017 prices and exclude VAT.

6.3.2 Optimism Bias

As there is a tendency for project appraisers to be overly optimistic when assessing total scheme costs, optimism bias has been included in the appraisal to increase the capital expenditure estimate of the Proposed Scheme and the potential for delays during construction, in accordance with the operational advice concerning H.M. Treasury's New Green Book on Appraisal and Evaluation in Central Government.

As schemes progress through the various stages from the identification of a general corridor to the development of various route options and finally the selection of the Proposed Scheme, the level of optimism bias is likely to reduce accordingly.

Current DfI Roads guidance recommends that the costs used in the economic appraisal of schemes include an upper bound allowance. At this stage of the project, an allowance of 36.3% for optimism bias has been used. This has been derived in accordance with the requirements of RSPPG E058.

A breakdown of the estimated costs of the proposed route options, including an allowance of 36.3% for optimism bias, is shown in Table 6.3.3 and Table 6.3.4. All costs are in Quarter 2, 2017 prices.

Table 6.3.3 Proposed Route Options Estimated Scheme Cost Summary Including 36.3% Optimism Bias: Red Route and Yellow Route

Item	Scheme Cost (£m's)	
	Red Route	Yellow Route
Total Construction Cost	£97.780	£90.274
Total Land Cost	£1.697	£2.076
Preparation (9% of Total Construction & Land Costs)	£8.953	£8.312
Supervision (5% of Total Construction & Land Costs)	£4.974	£4.618
Total Scheme Cost	£113.404	£105.279

Note: All costs are in Quarter 2, 2017 prices and exclude VAT.

Table 6.3.4 Proposed Route Options Estimated Scheme Cost Summary Including 36.3% Optimism Bias: Blue Route 1 to 3

Item	Scheme Cost (£m's)		
	Blue Route		
	Option 1	Option 2	Option 3
Total Construction Cost	£46.748	£62.162	£50.589
Total Land Cost	£1.398	£1.418	£1.382
Preparation (9% of Total Construction & Land Costs)	£4.333	£5.722	£4.677

Supervision (5% of Total Construction & Land Costs)	£2.407	£3.179	£2.599
Total Scheme Cost	£54.887	£72.481	£59.247

Note: All costs are in Quarter 2, 2017 prices and exclude VAT.

6.3.3 Cost Profile

The traffic and economic assessment of the proposed route options is based on a two year construction period. The associated cost profile shown in Table 6.3.5 has been adopted.

Table 6.3.5 Proposed Route Options Cost Profile

Year	Cost Profile	
	Construction	Land
2021	47%	100%
2022	50%	0%
2023	3%	0%

Note: The construction cost profile is based on typical profiles with a 2 year construction period.

6.4 Development of Computer Models

6.4.1 Appraisal and Evaluation in Central Government

In 2003, HM Treasury published the revised Green Book – Appraisal and Evaluation in Central Government, which came into effect on 1 April 2003 and outlines the best practice guide to carrying out appraisal and evaluation of capital projects, and in particular, concentrates on economic appraisal in the form of cost-benefit analysis.

The current edition of the Green Book is the edition published in 2003 with the addition of some updated information in July 2011 of material on the valuation of non-market goods.

The Northern Ireland (NI) Practical Guide to the Green Book presented the Department of Finance and Personnel (DFP) guidance and requirements on the appraisal, evaluation, approval and management of policies, programmes and projects. The document, published in 2003, contains practical guidance tailored specifically to the needs of the Northern Ireland Department, such as DFP's approval requirements, local policies and institutional arrangements.

In September 2009, DFP launched the latest on-line guide to expenditure, appraisal, evaluation, approval and management. The Northern Ireland Guide to Expenditure Appraisal and Evaluation (NIGEAE) supersedes the NI Practical Guide to the Green Book. The guide notes that the government spends billions of pounds every year delivering public services in Northern Ireland. It is vital that this money is put to use in a way that delivers the maximum benefit to the local population. It is also important that all spending is accountable to the NI Executive and Assembly.

The Northern Ireland Guide to Expenditure Appraisal and Evaluation (NIGEAE) is designed to help achieve these ends. It is the primary guide for Northern Ireland Departments on the appraisal, evaluation, approval and management of policies, programmes and projects - the essential elements in the cycle of expenditure planning and service delivery.

In May 2016, the Department of Finance and Personnel (DFP) changed name to the Department of Finance (DoF).

6.4.2 Overview of Model Development

The quantitative assessment of the transport economic efficiency and road safety aspects of a proposed road improvement scheme requires the development and application of various computer models. In the case of the Newry Southern Relief Road, this has involved the development of a COBA (Cost Benefit Analysis) model.

Cost Benefit Analysis is a technique which has been developed to assist in the assessment of Public Sector investments to ensure that money is spent in a consistent and efficient manner and that benefits to society from improvements are maximised.

The Department for Transport sponsored computer programme COBA is used to estimate the effects of highway improvements in terms of time, vehicle operating and accident costs on the users of the road system. These cost changes (benefits) are compared with the construction and maintenance costs over the assessment period.

Detailed traffic flows with and without the scheme being appraised are input together with a geometric description of the network links and junctions. The individual link and junction user costs are summed to determine the total cost on the networks over the assessment period. The procedures for developing and applying COBA are set out in the DMRB Volume 13 Economic Assessment of Road Schemes.

Because of differences in timings of expenditure of capital funds used to build the scheme in the early years of the project compared with the future maintenance cost expended over the 60 year assessment period and the benefits accruing over the 60 year assessment period, it is necessary to discount costs and benefits to a common base year (the 'present value year') to facilitate a comparison of between costs and benefits.

COBA Version 11 Release 19, which was released in 2017, is the latest version of the programme approved for use in Northern Ireland and has been used to compare the costs and benefits of the proposed route options over a 60 year assessment period after the road opens to traffic. COBA11 R19 expresses costs and benefits at 2010 year prices (the discount year or present value year). The programme discounts at 3.5% per annum for 30 years, thereafter at 3% per annum for 30 years and thereafter at 2.5% per annum.

COBA11 R19 includes the latest Road Traffic Forecasts 2015 traffic growth as the default assumption of traffic growth for major road schemes. These traffic forecasts replace the National Road Traffic Forecasts (NRTF) originally defined in 1997.

6.4.3 The COBA Model

A COBA model was developed to compare the cost and road user benefits of the proposed route options, taking into account both transport economic efficiency and road safety issues.

The overall geographical area of the COBA model, which extends from the Sheepbridge junction in the north to the Ellisholding Grade-Separated Junction and the Warrenpoint Harbour Access Junction in the south, was defined to encompass the significant effects of the proposed route options being considered. Due to the strategic nature of the proposed improvement, the limits of the model extend significantly beyond the proposed route options.

The modelled area is shown in Figure 6.4.1.

The assessment is based on standard COBA default values where these have been considered appropriate. For example, the default proportion of in-work trips has been adopted and default accident rates have been applied to both the Do-Minimum and Do-Something networks.

The COBA models are based on the 12-hour traffic flows and turning movements observed in June 2017.

When undertaking cost benefits analyses using the COBA computer model, three discrete scenarios need to be considered, namely the Do-Nothing scenario, the Do-Minimum scenario and the Do-Something scenario.

The Do-Nothing scenario represents the existing road network without any improvement.

The Do-Minimum and Do-Something scenarios are described overleaf.

6.4.4 COBA Do-Minimum Model

6.4.4.1 Do-Minimum Network

The Do-Minimum Network is the base road network against which the Do-Something Network is assessed. In the case of the Newry Southern Relief Road, no specific changes to the base road network have been identified and consequently the Do-Minimum Network is consistent with the existing Do-Nothing Network.

The limits of the highway network defined for the Do-Minimum model were defined to encompass the area surrounding the proposed Newry Southern Relief Road that is likely to be significantly affected by the potential reassignment of traffic on to the improved routes.

The location and identification of the various links and nodes which define the Do-Minimum COBA network are shown in Figure 6.4.2.

6.4.4.2 Trip Matrix Building

A detailed programme of data collection surveys was undertaken within the study area to assist in establishing current traffic volumes and vehicle proportions at key locations, to quantify variations in traffic demand during a typical weekday, to define current vehicle speeds and journey times along key routes and to estimate vehicle trip patterns in the area.

The surveys included Manual Classified Counts (MCCs), Automatic Traffic Counts (ATCs), the measurement of typical Journey Times and Vehicle Registration Surveys. These surveys were undertaken during June 2017 when traffic conditions were expected to be typical of average demand.

Based on the MCC information collected within the study area, the 2017 12-hour weekday vehicle proportions defined in the COBA Do-Minimum model are as follows:

- 82.6% Cars;
- 10.3% Light Goods Vehicles (LGV);
- 2.7% Other Goods Vehicles 1 (OGV1);
- 3.6% Other Goods Vehicles 2 (OGV2); and
- 0.9% Buses and Coaches (PSV).

The information derived directly from the observed June 2017 traffic surveys has been used to define trip patterns within the study area.

6.4.4.3 Trip Assignment

The characteristics of the main routes in and around Newry and the nature of the proposed route options are such that relevant trip patterns and route assignments through the immediate area can be estimated from the observed traffic conditions on the main routes to / from Newry.

For the purpose of the Stage 2 Scheme Assessment, the principal changes in trip patterns and traffic flows for strategic traffic passing through the study area have been determined based on the observed traffic patterns.

The 12-hour link flows and turning movements throughout the extent of the COBA model are therefore based on the observed traffic flows within the Newry study area.

The modelled 12-hour flows are shown in Figure 6.4.3.

6.4.4.4 Traffic Annualisation Factors

Traffic annualisation factors are used within the COBA model to derive total annual information from the observed daily traffic flow data.

In COBA, the ‘E-Factor’ is used to convert the 12-hour average weekday traffic flow to a corresponding 16-hour average weekday traffic flow and the ‘M-Factor’ is used to convert this 16-hour flow to a 24-hour total annual flow to provide a suitable basis for the 60-year economic assessment of the proposed route options.

E-Factor

The 5-day 12-hour and 16-hour flows derived from temporary ATCs provide a reasonable indication of traffic flows on the road network. A local E-Factor, which converts the 12-hour AAWDT matrix to a 16-hour AAWDT matrix, has been derived from the following available information:

- 12-Hour 2017 AAWDT Flow: 12,489 vehicles
- 16-Hour 2017 AAWDT Flow: 15,033 vehicles

This information is considered sufficient to derive a local 'E' factor, which at 1.20 is similar to the default value of 1.15 for a Non Built-up Trunk Network.

The E-Factor adopted for the COBA model is 1.20.

M-Factor

The calculation of a local M-Factor requires the derivation of 16-hour AAWDT flows and 24-hour AADT flows on the road network. As the available permanent ATC data does not provide hourly flows on the road network, a 16-hour AAWDT flow has been derived from the following available information:

- 12-Hour 2017 MCC Flow: 11,784 vehicles
- Local E-Factor: 1.20
- Derived 16-Hour AAWDT Flow: 14,141 vehicles

The 24-hour 2017 AADT flows derived from 2015 permanent ATC data factored to represent conditions in 2017 to provide a reasonable indication of traffic flows on the road network. A local M-Factor, which converts the 16-hour AAWDT to a 24-hour AADT, has been derived from the following available information:

- 16-Hour 2017 AAWDT Flow: 14,141 vehicles
- 24-Hour 2017 AADT Flow: 14,157 vehicles

This information is considered sufficient to derive a local M-Factor, which at 365 is slightly higher than the default value of 351 for a Non Built-Up Trunk Network in the month of May. The local M-Factor of 365 is considered to be more representative of local conditions.

The M-Factor adopted for the COBA model is 365.

Seasonality Index

The Seasonality Index is a measure of the variation that occurs in daily traffic flows throughout the year. Based on the 2015 traffic data from the permanent ATC, the Seasonality Index is as follows:

- 2015 AWDT for Peak Holiday Period (August): 16,021 vehicles
- 2015 AWDT for Neutral Months (April, May, June, September and October): 15,062 vehicles

The Seasonality Index derived from the 2015 permanent ATC data is 1.06, which is similar to the default value of 1.10 for a Non Built-Up Trunk Network.

The Seasonality Index adopted for the COBA Do-Minimum model is 1.06.

6.4.4.5 Model Calibration and Validation

As the principal economic benefits associated with the proposed Newry Southern Relief Road are likely to result from savings in transit time, it is necessary to calibrate the COBA Do-Minimum model to provide a reasonable representation of journey times within the transport corridor, including in particular journey times and speeds.

The modelled journey times have been calibrated to take account of the information collected as part of the June 2017 surveys.

To demonstrate that the model provides a reasonable representation of existing transport conditions in the area, the observed journey times and modelled journey times on the network derived from the COBA model were compared. The results of this comparison for the Blue Route are shown in Table 6.4.1 and Table 6.4.2.

Table 6.4.1 Observed Journey Times and Speeds: Blue Route, 12-Hour Period (07:00 hours – 19:00 hours)

JTS Point	Observed Two-Way JT		Modelled Two-Way JT		Modelled – Observed Differences in Two-Way JT	
	Average Time (secs)	Average Speed (kph)	Average Time (secs)	Average Speed (kph)	Average Time (secs)	Average Speed (kph)
B1 - B2	194	96	194	97	0	0
B2 - B3	90	88	89	90	-1	2
B3 - B4	20	33	18	26	-2	-7
B4 - B5	62	34	63	34	2	1
B5 - B6	36	21	39	19	4	-1
B6 - B7	60	8	51	10	-9	2
B7 - B8	51	10	44	12	-7	2
B8 - B9	51	13	54	12	3	-1
B9 - B10	147	16	149	15	2	0
B10 - B11	110	43	109	45	-1	2
B11 - B12	80	72	79	72	-1	0
B12 - B13	32	30	29	20	-3	-10
B13 - B14	205	98	218	99	13	1
B14 - B15	184	96	185	88	1	-8
B15 - B16	111	73	112	72	2	-1
B16 - B17	8	43	12	27	5	-16
Overall	1,437	64	1,445	63	8	0

Table 6.4.2 Comparison of Observed and Modelled Journey Times and Speeds: Blue Route, 12-Hour Period (07:00 hours – 19:00 hours)

BLUE ROUTE	Average Total Time (secs)	Average Speed (kph)
Observed	1,437	64
Modelled	1,445	63
Difference	8	0
% Difference	0.6%	-0.8%

Overall, the above results equate to an overall two-way difference between the observed and modelled times of 8 seconds over the length of the Blue Route, which confirms that the model provides a reasonable representation of mean vehicle times over this route.

The results of the comparison for the Red Route are shown in Table 6.4.3 and Table 6.4.4.

Table 6.4.3 Observed Journey Times and Speeds: Red Route, 12-Hour Period (07:00 hours – 19:00 hours)

JTS Point	Observed Two-Way JT		Modelled Two-Way JT		Modelled – Observed Differences in Two-Way JT	
	Average Time (secs)	Average Speed (kph)	Average Time (secs)	Average Speed (kph)	Average Time (secs)	Average Speed (kph)
R1 – R2	19	29	18	26	-1	-4
R2 – R3	64	33	63	34	-1	1
R3 – R4	45	13	39	17	-5	5
R4 – R5	58	10	54	11	-4	1
R5 – R6	125	34	123	35	-2	1
R6 – R7	22	58	28	46	6	-12
R7 – R8	239	63	238	63	0	0
R13 – R14	41	11	43	9	2	-2
R14 – R15	43	22	44	22	1	0
R15 – R16	62	21	62	22	-1	1
R16 – R17	35	22	38	19	4	-3
R17 – R18	16	14	18	14	3	0
R18 – R19	45	23	51	22	6	-1
R19 – R20	152	32	141	35	-11	3
R20 – R21	33	29	32	25	-1	-4
R21 – R22	81	50	81	51	0	1
R27 – R28	105	30	105	36	0	6
R28 – R29	91	40	90	33	-2	-7
R29 – R30	68	51	66	54	-2	3
R30 – R31	34	41	34	42	1	1
Overall	1,373	37	1,366	37	-7	0

Table 6.4.4 Comparison of Observed and Modelled Journey Times and Speeds: Red Route, 12-Hour Period (07:00 hours – 19:00 hours)

RED ROUTE	Average Total Time (secs)	Average Speed (kph)
Observed	1,373	37
Modelled	1,366	37
Difference	-7	0
% Difference	-0.5%	1.1%

Overall, the above results equate to an overall two-way difference between the observed and modelled times of 7 seconds over the length of the Red Route, which confirms that the model provides a reasonable representation of mean vehicle times over this route.

6.4.5 COBA Do-Something Models

For the purpose of the traffic and economic assessment, a series of Do-Something models have been created based on the proposed route options. The corresponding network diagrams indicating the various links and nodes which define the Do-Something Networks are shown in Figures 6.4.4 to 6.4.8.

The COBA Do-Something network consists of five discrete models for the proposed route options.

The volume of traffic likely to transfer on to the proposed route options has been based on an analysis of observed traffic conditions within and around Newry.

6.4.6 The QUADRO Model

QUADRO (Queues and Delays at Roadworks) is the industry standard computer model for assessing the effects of queues and delays during roadworks. As delays during construction are unlikely to be significant due to the off-line nature of the proposed route options, QUADRO models have not been developed to examine the effects of delays during the construction period.

6.4.7 Traffic Forecasting

For the purpose of the economic assessment, it has been assumed that construction of the scheme would be undertaken in 2021 and 2022, with the scheme opening in 2023. This timeframe has been adopted to provide a reasonable basis for the economic assessment of the proposed route options.

Given the strategic nature of the Newry Southern Relief Road route, the most likely forecast of long term traffic growth within the study area for the assessment of the proposed route options can be defined by the application of national forecasts of traffic growth.

The national Road Traffic Forecasts provide estimates of long term traffic growth based on information on travel demand, choice and policy, taking into account trends in population, economic activity and travel costs.

To assist in defining the most appropriate national forecast, the data available from the long term Automatic Traffic Counts (ATCs) maintained by DfI in and around the Newry area have been examined.

In addition to Permanent ATC 421 on the A2 Warrenpoint Road, there are four additional permanent ATCs located in the study area, which have been examined to estimate long term traffic trends in the study area. The locations of these permanent ATCs are shown in Figure 6.4.9.

A summary of the 2004 to 2014 ATC data from the Permanent ATCs is shown below in Table 6.4.5. Due to the opening of the A1 Newry bypass in 2010 and the subsequent changes in traffic volumes, data from 2004 to 2010 at Permanent ATC Sites 420, 437 and 438 have been excluded from the analysis.

Table 6.4.5 Summary of Two-Way Annual Average Traffic Flows

Year	ATC 420	ATC 421	ATC 437	ATC 438	ATC 439	ATC 421 / 439 Average Flow
2006	15,830	13,910	20,070	23,960	18,060	15,985
2007	15,550	14,550	20,890	26,190	18,490	16,520
2008	14,950	14,170	21,400	26,850	19,250	16,710
2009	14,960	14,030	-	26,520	-	-
2010	15,770	13,650	8,860	9,400	19,250	16,450
2011	16,700	13,610	10,120	11,590	19,940	16,775
2012	17,350	13,490	10,560	13,300	20,620	17,055
2013	17,250	13,200	10,760	12,220	19,520	16,360
2014	17,250	13,300	11,520	12,830	21,510	17,405
2015	17,600	14,100*	11,840	12,920	-	-

Note: 2015 ATC 421 AADT has been infilled to replace missing / unreliable data.

The trend lines of the recorded permanent ATC data from 2004 to 2014 are shown in Figure 6.4.10.

Examination of the permanent ATC data during the 3-year period between 2011 and 2014 indicates there was a general increase in traffic volumes at four of the five ATC Sites. The average traffic volumes at ATC Sites 421 and 439, which provide the most reliable long term source of traffic data, indicates traffic volumes have increased by approximately 1.24% per annum over the three year period.

For the purpose of the economic assessment of the proposed Newry Southern Relief Road, it has therefore been assumed that traffic growth will generally follow Road Traffic Forecasts 2015 projections which equates to approximately 1.2% growth per annum over the 6-year period between the 2017 Base Year and 2023 Opening Year. This rate of growth is generally consistent with the trends observed between 2011 and 2014 in the Newry area.

The growth factors for RTF traffic growth from the 2017 Base Year to the 2023 Opening Year and the 2037 Design Year are shown in Table 6.4.6.

Table 6.4.6 Road Traffic Forecasts Growth Factors

Period (Years)	RTF 2015 Growth Main Assessment
2017 Base Year to 2023 Opening Year	1.075
2023 Opening Year to 2037 Design Year	1.100

6.4.8 Accident Severity and Rates

The estimation of changes in traffic accidents is an important element of the cost benefit assessment process. It is therefore necessary to relate local accident characteristics to the corresponding national values. The two key aspects of this assessment include accident severities and accident rates.

To provide an indication of the severity of accidents on the network, a severity ratio is calculated which expresses the number of fatal and serious accidents to the total number of personal injury accidents over a section of road. The current (2009 base) national severity ratios, as defined in DMRB Volume 13, for link and junction accidents combined are as follows:

- S2 A Roads 30 / 40 mph – 0.130;
- S2 A Roads > 40 mph – 0.219;
- Dual Carriageways 30 / 40 mph – 0.113; and
- Dual Carriageways > 40 mph – 0.150.

For the purpose of defining national accident rates which express the number of personal injury accidents per million vehicle kilometres, a distinction is made between urban all-purpose roads where the speed limit is up to and including 40 mph and rural roads where the speed limit is more than 40 mph.

The current (2009 base) national personal injury accident rates, as defined in DMRB Volume 13, for link and junction accidents combined are as follows:

- Modern S2 Roads 30 / 40 mph – 0.532 PIAs / Million Vehicle Kilometres;
- Modern S2 Roads 50 / 60 / 70 mph – 0.244 PIAs / Million Vehicle Kilometres;
- Modern S2 Roads with HS 30 / 40 mph - 0.532 PIAs / Million Vehicle Kilometres;
- Modern S2 Roads with HS 50 / 60 / 70 mph - 0.244 PIAs / Million Vehicle Kilometres;
- Modern WS2 Roads 50 / 60 / 70 mph - 0.163 PIAs / Million Vehicle Kilometres;
- Older S2 A Roads 30 / 40 mph - 0.863 PIAs / Million Vehicle Kilometres;
- Older S2 A Roads 50 / 60 / 70 mph - 0.244 PIAs / Million Vehicle Kilometres;
- Other S2 Roads 50 / 60 / 70 mph - 0.233 PIAs / Million Vehicle Kilometres;
- Modern D2 Roads 50 / 60 / 70 mph - 0.107 PIAs / Million Vehicle Kilometres;

- Modern D2 Roads with HS 50 / 60 / 70 mph - 0.072 PIAs / Million Vehicle Kilometres; and
- Older D2 Roads 30 / 40 mph - 0.553 PIAs / Million Vehicle Kilometres.

A comparison between the average number of personal injury accidents observed between 2012 and 2016 on the modelled network and the number of accidents observed in the COBA Do-Minimum model are shown below in Table 6.4.7. The number of accidents obtained from the COBA model for 2017 was adjusted using the annual traffic flows in 2014, the mid-year between 2012 and 2016, to derive equivalent average annual COBA accident numbers for 2012 to 2016.

Also shown in the below Table for comparison between the observed and modelled accident data is the local severity ratio, which expresses the number of fatal and serious accidents relative to the total number of accidents.

Table 6.4.7 2012 to 2017 Total Number of Accidents by Severity

Year	Accident Severity				Severity Ratio
	Fatal	Serious	Slight	Total	
Average Annual Local Accidents (2012 to 2016)	1	6	68	75	0.094
2017 COBA Modelled Accidents	1	11	75	88	0.141
Equivalent Average Annual COBA Modelled Accidents (2012 to 2016)	1	11	71	82	0.141

Analysis of the observed and modelled road traffic accidents within the study area indicates that the overall number of 82 accidents in the model is slightly higher than the 75 accidents observed on the network. The modelled severity ratio of 0.141 is also slightly higher than the observed local severity ratio of 0.094.

Given the inherent difficulties of predicting future accident rates and casualty severities over the 60 year economic assessment period, the COBA assessment has been based on the application of default accident rates and costs. These have been applied to both the Do-Minimum and Do-Something networks to provide a reasonable measure of the relative change in road traffic accident characteristics associated with the two networks.

6.5 Operational Assessment of Proposed Route Options

6.5.1 Traffic Flows

A detailed programme of data collection surveys was undertaken within the study area to assist in establishing current traffic volumes and vehicle proportions at key locations within the corridor, to quantify variations in traffic demand during a typical weekday, to define current vehicle speeds and journey times along key routes and to estimate vehicle trip patterns in the area. Through the collection and analysis of this information, the prevailing traffic demand and operating conditions in the study area have been established.

6.5.1.1 Do-Minimum Network

The proposed route options have been developed to improve the movement of strategic traffic around the Newry area. Through the development of the COBA computer models and an estimate of the likely changes in travel patterns resulting from the provision of the proposed route options, the likely changes in traffic flows across the network can be estimated.

The two-way 24-hour AADT traffic flows for the Do-Minimum Network in the 2017 Base Year, the 2023 Opening Year and the 2037 Design Year under RTF 2015 traffic growth are shown in Figure 6.5.1.

6.5.1.2 Do-Something Network: Red Route

The two-way 24-hour AADT traffic flows for the Do-Something Network: Red Route in the 2023 Opening Year and 2037 Design Year under RTF 2015 traffic forecasts are shown in Figure 6.5.2.

Examination of the predicted changes in trip patterns indicates that the proposed Red Route would attract some 5,870 vehicles per day (vpd) in the 2023 Opening Year.

As a consequence of removing this volume of through traffic from Newry city centre, it is estimated that traffic flows on Dublin Road, west of River Street, would reduce by 3,870 vpd (16%) from 23,540 vpd to 19,670 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,880 vpd (10%) from 18,500 vpd to 16,620 vpd, which should significantly reduce delays and congestion at this location.

6.5.1.3 Do-Something Network: Yellow Route

The two-way 24-hour AADT traffic flows for the Do-Something Network: Yellow Route in the 2023 Opening Year and 2037 Design Year under RTF 2015 traffic forecasts are shown in Figure 6.5.3.

Examination of the predicted changes in trip patterns indicates that the proposed Yellow Route would attract some 4,770 vehicles per day (vpd) in the 2023 Opening Year.

As a consequence of removing this volume of through traffic from Newry city centre, it is estimated that traffic flows on Dublin Road, west of River Street, would reduce by 2,770 vpd (12%) from 23,540 vpd to 20,770 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,880 vpd (10%) from 18,500 vpd to 16,620 vpd, which should significantly reduce delays and congestion at this location.

6.5.1.4 Do-Something Network: Blue Route Option 1

The two-way 24-hour AADT traffic flows for the Do-Something Network: Blue Route Option 1 in the 2023 Opening Year and 2037 Design Year under RTF 2015 traffic growth forecasts are shown in Figure 6.5.4.

Examination of the predicted changes in trip patterns indicates that the proposed Blue Route Option 1 would attract some 5,390 vehicles per day (vpd) in the 2023 Opening Year.

As a consequence of removing this volume of through traffic from Newry city centre, it is estimated that traffic flows on Dublin Road, west of River Street, would reduce by 3,930 vpd (17%) from 23,540 vpd to 19,610 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,330 vpd (7%) from 18,500 vpd to 17,170 vpd, which should significantly reduce delays and congestion at this location.

6.5.1.5 Do-Something Network: Blue Route Option 2

The two-way 24-hour AADT traffic flows for the Do-Something Network: Blue Route Option 2 in the 2023 Opening Year and 2037 Design Year under RTF 2015 traffic growth forecasts are shown in Figure 6.5.5.

Examination of the predicted changes in trip patterns indicates that the proposed Blue Route Option 2 would attract some 5,390 vehicles per day (vpd) in the 2023 Opening Year.

As a consequence of removing this volume of through traffic from Newry city centre, it is estimated that traffic flows on Dublin Road, west of River Street, would reduce by 3,930 vpd (17%) from 23,540 vpd to 19,610 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,330 vpd (7%) from 18,500 vpd to 17,170 vpd, which should significantly reduce delays and congestion at this location.

6.5.1.6 Do-Something Network: Blue Route Option 3

The two-way 24-hour AADT traffic flows for the Do-Something Network: Blue Route Option 3 in the 2023 Opening Year and 2037 Design Year under RTF 2015 traffic growth forecasts are shown in Figure 6.5.6.

Examination of the predicted changes in trip patterns indicates that the proposed Blue Route Option 3 would attract some 5,390 vehicles per day (vpd) in the 2023 Opening Year.

As a consequence of removing this volume of through traffic from Newry city centre, it is estimated that traffic flows on Dublin Road, west of River Street, would reduce by 3,930 vpd (17%) from 23,540 vpd to 19,610 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,330 vpd (7%) from 18,500 vpd to 17,170 vpd, which should significantly reduce delays and congestion at this location.

6.5.2 Journey Times

6.5.2.1 Introduction

Savings in journey times are generally one of the most significant benefits resulting from the provision of a new transport improvement scheme. Although COBA reports link transit times along predefined routes in the modelled network, this information excludes junction delays, which in the case of the Proposed Route Options is an important consideration when comparing the overall changes in journey time.

COBA considers changes in traffic conditions during the day by modelling the 8,760 hours in a year in different portions called Flow Groups (FGs). Flow Groups 1-5 represent Weekday Hours, with FG4/5 representing the busiest 2 weekday hours per day, FG3 representing the next busiest 2 weekday hours, FG2 representing the next busiest 8 weekday hours, and FG1 representing the remaining 12 weekday hours.

Flow Groups 6-10 represent Weekend Hours, with FG9/10 representing the busiest 2 weekend hours per day, FG8 representing the next busiest 2 weekend hours, FG7 representing the next busiest 8 weekend hours, and FG6 representing the remaining 12 weekend hours.

To provide a direct comparison between journey times on the Do-Minimum and the Do-Something networks in the 2023 year of opening, the average vehicle speeds for each link in the network and the corresponding junction delays along the route were extracted from the COBA models for light vehicles based on the combined effects of traffic conditions in Flow Group 2 and Flow Group 4. Flow Group 2 and Flow Group 4 provide a reasonable representation of operating conditions during the inter-peak and peak period respectively.

The modelled journey times for the Do-Minimum Network have been extracted for the following six strategic routes through Newry:

- Between Warrenpoint Harbour and B113 Carrickcarnan Junction, towards Dublin;
- Between Warrenpoint Harbour and Camlough Junction;
- Between Warrenpoint Harbour and Carnbane Junction, towards Armagh;
- Between Warrenpoint Harbour and Sheepbridge Junction, towards Belfast;
- Between Greenbank Roundabout and B113 Carrickcarnan Junction, towards Dublin; and
- Between Newry City Centre and B113 Carrickcarnan Junction, towards Dublin.

The journey time routes for the Do-Minimum network are shown in Figure 6.5.7.

The modelled journey times for the Do-Something Networks have also been extracted for the same routes through Newry for each of the Proposed Route Options.

6.5.2.2 Journey Time and Generalised Cost Savings

Route choice through the road network is based on an estimate of generalised cost using a combination of journey time and journey distance. As road users typically value time more than distance, the generalised cost is based on the standard Time + 0.5 Distance relationship.

A comparison of journey times and the corresponding generalised cost savings for the routes in the Do-Minimum and Do-Something Networks is shown in Table 6.5.1, Table 6.5.2, Table 6.5.3 and Table 6.5.4. This comparison includes details for the 2023 year of opening and 2037 design year.

Table 6.5.1 Summary of Journey Time and Generalised Cost Savings: 2023 Opening Year, Red Route and Yellow Route

Route	Do-Min Network	Red Route				Yellow Route			
	JT (mins)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)
Warrenpoint – Dublin	17.7	8.7	9.0	11.5	65%	9.1	8.6	11.3	64%
Dublin – Warrenpoint	18.0	9.2	8.8	11.2	62%	9.6	8.4	11.0	61%
2-Way	17.9	9.0	8.9	11.4	64%	9.3	8.5	11.2	62%
Warrenpoint – Camlough	13.0	10.6	2.4	1.3	10%	10.9	2.1	1.0	8%
Camlough – Warrenpoint	15.8	11.9	4.0	2.9	18%	12.2	3.6	2.7	17%
2-Way	14.4	11.2	3.2	2.1	14%	11.6	2.8	1.8	12%
Warrenpoint – Armagh	17.6	11.3	6.3	5.8	33%	11.7	5.9	5.5	31%
Armagh – Warrenpoint	17.4	11.6	5.8	5.2	30%	12.0	5.4	4.9	28%
2-Way	17.5	11.5	6.0	5.5	31%	11.8	5.7	5.2	30%
Warrenpoint – Belfast	17.1	13.0	4.1	2.2	13%	13.3	3.8	1.9	11%
Belfast – Warrenpoint	16.4	12.7	3.7	1.6	10%	13.0	3.4	1.4	9%
2-Way	16.8	12.8	3.9	1.9	11%	13.2	3.6	1.7	10%
Greenbank – Dublin	13.2	9.6	3.7	2.1	16%	11.9	1.3	-1.8	-14%
Dublin – Greenbank	13.6	10.2	3.4	1.8	13%	12.6	1.0	-2.2	-16%
2-Way	13.4	9.9	3.6	1.9	14%	12.3	1.2	-2.0	-15%
City Centre – Dublin	11.7	11.7	-0.1	-2.6	-22%	14.2	-2.5	-6.6	-57%
Dublin – City Centre	11.5	12.4	-0.9	-3.5	-30%	14.9	-3.4	-7.5	-65%
2-Way	11.6	12.1	-0.5	-3.1	-26%	14.5	-3.0	-7.0	-61%

Note: Journey Time and Generalised Cost savings are based on a weighted average of Flow Group 2 and Flow Group 4.

Table 6.5.2 Summary of Journey Time and Generalised Cost Savings: 2023 Opening Year, Blue Route Options 1 to 3

Route	Do-Min Network	Blue Route Option 1				Blue Route Option 2				Blue Route Option 3			
	JT (mins)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)
Warrenpoint – Dublin	17.7	10.4	7.3	8.7	49%	10.3	7.4	8.9	50%	10.3	7.4	8.9	50%
Dublin – Warrenpoint	18.0	11.1	6.9	8.3	46%	11.0	7.1	8.5	47%	11.0	7.1	8.5	47%
2-Way	17.9	10.8	7.1	8.5	48%	10.6	7.2	8.7	49%	10.6	7.2	8.7	49%
Warrenpoint – Camlough	13.0	12.2	0.7	-1.5	-12%	12.1	0.9	-1.3	-10%	12.1	0.9	-1.3	-10%
Camlough – Warrenpoint	15.8	13.7	2.1	0.0	0%	13.6	2.3	0.2	1%	13.5	2.3	0.2	1%
2-Way	14.4	13.0	1.4	-0.8	-6%	12.8	1.6	-0.6	-5%	12.8	1.6	-0.6	-5%
Warrenpoint – Armagh	17.6	13.0	4.6	3.0	17%	12.9	4.7	3.2	18%	12.9	4.7	3.2	18%
Armagh – Warrenpoint	17.4	13.4	4.0	2.2	13%	13.3	4.1	2.5	14%	13.3	4.1	2.5	14%
2-Way	17.5	13.2	4.3	2.6	15%	13.1	4.4	2.8	16%	13.1	4.4	2.8	16%
Warrenpoint – Belfast	17.1	14.7	2.4	-0.6	-4%	14.6	2.6	-0.4	-2%	14.6	2.6	-0.4	-2%
Belfast – Warrenpoint	16.4	14.5	1.9	-1.3	-8%	14.4	2.0	-1.1	-7%	14.4	2.0	-1.1	-7%
2-Way	16.8	14.6	2.2	-0.9	-6%	14.5	2.3	-0.7	-4%	14.5	2.3	-0.7	-4%
Greenbank – Dublin	13.2	7.8	5.5	5.6	42%	7.7	5.6	5.8	44%	7.7	5.6	5.8	44%
Dublin – Greenbank	13.6	8.6	5.1	5.1	37%	8.4	5.2	5.3	39%	8.4	5.2	5.3	39%
2-Way	13.4	8.2	5.3	5.3	40%	8.0	5.4	5.5	41%	8.0	5.4	5.5	41%
City Centre – Dublin	11.7	10.1	1.5	0.8	6%	10.0	1.7	1.0	8%	10.0	1.7	1.0	8%
Dublin – City Centre	11.5	10.9	0.6	-0.3	-3%	10.8	0.7	-0.1	-1%	10.8	0.7	-0.1	-1%
2-Way	11.6	10.5	1.1	0.2	2%	10.4	1.2	0.4	4%	10.4	1.2	0.4	4%

Note: Journey Time and Generalised Cost savings are based on a weighted average of Flow Group 2 and Flow Group 4.

Table 6.5.3 Summary of Journey Time and Generalised Cost Savings: 2037 Design Year, Red Route and Yellow Route

Route	Do-Min Network	Red Route				Yellow Route			
	JT (mins)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)
Warrenpoint – Dublin	18.4	8.8	9.6	12.2	66%	9.1	9.3	12.0	65%
Dublin – Warrenpoint	18.5	9.3	9.2	11.7	63%	9.6	8.9	11.5	62%

2-Way	18.5	9.0	9.4	11.9	65%	9.4	9.1	11.7	63%
Warrenpoint – Camlough	13.4	10.6	2.8	1.6	12%	11.0	2.4	1.4	10%
Camlough – Warrenpoint	16.4	11.9	4.5	3.4	21%	12.3	4.2	3.2	19%
2-Way	14.9	11.3	3.6	2.5	17%	11.6	3.3	2.3	15%
Warrenpoint – Armagh	18.4	11.4	7.0	6.5	35%	11.7	6.7	6.3	34%
Armagh – Warrenpoint	18.1	11.7	6.4	5.8	32%	12.0	6.1	5.6	31%
2-Way	18.3	11.5	6.7	6.2	34%	11.9	6.4	6.0	33%
Warrenpoint – Belfast	17.9	13.0	4.9	2.9	16%	13.4	4.5	2.7	15%
Belfast – Warrenpoint	17.1	12.7	4.4	2.3	13%	13.1	4.0	2.0	12%
2-Way	17.5	12.9	4.6	2.6	15%	13.2	4.3	2.4	14%
Greenbank – Dublin	13.9	9.6	4.3	2.7	20%	12.0	1.9	-1.2	-9%
Dublin – Greenbank	14.1	10.2	3.9	2.2	16%	12.6	1.5	-1.7	-12%
2-Way	14.0	9.9	4.1	2.5	18%	12.3	1.7	-1.5	-10%
City Centre – Dublin	12.2	11.9	0.2	-2.3	-19%	14.4	-2.2	-6.3	-52%
Dublin – City Centre	11.9	12.6	-0.7	-3.3	-28%	15.1	-3.2	-7.3	-62%
2-Way	12.0	12.2	-0.2	-2.8	-23%	14.7	-2.7	-6.8	-57%

Note: Journey Time and Generalised Cost savings are based on a weighted average of Flow Group 2 and Flow Group 4.

Table 6.5.4 Summary of Journey Time and Generalised Cost Savings: 2037 Design Year, Blue Route Options 1 to 3

Route	Do-Min Network	Blue Route Option 1				Blue Route Option 2				Blue Route Option 3			
	JT (mins)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)	JT (mins)	JT Sav. (mins)	Cost Sav. (mins)	Cost Sav. (%)
Warrenpoint – Dublin	18.4	10.5	7.9	9.4	51%	10.3	8.1	9.6	52%	10.3	8.1	9.6	52%
Dublin – Warrenpoint	18.5	11.1	7.4	8.8	47%	11.0	7.5	9.0	49%	11.0	7.5	9.0	48%
2-Way	18.5	10.8	7.7	9.1	49%	10.6	7.8	9.3	50%	10.7	7.8	9.3	50%
Warrenpoint – Camlough	13.4	12.3	1.1	-1.2	-9%	12.1	1.3	-0.9	-7%	12.2	1.2	-1.0	-7%
Camlough – Warrenpoint	16.4	13.8	2.7	0.5	3%	13.6	2.8	0.8	5%	13.6	2.8	0.7	4%
2-Way	14.9	13.0	1.9	-0.3	-3%	12.9	2.1	-0.1	-1%	12.9	2.0	-0.1	-1%
Warrenpoint – Armagh	18.4	13.1	5.4	3.8	20%	12.9	5.5	4.0	22%	12.9	5.5	4.0	21%
Armagh – Warrenpoint	18.1	13.5	4.6	2.9	16%	13.4	4.8	3.2	17%	13.4	4.7	3.1	17%

2-Way	18.3	13.3	5.0	3.3	18%	13.1	5.1	3.6	20%	13.2	5.1	3.5	19%
Warrenpoint – Belfast	17.9	14.7	3.2	0.2	1%	14.6	3.4	0.4	2%	14.6	3.3	0.4	2%
Belfast – Warrenpoint	17.1	14.5	2.6	-0.6	-4%	14.4	2.7	-0.4	-2%	14.4	2.7	-0.4	-3%
2-Way	17.5	14.6	2.9	-0.2	-1%	14.5	3.0	0.0	0%	14.5	3.0	0.0	0%
Greenbank – Dublin	13.9	7.8	6.1	6.2	45%	7.7	6.2	6.4	46%	7.7	6.2	6.4	46%
Dublin – Greenbank	14.1	8.6	5.5	5.5	39%	8.4	5.6	5.8	41%	8.5	5.6	5.8	41%
2-Way	14.0	8.2	5.8	5.9	42%	8.1	5.9	6.1	44%	8.1	5.9	6.1	43%
City Centre – Dublin	12.2	10.3	1.9	1.1	9%	10.0	2.1	1.4	12%	10.2	2.0	1.3	11%
Dublin – City Centre	11.9	11.1	0.8	-0.1	-1%	10.8	1.0	0.2	2%	11.0	0.9	0.1	1%
2-Way	12.0	10.7	1.3	0.5	4%	10.4	1.6	0.8	7%	10.6	1.4	0.7	6%

Note: Journey Time and Generalised Cost savings are based on a weighted average of Flow Group 2 and Flow Group 4.

6.5.2.3 Do-Something Network: Red Route

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.7 minutes to 8.7 minutes in the 2023 Opening Year, a saving of 9.0 minutes. This equates to a generalised cost saving of 65%. By the 2037 Design Year, the savings in journey time would increase to approximately 9.6 minutes which equates to a generalised cost saving of 66%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 18.0 minutes to 9.2 minutes in the 2023 Opening Year, a saving of 8.8 minutes. This equates to a generalised cost saving of 62%. By the 2037 Design Year, the savings in journey time would increase to approximately 9.2 minutes which equates to a generalised cost saving of 63%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Camlough Junction would reduce from approximately 13.0 minutes to 10.6 minutes in the 2023 Opening Year, a saving of 2.4 minutes. This equates to a generalised cost saving of 10%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.8 minutes which equates to a generalised cost saving of 12%.

In the reverse direction, journey times from Camlough Junction to Warrenpoint Harbour would reduce from approximately 15.8 minutes to 11.9 minutes in the 2023 Opening Year, a saving of 4.0 minutes. This equates to a generalised cost saving of 18%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.5 minutes which equates to a generalised cost saving of 21%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 17.6 minutes to 11.3 minutes in the 2023 Opening Year, a saving of 6.3 minutes. This equates to a generalised cost saving of 33%. By the 2037 Design Year, the savings in journey time would increase to approximately 7.0 minutes which equates to a generalised cost saving of 35%.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 17.4 minutes to 11.6 minutes in the 2023 Opening Year, a saving of 5.8 minutes. This equates to a generalised cost saving of 30%. By the 2037 Design Year, the savings in journey time would increase to approximately 6.4 minutes which equates to a generalised cost saving of 32%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 17.1 minutes to 13.0 minutes in the 2023 Opening Year, a saving of 4.1 minutes. This equates to a generalised cost saving of 13%.

By the 2037 Design Year, the savings in journey time would increase to approximately 4.9 minutes which equates to a generalised cost saving of 16%.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 16.4 minutes to 12.7 minutes in the 2023 Opening Year, a saving of 3.7 minutes. This equates to a generalised cost saving of 10%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.4 minutes which equates to a generalised cost saving of 13%.

Examination of the above journey time information indicates that journey times from Greenbank Roundabout to B113 Carrickcarnan Junction would reduce from approximately 13.2 minutes to 9.6 minutes in the 2023 Opening Year, a saving of 3.7 minutes. This equates to a generalised cost saving of 16%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.3 minutes which equates to a generalised cost saving of 20%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Greenbank Roundabout would reduce from approximately 13.6 minutes to 10.2 minutes in the 2023 Opening Year, a saving of 3.4 minutes. This equates to a generalised cost saving of 13%. By the 2037 Design Year, the savings in journey time would increase to approximately 3.9 minutes which equates to a generalised cost saving of 16%.

Examination of the above journey time information indicates that journey times from Newry city centre to B113 Carrickcarnan Junction would reduce from approximately 11.7 minutes to 11.7 minutes in the 2023 Opening Year, a saving of -0.1 minutes. This equates to a generalised cost saving of -22%. By the 2037 Design Year, the savings in journey time would increase to approximately 0.2 minutes which equates to a generalised cost saving of -19%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Newry city centre would increase from approximately 11.5 minutes to 12.4 minutes in the 2023 Opening Year, a saving of -0.9 minutes. This equates to a generalised cost saving of -30%. By the 2037 Design Year, the savings in journey time would increase to approximately -0.7 minutes which equates to a generalised cost saving of -28%.

6.5.2.4 Do-Something Network: Yellow Route

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.7 minutes to 9.1 minutes in the 2023 Opening Year, a saving of 8.6 minutes. This equates to a generalised cost saving of 64%. By the 2037 Design Year, the savings in journey time would increase to approximately 9.3 minutes which equates to a generalised cost saving of 65%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 18.0 minutes to 9.6 minutes in the 2023 Opening Year, a saving of 8.4 minutes. This equates to a generalised cost saving of 61%. By the 2037 Design Year, the savings in journey time would increase to approximately 8.9 minutes which equates to a generalised cost saving of 62%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Camlough Junction would reduce from approximately 13.0 minutes to 10.9 minutes in the 2023 Opening Year, a saving of 2.1 minutes. This equates to a generalised cost saving of 8%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.4 minutes which equates to a generalised cost saving of 10%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.8 minutes to 12.2 minutes in the 2023 Opening Year, a saving of 3.6 minutes. This equates to a generalised cost saving of 17%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.2 minutes which equates to a generalised cost saving of 19%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 17.6 minutes to 11.7 minutes in the 2023 Opening Year, a saving of 5.9 minutes. This equates to a generalised cost saving of 31%. By the 2037 Design Year, the savings in journey time would increase to approximately 6.7 minutes which equates to a generalised cost saving of 34%.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 17.4 minutes to 12.0 minutes in the 2023 Opening Year, a saving of 5.4 minutes. This equates to a generalised cost saving of 28%. By the 2037 Design Year, the savings in journey time would increase to approximately 6.1 minutes which equates to a generalised cost saving of 31%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 17.1 minutes to 13.3 minutes in the 2023 Opening Year, a saving of 3.8 minutes. This equates to a generalised cost saving of 11%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.5 minutes which equates to a generalised cost saving of 15%.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 16.4 minutes to 13.0 minutes in the 2023 Opening Year, a saving of 3.4 minutes. This equates to a generalised cost saving of 9%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.0 minutes which equates to a generalised cost saving of 12%.

Examination of the above journey time information indicates that journey times from Greenbank Roundabout to B113 Carrickcarnan Junction would reduce from approximately 13.2 minutes to 11.9 minutes in the 2023 Opening Year, a saving of 1.3 minutes. This equates to a generalised cost saving of -14%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.9 minutes which equates to a generalised cost saving of -9%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Greenbank Roundabout would reduce from approximately 13.6 minutes to 12.6 minutes in the 2023 Opening Year, a saving of 1.0 minutes. This equates to a generalised cost saving of -16%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.5 minutes which equates to a generalised cost saving of -12%.

Examination of the above journey time information indicates that journey times from Newry city centre to B113 Carrickcarnan Junction would increase from approximately 11.7 minutes to 14.2 minutes in the 2023 Opening Year, a saving of -2.5 minutes. This equates to a generalised cost saving of -57%. By the 2037 Design Year, the savings in journey time would increase to approximately -2.2 minutes which equates to a generalised cost saving of -52%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Newry city centre would increase from approximately 11.5 minutes to 14.9 minutes in the 2023 Opening Year, a saving of -3.4 minutes. This equates to a generalised cost saving of -65%. By the 2037 Design Year, the savings in journey time would increase to approximately -3.2 minutes which equates to a generalised cost saving of -62%.

6.5.2.5 Do-Something Network: Blue Route Option 1

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.7 minutes to 10.4 minutes in the 2023 Opening Year, a saving of 7.3 minutes. This equates to a generalised cost saving of 49%. By the 2037 Design Year, the savings in journey time would increase to approximately 9.4 minutes which equates to a generalised cost saving of 51%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 18.0 minutes to 11.1 minutes in the 2023 Opening Year, a saving of 6.9 minutes. This equates to a generalised cost saving of 46%. By the 2037 Design Year, the savings in journey time would increase to approximately 7.4 minutes which equates to a generalised cost saving of 47%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Camlough Junction would reduce from approximately 13.0 minutes to 12.2 minutes in the 2023 Opening Year, a saving of 0.7 minutes. This equates to a generalised cost saving of -12%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.1 minutes which equates to a generalised cost saving of -9%.

In the reverse direction, journey times from Camlough Junction to Warrenpoint Harbour would reduce from approximately 15.8 minutes to 13.7 minutes in the 2023 Opening Year, a saving of 2.1 minutes. This equates to a generalised cost saving of 0%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.7 minutes which equates to a generalised cost saving of 3%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 17.6 minutes to 13.0 minutes in the 2023 Opening Year, a saving of 4.6 minutes. This equates to a generalised cost saving of 17%. By the 2037 Design Year, the savings in journey time would increase to approximately 5.4 minutes which equates to a generalised cost saving of 20%.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 17.4 minutes to 13.4 minutes in the 2023 Opening Year, a saving of 4.0 minutes. This equates to a generalised cost saving of 13%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.6 minutes which equates to a generalised cost saving of 16%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 17.1 minutes to 14.7 minutes in the 2023 Opening Year, a saving of 2.4 minutes. This equates to a generalised cost saving of -4%. By the 2037 Design Year, the savings in journey time would increase to approximately 3.2 minutes which equates to a generalised cost saving of 1%.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 16.4 minutes to 14.5 minutes in the 2023 Opening Year, a saving of 1.9 minutes. This equates to a generalised cost saving of -8%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.6 minutes which equates to a generalised cost saving of -4%.

Examination of the above journey time information indicates that journey times from Greenbank Roundabout to B113 Carrickcarnan Junction would reduce from approximately 13.2 minutes to 7.8 minutes in the 2023 Opening Year, a saving of 5.5 minutes. This equates to a generalised cost saving of 42%. By the 2037 Design Year, the savings in journey time would increase to approximately 6.1 minutes which equates to a generalised cost saving of 45%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Greenbank Roundabout would reduce from approximately 13.6 minutes to 8.6 minutes in the 2023 Opening Year, a saving of 5.1 minutes. This equates to a generalised cost saving of 37%. By the 2037 Design Year, the savings in journey time would increase to approximately 5.5 minutes which equates to a generalised cost saving of 39%.

Examination of the above journey time information indicates that journey times from Newry city centre to B113 Carrickcarnan Junction would increase from approximately 11.7 minutes to 10.1 minutes in the 2023 Opening Year, a saving of 1.5 minutes. This equates to a generalised cost saving of 6%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.9 minutes which equates to a generalised cost saving of 9%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Newry city centre would increase from approximately 11.5 minutes to 10.9 minutes in the 2023 Opening Year, a saving of 0.6 minutes. This equates to a generalised cost saving of -3%. By the 2037 Design Year, the savings in journey time would increase to approximately 0.8 minutes which equates to a generalised cost saving of -1%.

6.5.2.6 Do-Something Network: Blue Route Option 2

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.7 minutes to 10.3 minutes in the 2023 Opening Year, a saving of 7.4 minutes. This equates to a generalised cost saving of 50%. By the 2037 Design Year, the savings in journey time would increase to approximately 8.1 minutes which equates to a generalised cost saving of 52%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 18.0 minutes to 11.0 minutes in the 2023 Opening Year, a saving of 7.1 minutes. This equates to a generalised cost saving of 47%. By the 2037 Design Year, the savings in journey time would increase to approximately 7.5 minutes which equates to a generalised cost saving of 49%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Camlough Junction would reduce from approximately 13.0 minutes to 12.1 minutes in the 2023 Opening Year, a saving of 0.9 minutes. This equates to a generalised cost saving of -10%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.3 minutes which equates to a generalised cost saving of -7%.

In the reverse direction, journey times from Camlough Junction to Warrenpoint Harbour would reduce from approximately 15.8 minutes to 13.6 minutes in the 2023 Opening Year, a saving of 2.3 minutes. This equates to a generalised cost saving of 1%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.8 minutes which equates to a generalised cost saving of 5%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 17.6 minutes to 12.9 minutes in the 2023 Opening Year, a saving of 4.7 minutes. This equates to a generalised cost saving of 18%. By the 2037 Design Year, the savings in journey time would increase to approximately 5.5 minutes which equates to a generalised cost saving of 22%.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 17.4 minutes to 13.3 minutes in the 2023 Opening Year, a saving of 4.1 minutes. This equates to a generalised cost saving of 14%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.8 minutes which equates to a generalised cost saving of 17%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 17.1 minutes to 14.6 minutes in the 2023 Opening Year, a saving of 2.6 minutes. This equates to a generalised cost saving of -2%. By the 2037 Design Year, the savings in journey time would increase to approximately 3.4 minutes which equates to a generalised cost saving of 2%.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 16.4 minutes to 14.4 minutes in the 2023 Opening Year, a saving of 2.0 minutes. This equates to a generalised cost saving of -7%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.7 minutes which equates to a generalised cost saving of -2%.

Examination of the above journey time information indicates that journey times from Greenbank Roundabout to B113 Carrickcarnan Junction would reduce from approximately 13.2 minutes to 7.7 minutes in the 2023 Opening Year, a saving of 5.6 minutes. This equates to a generalised cost saving of 44%. By the 2037 Design Year, the savings in journey time would increase to approximately 6.2 minutes which equates to a generalised cost saving of 46%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Greenbank Roundabout would reduce from approximately 13.6 minutes to 8.4 minutes in the 2023 Opening Year, a saving of 5.2 minutes. This equates to a generalised cost saving of 39%. By the 2037 Design Year, the savings in journey time would increase to approximately 5.6 minutes which equates to a generalised cost saving of 41%.

Examination of the above journey time information indicates that journey times from Newry City Centre to B113 Carrickcarnan Junction would increase from approximately 11.7 minutes to 10.0 minutes in the 2023 Opening Year, a saving of 1.7 minutes. This equates to a generalised cost saving of 8%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.1 minutes which equates to a generalised cost saving of 12%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Newry city centre would increase from approximately 11.5 minutes to 10.8 minutes in the 2023 Opening Year, a saving of 0.7 minutes. This equates to a generalised cost saving of -1%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.0 minutes which equates to a generalised cost saving of 2%.

6.5.2.7 Do-Something Network: Blue Route Option 3

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.7 minutes to 10.3 minutes in the 2023 Opening Year, a saving of 7.4 minutes. This equates to a generalised cost saving of 50%. By the 2037 Design Year, the savings in journey time would increase to approximately 8.1 minutes which equates to a generalised cost saving of 52%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 18.0 minutes to 11.0 minutes in the 2023 Opening Year, a saving of 7.1 minutes. This equates to a generalised cost saving of 47%. By the 2037 Design Year, the savings in journey time would increase to approximately 7.5 minutes which equates to a generalised cost saving of 48%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Camlough Junction would reduce from approximately 13.0 minutes to 12.1 minutes in the 2023 Opening Year, a saving of 0.9 minutes. This equates to a generalised cost saving of -10%. By the 2037 Design Year, the savings in journey time would increase to approximately 1.2 minutes which equates to a generalised cost saving of -7%.

In the reverse direction, journey times from Camlough Junction to Warrenpoint Harbour would reduce from approximately 15.8 minutes to 13.5 minutes in the 2023 Opening Year, a saving of 2.3 minutes. This equates to a generalised cost saving of 1%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.8 minutes which equates to a generalised cost saving of 4%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 17.6 minutes to 12.9 minutes in the 2023 Opening Year, a saving of 4.7 minutes. This equates to a generalised cost saving of 18%. By the 2037 Design Year, the savings in journey time would increase to approximately 5.5 minutes which equates to a generalised cost saving of 21%.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 17.4 minutes to 13.3 minutes in the 2023 Opening Year, a saving of 4.1 minutes. This equates to a generalised cost saving of 14%. By the 2037 Design Year, the savings in journey time would increase to approximately 4.7 minutes which equates to a generalised cost saving of 17%.

Examination of the above journey time information indicates that journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 17.1 minutes to 14.6 minutes in the 2023 Opening Year, a saving of 2.6 minutes. This equates to a generalised cost saving of -2%. By the 2037 Design Year, the savings in journey time would increase to approximately 3.3 minutes which equates to a generalised cost saving of 2%.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 16.4 minutes to 14.4 minutes in the 2023 Opening Year, a saving of 2.0 minutes. This equates to a generalised cost saving of -7%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.7 minutes which equates to a generalised cost saving of -3%.

Examination of the above journey time information indicates that journey times from Greenbank Roundabout to B113 Carrickcarnan Junction would reduce from approximately 13.2 minutes to 7.7 minutes in the 2023 Opening Year, a saving of 5.6 minutes. This equates to a generalised cost saving of 44%. By the 2037 Design Year, the savings in journey time would increase to approximately 6.2 minutes which equates to a generalised cost saving of 46%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Greenbank Roundabout would reduce from approximately 13.6 minutes to 8.4 minutes in the 2023 Opening Year, a saving of 5.2 minutes. This equates to a generalised cost saving of 39%. By the 2037 Design Year, the savings in journey time would increase to approximately 5.6 minutes which equates to a generalised cost saving of 41%.

Examination of the above journey time information indicates that journey times from Newry City Centre to B113 Carrickcarnan Junction would increase from approximately 11.7 minutes to 10.0 minutes in the 2023 Opening Year, a saving of 1.7 minutes. This equates to a generalised cost saving of 8%. By the 2037 Design Year, the savings in journey time would increase to approximately 2.0 minutes which equates to a generalised cost saving of 11%.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Newry City Centre would increase from approximately 11.5 minutes to 10.8 minutes in the 2023 Opening Year, a saving of 0.7 minutes. This equates to a generalised cost saving of -1%. By the 2037 Design Year, the savings in journey time would increase to approximately 0.9 minutes which equates to a generalised cost saving of 1%.

An overall summary of the two-way generalised cost savings associated with the Proposed Route Options is shown below in Table 6.5.5.

Table 6.5.5 Summary of Two-Way Generalised Cost Savings, Do-Something Networks

Route	Year	Two-Way Generalised Cost Savings (%)				
		Red Route	Yellow Route	Blue Route		
				Option 1	Option 2	Option 3
Warrenpoint to / from Dublin	2023	64%	62%	48%	49%	49%
Warrenpoint to / from Camlough	2023	14%	12%	-6%	-5%	-5%
Warrenpoint to / from Armagh	2023	31%	30%	15%	16%	16%
Warrenpoint to / from Belfast	2023	11%	10%	-6%	-4%	-4%
Greenbank to / from Dublin	2023	14%	-15%	40%	41%	41%
City Centre to / from Dublin	2023	-26%	-61%	2%	4%	4%
Warrenpoint to / from Dublin	2037	65%	63%	49%	50%	50%
Warrenpoint to / from Camlough	2037	17%	15%	-3%	-1%	-1%
Warrenpoint to / from Armagh	2037	34%	33%	18%	20%	19%
Warrenpoint to / from Belfast	2037	15%	14%	-1%	0%	0%
Greenbank to / from Dublin	2037	18%	-10%	42%	44%	43%
City Centre to / from Dublin	2037	-23%	-57%	4%	7%	6%

6.5.3 Trip Patterns and Traffic Reassignment

The provision of the Proposed Route Option will provide an alternative route for strategic traffic that currently passes through the city.

Through the analysis of the baseline traffic surveys undertaken in 2017 around the city, existing trip patterns for strategic traffic passing through the city have been estimated. Based on these patterns, the likely changes in traffic movements associated with the proposed route options have been estimated for the purpose of the Stage 2 comparative assessment.

An overall summary of the two-way traffic reassignment distribution levels in the 2023 Opening Year and 2037 Design Year for each proposed route option is shown below in Table 6.5.6.

Where there is a two-way cost saving of more than 0%, the assessment is based on all relevant traffic reassigning on to the Proposed Route Option.

Where there is a two-way cost saving of between 0% and -6%, the assessment is based on half of the relevant traffic reassigning on to the Proposed Route Option.

Where there is a two-way cost saving of less than -6%, traffic would continue to use the existing routes and the assessment is based on no traffic reassigning on to the Proposed Route Option.

For the assessment of the Blue Route Options, it is likely that some traffic from the city centre could also be attracted to the proposed route. For the purpose of the assessment, it has been assumed that 5% of traffic passing Kilmorey Street on William Street could be attracted to the proposed route.

Table 6.5.6 Summary of Two-Way Traffic Reassignment Distribution

Route	Equivalent 2017 12-Hour Flow	Year	Two-Way Traffic Redistribution				
			Red Route	Yellow Route	Blue Route		
					Option 1	Option 2	Option 3
Warrenpoint to / from Dublin	700 / 750	2023	All	All	All	All	All
Warrenpoint to / from Camlough	350 / 350	2023	All	All	Half	Half	Half
Warrenpoint to / from Armagh	300 / 300	2023	All	All	All	All	All
Warrenpoint to / from Belfast	400 / 450	2023	All	All	Half	Half	Half
Greenbank to / from Dublin	450 / 400	2023	All	None	All	All	All
City Centre to / from Dublin	200 / 200	2023	None	None	All of 5%	All of 5%	All of 5%
Warrenpoint to / from Dublin	700 / 750	2037	All	All	All	All	All
Warrenpoint to / from Camlough	350 / 350	2037	All	All	Half	Half	Half
Warrenpoint to / from Armagh	300 / 300	2037	All	All	All	All	All
Warrenpoint to / from Belfast	400 / 450	2037	All	All	Half	Half	Half
Greenbank to / from Dublin	450 / 400	2037	All	None	All	All	All
City Centre to / from Dublin	200 / 200	2037	None	None	All of 5%	All of 5%	All of 5%

6.5.4 Network Capacity

6.5.4.1 Do-Minimum Network

As part of the overall operational assessment of a proposed road improvement scheme, the COBA model identifies links and junctions where traffic demand exceeds operating capacity. The number of over-capacity links and junctions provides a measure of operating conditions on the network. Where demand exceeds capacity, delays and the corresponding costs increase significantly.

Based on the information obtained from the COBA models, the links and junctions that are reported as being over-capacity have been identified to provide an indication of the traffic conditions on the various networks. The assessment considers the effects of normal variations in traffic demand that occur during the day, as defined by the various Flow Groups, and the effects of growth in traffic from the 2017 Base Year to the 2023 Opening Year and the 2037 Design Year.

The number of over-capacity links and junctions in the Do-Minimum Network under RTF 2015 traffic growth forecasts is summarised in Table 6.5.7.

Table 6.5.7 Number of Over-Capacity Links and Junctions, Do-Minimum Network

Year	Flow Group	Do-Minimum Network	
		Link	Junction
2017	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	1
	Flow Group 8 / 9	4	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	8	3
	Flow Group 8 / 9	5	1

2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	5
	Flow Group 8 / 9	7	1

Examination of the above results indicates that traffic demand in 2017 under Flow Group 3 / 4 traffic conditions would exceed capacity on 6 links and 1 junction. By the 2023 Opening Year, this would increase to 8 links and 3 junctions and to 9 links and 5 junctions in 2037.

The locations of the links and junctions that are over-capacity under RTF 2015 traffic growth forecasts for the Do-Minimum Network are shown in Figure 6.5.8.

6.5.4.2 Do-Something Network: Red Route

The number of over-capacity links and junctions in the Do-Something Network: Red Route under RTF 2015 traffic growth forecasts is summarised in Table 6.5.8.

It should be noted that although the proposed route options would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2017 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 6.5.8 Number of Over-Capacity Links and Junctions, Do-Something Network: Red Route

Year	Flow Group	Do-Something Network: Red Route	
		Link	Junction
2017	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	5	1
	Flow Group 8 / 9	2	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	1
	Flow Group 8 / 9	4	1
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	7	3
	Flow Group 8 / 9	5	1

Examination of the above results indicates that traffic demand in 2017 under Flow Group 3 / 4 traffic conditions would exceed capacity on 5 links and 1 junction. By the 2023 Opening Year, this would increase to 6 links and 1 junction and to 7 links and 3 junctions in 2037.

The locations of the links and junctions that are over-capacity under RTF 2015 traffic growth forecasts for the Do-Something Network: Red route are shown in Figure 6.5.9.

6.5.4.3 Do-Something Network: Yellow Route

The number of over-capacity links and junctions in the Do-Something Network: Yellow Route under RTF 2015 traffic growth forecasts is summarised in Table 6.5.9.

Table 6.5.9 Number of Over-Capacity Links and Junctions, Do-Something Network: Yellow Route

Year	Flow Group	Do-Something Network: Yellow Route	
		Link	Junction
2017	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	5	1
	Flow Group 8 / 9	2	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	1
	Flow Group 8 / 9	5	1
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	7	4
	Flow Group 8 / 9	5	1

Examination of the above results indicates that traffic demand in 2017 under Flow Group 3 / 4 traffic conditions would exceed capacity on 5 links and 1 junction. By the 2023 Opening Year, this would increase to 6 links and 1 junction and to 7 links and 4 junctions in 2037.

The locations of the links and junctions that are over-capacity under RTF 2015 traffic growth forecasts for the Do-Something Network: Yellow Route are shown in Figure 6.5.10.

6.5.4.4 Do-Something Network: Blue Route Option 1

The number of over-capacity links and junctions in the Do-Something Network: Blue Route – Option 1 under RTF 2015 traffic growth forecasts is summarised in Table 6.5.10.

Table 6.5.10 Number of Over-Capacity Links and Junctions, Do-Something Network: Blue Route Option 1

Year	Flow Group	Do-Something Network: Blue Route – Option 1	
		Link	Junction
2017	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	5	1
	Flow Group 8 / 9	2	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	1
	Flow Group 8 / 9	5	1
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	7	3
	Flow Group 8 / 9	5	1

Examination of the above results indicates that traffic demand in 2017 under Flow Group 3 / 4 traffic conditions would exceed capacity on 5 links and 1 junction. By the 2023 Opening Year, this would increase to 6 links and 1 junction and to 7 links and 3 junctions in 2037.

The locations of the links and junctions that are over-capacity under RTF 2015 traffic growth forecasts for the Do-Something Network: Blue Route Option 1 are shown in Figure 6.5.11.

6.5.4.5 Do-Something Network: Blue Route Option 2

The number of over-capacity links and junctions in the Do-Something Network: Blue Route – Option 2 under RTF 2015 traffic growth forecasts is summarised in Table 6.5.11.

Table 6.5.11 Number of Over-Capacity Links and Junctions, Do-Something Network: Blue Route Option 2

Year	Flow Group	Do-Something Network: Blue Route – Option 2	
		Link	Junction
2017	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	5	1
	Flow Group 8 / 9	2	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	1
	Flow Group 8 / 9	5	1
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	7	3
	Flow Group 8 / 9	5	1

Examination of the above results indicates that traffic demand in 2017 under Flow Group 3 / 4 traffic conditions would exceed capacity on 5 links and 1 junction. By the 2023 Opening Year, this would increase to 6 links and 1 junction and to 7 links and 3 junctions in 2037.

The locations of the links and junctions that are over-capacity under RTF 2015 traffic growth forecasts for the Do-Something Network: Blue Route Option 2 are shown in Figure 6.5.12.

6.5.4.6 Do-Something Network: Blue Route Option 3

The number of over-capacity links and junctions in the Do-Something Network: Blue Route – Option 3 under RTF 2015 traffic growth forecasts is summarised in Table 6.5.12.

Table 6.5.12 Number of Over-Capacity Links and Junctions, Do-Something Network: Blue Route Option 3

Year	Flow Group	Do-Something Network: Blue Route – Option 3	
		Link	Junction
2017	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	5	1
	Flow Group 8 / 9	2	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	1
	Flow Group 8 / 9	5	1
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	7	3
	Flow Group 8 / 9	5	1

Examination of the above results indicates that traffic demand in 2017 under Flow Group 3 / 4 traffic conditions would exceed capacity on 5 links and 1 junction. By the 2023 Opening Year, this would increase to 6 links and 1 junction and to 7 links and 3 junctions in 2037.

The locations of the links and junctions that are over-capacity under RTF 2015 traffic growth forecasts for the Do-Something Network: Blue Route Option 3 are shown in Figure 6.5.13.

6.6 Road Safety

6.6.1 Introduction

Given the uncertainties in predicting future accident rates and casualty severities over the 60-year economic assessment period from the proposed year of opening, the COBA assessment has been based on the application of default accident rates and costs. These have been applied to both the Do-Minimum and Do-Something networks to provide a reasonable measure of the relative change in road traffic accident characteristics associated with the networks.

6.6.2 Do-Something Network Road Safety

6.6.2.1 Do-Something Network: Red Route

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under RTF 2015 traffic growth forecasts due to the provision of the Red Route are shown in Table 6.6.1and Table 6.6.2. The associated Present Value of Benefits are also shown in these Tables.

Table 6.6.1 Accident Numbers and Costs, Do-Something Network: Red Route

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	65.0	58.0	3,507.7	159.382
Do-Something: Red Route	62.4	55.7	3,366.8	154.464
Benefits	2.6	2.3	140.9	4.918

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Table 6.6.2 Casualties by Severity, Do-Something Network: Red Route

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	37.6	460.3	4,257.9	3,507.7
Do-Something: Red Route	37.8	446.6	4,096.0	3,366.8
Benefits	-0.2	13.7	161.9	140.9

From the above information, the Red Route would save approximately 141 personal injury accidents over the 60-year period, which equates to an economic benefit of £4.9m under RTF 2015 growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Red Route would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

6.6.2.2 Do-Something Network: Yellow Route

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under RTF 2015 traffic growth forecasts due to the provision of the Yellow Route are shown in Table 6.6.3 and Table 6.6.4. The associated Present Value of Benefits are also shown in these Tables.

Table 6.6.3 Accident Numbers and Costs, Do-Something Network: Yellow Route

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	65.0	58.0	3,507.7	159.382
Do-Something: Yellow Route	63.1	56.3	3,405.3	156.269
Benefits	1.9	1.7	102.4	3.114

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Table 6.6.4 Casualties by Severity, Do-Something Network: Yellow Route

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	37.6	460.3	4,257.9	3,507.7
Do-Something: Yellow Route	38.2	452.1	4,142.5	3,405.3
Benefits	-0.6	8.1	115.4	102.4

From the above information, the Yellow Route would save approximately 102 personal injury accidents over the 60-year period, which equates to an economic benefit of £3.1m under RTF 2015 growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Yellow Route would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

6.6.2.3 Do-Something Network: Blue Route Option 1

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under RTF 2015 traffic growth forecasts due to the provision of the Blue Route Option 1 are shown in Table 6.6.5 and Table 6.6.6. The associated Present Values of Benefits are also shown in these Tables.

Table 6.6.5 Accident Numbers and Costs, Do-Something Network: Blue Route Option 1

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	65.0	58.0	3,507.7	159.382
Do-Something: Blue Route – Option 1	62.7	55.9	3,379.9	154.869
Benefits	2.3	2.1	127.8	4.513

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Table 6.6.6 Casualties by Severity, Do-Something Network: Blue Route Option 1

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	37.6	460.3	4,257.9	3,507.7
Do-Something: Blue Route – Option 1	37.7	447.6	4,110.9	3,379.9
Benefits	-0.1	12.7	147.0	127.8

From the above information, the Blue Route Option 1 would save approximately 128 personal injury accidents over the 60-year period, which equates to an economic benefit of £4.5m under RTF 2015 growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Blue Route Option 1 would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

6.6.2.4 Do-Something Network: Blue Route Option 2

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under RTF 2015 traffic growth forecasts due to the provision of the Blue Route Option 2 are shown in Table 6.6.7 and Table 6.6.8. The associated Present Values of Benefits are also shown in these Tables.

Table 6.6.7 Accident Numbers and Costs, Do-Something Network: Blue Route Option 2

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	65.0	58.0	3,507.7	159.382
Do-Something: Blue Route – Option 2	62.6	55.9	3,378.3	154.765
Benefits	2.4	2.1	129.4	4.617

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Table 6.6.8 Casualties by Severity, Do-Something Network: Blue Route Option 2

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	37.6	460.3	4,257.9	3,507.7
Do-Something: Blue Route – Option 2	37.7	447.2	4,108.8	3,378.3
Benefits	-0.1	13.0	149.1	129.4

From the above information, the Blue Route Option 2 would save approximately 129 personal injury accidents over the 60-year period, which equates to an economic benefit of £4.6m under RTF 2015 growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Blue Route Option 2 would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

6.6.2.5 Do-Something Network: Blue Route Option 3

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under RTF 2015 traffic growth forecasts due to the provision of the Blue Route Option 3 are shown in Table 6.6.9 and Table 6.6.10. The associated Present Value of Benefits are also shown in these Tables.

Table 6.6.9 Accident Numbers and Costs, Do-Something Network: Blue Route Option 3

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	65.0	58.0	3,507.7	159.382
Do-Something: Blue Route – Option 3	62.6	55.9	3,378.3	154.764
Benefits	2.4	2.1	129.4	4.618

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Table 6.6.10 Casualties by Severity, Do-Something Network: Blue Route Option 3

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	37.6	460.3	4,257.9	3,507.7
Do-Something: Blue Route – Option 3	37.7	447.2	4,108.8	3,378.3
Benefits	-0.1	13.0	149.1	129.4

From the above information, the Blue Route Option 3 would save approximately 129 personal injury accidents over the 60-year period, which equates to an economic benefit of £4.6m under RTF 2015 growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Blue Route Option 3 would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

An overall summary of the accident benefits associated with the proposed route options is shown below in Table 6.6.11.

Table 6.6.11 Accident Benefits, Do-Something Networks

Accident Benefits	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Accident Benefits (£m's)	4.918	3.114	4.513	4.617	4.618
Accident Benefits (No.)	140.9	102.4	127.8	129.4	129.4
Proposed Improvement Option Cost Savings Ranking	1st	5th	4th	3rd	2nd

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Examination of the above information indicates that the accident benefits range from £3.114m for the Yellow Route to £4.918m for the Red Route.

6.7 Economic Assessment of Proposed Route Options

6.7.1 COBA Assessment

The economic results from the COBA models for the proposed route options, based on the scheme costs defined previously including optimism bias and the application of Road Traffic Forecasts 2015 traffic growth projection, are summarised in Table 6.7.1 and Table 6.7.2.

Table 6.7.1 COBA Route Options Assessment Summary, Do-Something Networks: Red Route and Yellow Route

Item	Do-Something Network	
	Red Route	Yellow Route
Present Value of Benefits (PVB) (£m's)	£109.498	£92.269
Present Value of Costs (PVC) (£m's)	£59.899	£55.573
Net Present Value (NPV) (£m's)	£49.599	£36.696
Benefit to Cost Ratio (BCR)	1.828	1.660

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Table 6.7.2 COBA Route Options Assessment Summary, Do-Something Networks: Blue Route Options 1 to 3

Item	Do-Something Network		
	Blue Route		
	Option 1	Option 2	Option 3
Present Value of Benefits (PVB) (£m's)	£89.089	£91.270	£91.303
Present Value of Costs (PVC) (£m's)	£29.165	£38.328	£31.413
Net Present Value (NPV) (£m's)	£59.924	£52.942	£59.889
Benefit to Cost Ratio (BCR)	3.055	2.381	2.906

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

In accordance with current government guidelines on the reporting of transport economic efficiency, the results of the economic assessment are presented in the market prices unit of account that was introduced in COBA11.

A more detailed presentation of the COBA results is shown in Table 6.7.3 and Table 6.7.4 and indicates the transport economic efficiency, public accounts and monetised costs and benefits as defined in COBA11 Tables 15A to 15C.

Table 6.7.3 COBA Route Options Assessment, Do-Something Networks: Red Route and Yellow Route

Item	Do-Something Network (£m's)	
	Red Route	Yellow Route
Consumers (User Benefits)		
Travel Time	£66.375	£54.835
Approx. Link Transit Time	£59.386	£53.499
Approx. Junction Delay	£6.989	£1.336
Vehicle Operating Costs	£0.962	£3.624
Travel Time and VOC during Construction (QUADRO)	£0.000	£0.000
Travel Time and VOC during Maintenance (QUADRO)	£0.000	£0.000
Net Non-Business User Benefits	£67.337	£58.459
Business Users (User Benefits)		
Travel Time	£35.977	£29.687
Approx. Link Transit Time	£32.189	£28.964
Approx. Junction Delay	£3.788	£0.723
Vehicle Operating Costs	£2.363	£3.605
Travel Time and VOC during Construction (QUADRO)	£0.000	£0.000
Travel Time and VOC during Maintenance (QUADRO)	£0.000	£0.000
Subtotal	£38.340	£33.292
Private Sector Provider Impacts (Operating Costs)	£0.342	£0.430
Net Business Impact	£38.682	£33.721
Total Present Value of TEE Benefits	£106.020	£92.180
Public Accounts		

Government Funding		
Operating Costs	£0.637	£0.552
Investment Costs	£59.262	£55.021
Present Value of Costs	£59.899	£55.573
Analysis of Monetised Costs and Benefits		
TEE Benefits		
Consumer User Benefits	£67.337	£58.459
Business Benefits	£38.340	£33.292
Private Sector Provider Impacts	£0.342	£0.430
Accident Benefits	£4.918	£3.114
Indirect Tax Revenues	-£1.734	-£3.619
Emissions Benefits	£0.294	£0.594
Present Value of Benefits (PVB)	£109.498	£92.269
Present Value of Costs (PVC)	£59.899	£55.573
Overall Impact		
Net Present Value (NPV)	£49.599	£36.696
Benefit to Cost Ratio (BCR)	1.828	1.660

Source: COBA11 Release 19 Tables 15A – 15C.

Note: Costs in 2010 prices in £m's discounted to 2010 at 3.5% for the first 30 years, 3% thereafter for 46 years and thereafter 2.5%.

Table 6.7.4 COBA Route Options Assessment, Do-Something Networks: Blue Route Options 1 to 3

Item	Do-Something Network (£m's)		
	Blue Route		
	Option 1	Option 2	Option 3
Consumers (User Benefits)			
Travel Time	£53.786	£54.759	£54.779
Approx. Link Transit Time	£50.557	£51.590	£51.610
Approx. Junction Delay	£3.229	£3.169	£3.169
Vehicle Operating Costs	£0.157	£0.769	£0.770
Travel Time and VOC during Construction (QUADRO)	£0.000	£0.000	£0.000
Travel Time and VOC during Maintenance (QUADRO)	£0.000	£0.000	£0.000
Net Non-Business User Benefits	£53.943	£55.528	£55.549
Business Users (User Benefits)			
Travel Time	£29.367	£29.888	£29.898
Approx. Link Transit Time	£27.604	£28.158	£28.169
Approx. Junction Delay	£1.763	£1.730	£1.729

Vehicle Operating Costs	£1.888	£2.216	£2.216
Travel Time and VOC during Construction (QUADRO)	£0.000	£0.000	£0.000
Travel Time and VOC during Maintenance (QUADRO)	£0.000	£0.000	£0.000
Subtotal	£31.255	£32.104	£32.114
Private Sector Provider Impacts (Operating Costs)	£0.264	£0.300	£0.300
Net Business Impact	£31.519	£32.404	£32.415
Total Present Value of TEE Benefits	£85.462	£87.932	£87.964
Public Accounts			
Government Funding			
Operating Costs	£0.477	£0.448	£0.447
Investment Costs	£28.688	£37.880	£30.966
Present Value of Costs	£29.165	£38.328	£31.413
Analysis of Monetised Costs and Benefits			
TEE Benefits			
Consumer User Benefits	£53.943	£55.528	£55.549
Business Benefits	£31.255	£32.104	£32.114
Private Sector Provider Impacts	£0.264	£0.300	£0.300
Accident Benefits	£4.513	£4.617	£4.618
Indirect Tax Revenues	-£1.069	-£1.539	-£1.538
Emissions Benefits	£0.184	£0.259	£0.259
Present Value of Benefits (PVB)	£89.089	£91.270	£91.303
Present Value of Costs (PVC)	£29.165	£38.328	£31.413
Overall Impact			
Net Present Value (NPV)	£59.924	£52.942	£59.889
Benefit to Cost Ratio (BCR)	3.055	2.381	2.906

Source: COBA11 Release 19 Tables 15A – 15C.

Note: Costs in 2010 prices in £m's discounted to 2010 at 3.5% for the first 30 years, 3% thereafter for 46 years and thereafter 2.5%.

The results from the COBA assessment indicate that all five proposed route options would deliver a positive Net Present Value and Benefit to Cost Ratio.

An overall summary of the estimated scheme costs defined previously including optimism bias, the economic results from the COBA models for the five route options, which are based on the application of Road Traffic Forecasts 2015 traffic growth projection, is shown in Table 6.7.5.

Table 6.7.5 Proposed Route Options Estimated Scheme Costs and COBA Assessment Summary, Do-Something Networks

Item	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Total Scheme Cost (£m's)	£113.404	£105.279	£54.887	£72.481	£59.247
Present Value of Costs (£m's)	£59.899	£55.573	£29.165	£38.328	£31.413
Present Value of Benefits (£m's)	£109.498	£92.269	£89.089	£91.270	£91.303
Net Present Value (£m's)	£49.599	£36.696	£59.924	£52.942	£59.889
Benefit to Cost Ratio (BCR)	1.828	1.660	3.055	2.381	2.906
Proposed Route Option BCR Ranking	4th	5th	1st	3rd	2nd

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Department for Transport (DfT) Value for Money Guidance indicates that:

- Negative BCR = Very Poor Value for Money;
- 0 > BCR > 1 = Poor Value for Money;
- 1 > BCR > 1.5 = Low Value for Money;
- 1.5 > BCR > 2 = Medium Value for Money;
- 2 > BCR > 4 = High Value for Money;
- BCR > 4 = Very High Value for Money;

Based on the above results:

- Blue Route Option 1 would represent high value for money;
- Blue Route Option 2 would represent high value for money;
- Blue Route Option 3 would represent high value for money;
- Red route would represent medium value for money; and
- Yellow route would represent medium value for money.

6.8 Sensitivity Tests

A series of sensitivity tests has been undertaken to examine the extent to which the results from the COBA economic assessment varies under different scenarios. The results of these sensitivity tests are shown below.

6.8.1 Traffic Forecast Sensitivity Test

As there is an inherent degree of uncertainty in predicting long-term future traffic flows over the 60-year period of the economic assessment, a sensitivity test has been undertaken to examine the extent to which the results from the COBA economic assessments vary under different traffic forecasts.

The proposed route options have therefore been tested considering the effects of National Road Traffic Forecasts (NRTF) low and central growth projections from the year 2017 onwards.

A comparison between the RTF 2015 traffic forecasts, which have been used for the main assessment, and the corresponding NRTF low and central growth forecasts is shown in Table 6.8.1.

Table 6.8.1 National Road Traffic Forecasts Growth Factors

Period (Years)	RTF 2015 Growth Main Assessment	NRTF Low Growth Sensitivity Test	NRTF Central Growth Sensitivity Test
2017 Base Year to 2023 Opening Year	1.075	1.040	1.063
2023 Opening Year to 2037 Design Year	1.100	1.051	1.100

The results of the COBA sensitivity test based on NRTF low and NRTF central growth projections are shown in Table 6.8.2 and Table 6.8.3.

Table 6.8.2 COBA Proposed Route Options Assessment Summary, Traffic Forecast Sensitivity Test, Do-Something Networks: NRTF Low Growth

Item	Do-Something Network NRTF Low Growth				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Present Value of Benefits (PVB) (£m's)	£87.257	£72.774	£71.222	£73.268	£73.298
Present Value of Costs (PVC) (£m's)	£59.899	£55.573	£29.165	£38.328	£31.413
Net Present Value (NPV) (£m's)	£27.358	£17.201	£42.057	£34.940	£41.885
Benefit to Cost Ratio (BCR)	1.457	1.310	2.442	1.912	2.333

Note: Assessment is based on NRTF Low growth with results expressed in 2010 prices.

The results of the COBA NRTF Low growth traffic forecast sensitivity test indicate that all five proposed route options would deliver a positive Net Present Value and BCR greater than 1.3.

Table 6.8.3 COBA Proposed Route Options Assessment Summary, Traffic Forecast Sensitivity Test, Do-Something Networks: NRTF Central Growth

Item	Do-Something Network NRTF Central Growth				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Present Value of Benefits (PVB) (£m's)	£105.577	£88.845	£85.978	£88.158	£88.191
Present Value of Costs (PVC) (£m's)	£59.899	£55.573	£29.165	£38.328	£31.413
Net Present Value (NPV) (£m's)	£45.678	£33.271	£56.813	£49.831	£56.777
Benefit to Cost Ratio (BCR)	1.763	1.599	2.948	2.300	2.807

Note: Assessment is based on NRTF Central growth with results expressed in 2010 prices.

The results of the COBA NRTF Central growth traffic forecast sensitivity test indicate that all five proposed route options would deliver a positive Net Present Value and BCR greater than 1.5.

6.8.2 Blue Route Options 1A to 3A Opening Structure Sensitivity Test

The Blue Route options defined for the main assessments are based on fixed structures over the Newry Canal. The Blue Route options have also been considered with an opening structure over the Newry Canal. A summary of the estimated costs of the Blue Route Options 1A to 3A in Quarter 2, 2017 prices is shown in Table 6.8.4.

It is estimated that the inclusion of an opening structure on the Blue Route Options would increase the cost by £18.1m, excluding Optimism Bias.

Table 6.8.4 Proposed Route Options Estimated Scheme Cost Summary: Blue Route Options 1A to 3A

Item	Scheme Cost (£m's)		
	Blue Route		
	Option 1A	Option 2A	Option 3A
Total Construction Cost	£50.213	£61.521	£53.031
Total Land Cost	£1.026	£1.040	£1.014
Preparation (9% of Total Construction & Land Costs)	£4.611	£5.631	£4.864
Supervision (5% of Total Construction & Land Costs)	£2.562	£3.128	£2.702
Total Scheme Cost	£58.412	£71.320	£61.611

Note: All costs are in Quarter 2, 2017 prices and exclude VAT.

A breakdown of the estimated costs of the proposed route options, including an allowance of 36.3% for optimism bias, is shown in Table 6.8.5. All costs are in Quarter 2, 2017 prices.

It is estimated that the inclusion of an opening structure on the Blue Route options would increase the cost by £24.7m, including Optimism Bias.

Table 6.8.5 Proposed Route Options Estimated Scheme Cost Summary Including 36.3% Optimism Bias: Blue Route 1A to 3A

Item	Scheme Cost (£m's)		
	Blue Route		
	Option 1A	Option 2A	Option 3A
Total Construction Cost	£68.440	£83.853	£72.281
Total Land Cost	£1.398	£1.418	£1.382
Preparation (9% of Total Construction & Land Costs)	£6.285	£7.674	£6.630
Supervision (5% of Total Construction & Land Costs)	£3.492	£4.264	£3.683
Total Scheme Cost	£79.616	£97.209	£83.976

Note: All costs are in Quarter 2, 2017 prices and exclude VAT.

The results of the economic assessment for the Blue Route Options 1A to 3A based on the opening structure are shown below in Table 6.8.6 based on RTF 2015 traffic growth forecasts.

Table 6.8.6 COBA Route Options Assessment Summary, Do-Something Networks: Blue Route Options 1A to 3A

Item	Do-Something Network RTF 2015 Growth		
	Blue Route		
	Option 1A	Option 2A	Option 3A
Present Value of Benefits (PVB) (£m's)	£89.089	£91.270	£91.303
Present Value of Costs (PVC) (£m's)	£42.084	£51.246	£44.332
Net Present Value (NPV) (£m's)	£47.005	£40.024	£46.970
Benefit to Cost Ratio (BCR)	2.117	1.781	2.060

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

The Blue Route options 1A to 3A have also been tested considering the effects of NRTF low and NRTF central growth projections from the year 2017 onwards. The results of the NRTF Low growth assessment are shown below in Table 6.8.7.

Table 6.8.7 COBA Route Options Assessment Summary, Do-Something Networks: Blue Route Options 1A to 3A: NRTF Low Growth

Item	Do-Something Network NRTF Low Growth		
	Blue Route		
	Option 1A	Option 2A	Option 3A
Present Value of Benefits (PVB) (£m's)	£71.222	£73.268	£73.298
Present Value of Costs (PVC) (£m's)	£42.084	£51.246	£44.332
Net Present Value (NPV) (£m's)	£29.138	£22.022	£28.966
Benefit to Cost Ratio (BCR)	1.692	1.430	1.653

Note: Assessment is based on NRTF Low growth with results expressed in 2010 prices.

The results of the NRTF Central growth assessment are shown below in Table 6.8.8.

Table 6.8.8 COBA Route Options Assessment Summary, Do-Something Networks: Blue Route Options 1A to 3A: NRTF Central Growth

Item	Do-Something Network NRTF Central Growth		
	Blue Route		
	Option 1A	Option 2A	Option 3A
Present Value of Benefits (PVB) (£m's)	£85.978	£88.158	£88.191
Present Value of Costs (PVC) (£m's)	£42.084	£51.246	£44.332
Net Present Value (NPV) (£m's)	£43.894	£36.912	£43.858
Benefit to Cost Ratio (BCR)	2.043	1.720	1.989

Note: Assessment is based on NRTF Central growth with results expressed in 2010 prices.

6.8.3 Accident Benefits Sensitivity Test

As described previously in this report, the COBA assessment is based on the application of default accident rates and costs to provide a reasonable estimate of the long-term effects of the proposed route options over the 60-year assessment period. Based on the above approach, the proposed route options would provide the following economic road safety benefits:

- Do-Something Network: Red Route: £4.918m
- Do-Something Network: Yellow Route: £3.114m
- Do-Something Network: Blue Route – Option 1: £4.513m
- Do-Something Network: Blue Route – Option 2: £4.617m
- Do-Something Network: Blue Route – Option 3: £4.618m

An assessment of local accident characteristics was presented earlier in the report which compared the prevailing local accident trends with the national UK default accident rates and severities defined in COBA. This analysis indicated that the local accident rates on the network were generally lower than the corresponding COBA default rates. It is therefore possible that the application of default accident rates and costs in the COBA model could over-estimate the actual road safety benefits associated with the proposed route options.

To examine the effects of changes in accident benefits, a sensitivity test has been undertaken where the default accident benefits reported by COBA have been excluded from the overall economic assessment based on RTF 2015 traffic growth forecasts. The results of the COBA sensitivity test based on no accident benefits are shown in Table 6.8.9.

Table 6.8.9 COBA Proposed Route Options Assessment Summary, Accident Benefits Sensitivity Test, Do-Something Networks

Item	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Present Value of Benefits (PVB) (£m's)	£104.580	£89.155	£84.576	£86.653	£86.685
Present Value of Costs (PVC) (£m's)	£59.899	£55.573	£29.165	£38.328	£31.413
Net Present Value (NPV) (£m's)	£44.681	£33.582	£55.411	£48.325	£55.272
Benefit to Cost Ratio (BCR)	1.746	1.604	2.900	2.261	2.760

Note: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

The results of the COBA accident benefits sensitivity test indicate that each of the proposed route options provides a positive economic return with the exclusion of the default accident benefits.

6.9 Summary and Conclusions

Five Route Options linking the A1 Dublin Road to the A2 Warrenpoint Road have been identified to assist in defining the Preferred Route for the proposed Newry Southern Relief Road.

These options are as follows:

- Red Route;
- Yellow Route;
- Blue Route Option 1;
- Blue Route Option 2; and
- Blue Route Option 3.

A COBA model was developed to compare the costs and road user benefits of the Proposed Route Options, taking into account both transport economic efficiency and road safety issues.

For the purpose of the Stage 2 Economic Assessment it has been assumed that the scheme would open in 2023.

6.9.1 Journey Time and Generalised Cost Savings

Savings in journey times are generally one of the most significant benefits resulting from the provision of a new transport improvement scheme. An overall summary of the two-way journey time savings associated with the Proposed Route Options in the 2023 Opening Year is shown below in Table 6.9.1.

Table 6.9.1 Summary of Two-Way Journey Time Savings, Do-Something Networks, 2023 Opening Year

Route	Year	Two-Way Journey Time Savings (mins)				
		Red Route	Yellow Route	Blue Route		
				Option 1	Option 2	Option 3
Warrenpoint to / from Dublin	2023	8.9	8.5	7.1	7.2	7.2
Warrenpoint to / from Camlough	2023	3.2	2.8	1.4	1.6	1.6
Warrenpoint to / from Armagh	2023	6.0	5.7	4.3	4.4	4.4
Warrenpoint to / from Belfast	2023	3.9	3.6	2.2	2.3	2.3
Greenbank to / from Dublin	2023	3.6	1.2	5.3	5.4	5.4
City Centre to / from Dublin	2023	-0.5	-3.0	1.1	1.2	1.2

Note: Journey Time savings are based on a weighted average of Flow Group 2 and Flow Group 4.

Examination of the above information indicates that for strategic movements between Warrenpoint and Dublin, the two-way journey time savings range from 7.1 minutes for Blue Route Option 1 to 8.9 minutes for the Red route in the 2023 Opening Year.

For strategic movements between Warrenpoint and Camlough, the two-way journey time savings range from 1.4 minutes for Blue Route Option 1 to 3.2 minutes for the Red route in the 2023 Opening Year.

For strategic movements between Warrenpoint and Armagh, the two-way journey time savings range from 4.3 minutes for Blue Route Option 1 to 6.0 minutes for the Red route in the 2023 Opening Year.

For strategic movements between Warrenpoint and Belfast, the two-way journey time savings range from 2.2 minutes for Blue Route Option 1 to 3.9 minutes for the Red route in the 2023 Opening Year.

For strategic movements between Greenbank and Dublin, the two-way journey time savings range from 1.2 minutes for Yellow Route to 5.4 minutes for Blue Route Options 2 and 3 in the 2023 Opening Year.

For strategic movements between Newry City Centre and Dublin, the two-way journey time savings range from -3.0 minutes for the Yellow Route to 1.2 minutes for Blue Route Options 2 and 3 in the 2023 Opening Year.

An overall summary of the two-way generalised cost savings associated with the Proposed Route Options in the 2023 Opening Year is shown below in Table 6.9.2.

Table 6.9.2 Summary of Two-Way Generalised Cost Savings, Do-Something Networks, 2023 Opening Year

Route	Year	Two-Way Generalised Cost Savings (%)				
		Red Route	Yellow Route	Blue Route		
				Option 1	Option 2	Option 3
Warrenpoint to / from Dublin	2023	64%	62%	48%	49%	49%
Warrenpoint to / from Camlough	2023	14%	12%	-6%	-5%	-5%
Warrenpoint to / from Armagh	2023	31%	30%	15%	16%	16%
Warrenpoint to / from Belfast	2023	11%	10%	-6%	-4%	-4%
Greenbank to / from Dublin	2023	14%	-15%	40%	41%	41%
City Centre to / from Dublin	2023	-26%	-61%	2%	4%	4%

Note: Generalised Cost savings are based on a weighted average of Flow Group 2 and Flow Group 4.

Examination of the above information indicates that for strategic movements between Warrenpoint and Dublin in the 2023 opening year, the Red / Yellow Routes and Blue Route Options would reduce generalised costs by approximately 63% and 49% respectively.

Examination of the above information indicates that for strategic movements between Warrenpoint and Camlough in the 2023 opening year, the Red / Yellow Routes would reduce generalised costs by approximately 13% and the Blue Route Options would increase generalised costs by approximately 5%.

Examination of the above information indicates that for strategic movements between Warrenpoint and Armagh in the 2023 opening year, the Red / Yellow Routes and Blue Route Options would reduce generalised costs by approximately 30% and 16% respectively.

Examination of the above information indicates that for strategic movements between Warrenpoint and Belfast in the 2023 opening year, the Red / Yellow Routes would reduce generalised costs by approximately 10% and the Blue Route Options would increase generalise costs by approximately 5%.

Examination of the above information indicates that for strategic movements between Greenbank and Dublin in the 2023 opening year, the Red Route would reduce generalised costs by approximately 14%, the Yellow Route would increase the generalised costs by approximately 15%, and the Blue Route Options would reduce generalise costs by approximately 41%.

Examination of the above information indicates that for strategic movements between Newry city centre and Dublin in the 2023 opening year, the Red Route would increase generalised costs by approximately 26%, the Yellow Route would increase the generalised costs by approximately 61%, and the Blue Route Options would reduce generalised costs by approximately 3%.

6.9.2 Network Capacity

Examination of the over-capacity links and junctions in the Do-Minimum Network under RTF 2015 traffic growth forecasts indicates that traffic demand in the 2023 Opening Year under Flow Group 3 / 4 conditions would exceed capacity on 8 links and 3 junctions, increasing to 9 links and 5 junctions by the 2037 Design Year.

Examination of the over-capacity links and junctions in all five Do-Something Networks under RTF 2015 traffic growth forecasts indicates that the number of links and junctions over-capacity in the 2023 Opening Year under Flow Group 3 / 4 conditions would reduce to 6 links and 1 junctions relative to the Do-Minimum Network.

Under the same traffic conditions, the number of links and junctions over-capacity in the 2037 Design Year would reduce to 7 links and 3 junctions relative to the Do-Minimum Network, with the exception of Yellow Route where the number of links and junctions over-capacity would reduce to 7 links and 4 junctions.

6.9.3 Road Safety

Given the uncertainties in predicting future accident rates and casualty severities over the 60-year economic assessment period from the proposed year of opening, the COBA assessment has been based on the application of default accident rates and costs. These have been applied to both the Do-Minimum and Do-Something networks to provide a reasonable measure of the relative change in road traffic accident characteristics associated with the networks.

An overall summary of the accident benefits associated with the proposed route options is shown below in Table 6.9.3.

Table 6.9.3 Accident Benefits, Do-Something Networks

Accident Benefits	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Accident Benefits (£m's)	4.918	3.114	4.513	4.617	4.618
Accident Benefits (No.)	140.9	102.4	127.8	129.4	129.4
Proposed Improvement Option Cost Savings Ranking	1st	5th	4th	3rd	2nd

Examination of the above information indicates that the accident benefits range from £3.114m for the Yellow Route to £4.918m for the Red route.

6.9.4 Economic Assessment of Proposed Route Options

Based on the results of the COBA models presented in this report, it is concluded that all of the proposed route options would return a positive Net Present Value under RTF 2015 traffic growth projections.

An overall summary of the estimated scheme costs including 36.3% optimism bias and the economic results from the COBA models for the proposed route options based on the application of RTF 2015 growth projection is shown in Table 6.9.4.

Table 6.9.4 Proposed Route Options Estimated Scheme Costs and COBA Assessment Summary, Do-Something Networks

Item	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Total Scheme Cost, incl. OB (£m's)	£113.404	£105.279	£54.887	£72.481	£59.247
Present Value of Costs (£m's)	£59.899	£55.573	£29.165	£38.328	£31.413
Present Value of Benefits (£m's)	£109.498	£92.269	£89.089	£91.270	£91.303
Net Present Value (£m's)	£49.599	£36.696	£59.924	£52.942	£59.889
Benefit to Cost Ratio (BCR)	1.828	1.660	3.055	2.381	2.906
Proposed Route Option BCR Ranking	4th	5th	1st	3rd	2nd

Note 1: Estimated scheme costs are in Q2 2017 prices, including 36.3% optimism bias.

Note 2: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Department for Transport (DfT) Value for Money Guidance indicates that:

- Negative BCR = Very Poor Value for Money;
- 0 > BCR > 1 = Poor Value for Money;
- 1 > BCR > 1.5 = Low Value for Money;
- 1.5 > BCR > 2 = Medium Value for Money;
- 2 > BCR > 4 = High Value for Money;
- BCR > 4 = Very High Value for Money;

Based on the above results:

- Blue Route Option 1 would represent high value for money;
- Blue Route Option 2 would represent high value for money;
- Blue Route Option 3 would represent high value for money;
- Red route would represent medium value for money; and
- Yellow Route would represent medium value for money.

It is therefore concluded that Blue Route Options 1 and 3 would deliver the highest overall economic returns.

7. Conclusions and Recommendations

7.1 Introduction

The scheme brief from DfI - Roads included the completion of a Stage 1 Assessment Report (Preliminary Options Report) (completed June 2017) and a Stage 2 Assessment Report (Preferred Option Report), with a possible extension to include a Stage 3 contract completion and Post Project Review, subject to the necessary approvals and availability of funding.

The brief for the project identifies the scheme as providing a link south-east of Newry between the A1 Belfast to Dublin Road and the A2 Newry to Warrenpoint Dual Carriageway.

7.1.1 Scheme Objectives

The development and assessment of the various route options within each corridor identified at Stage 1 took into consideration the Government's four main objectives for transport, namely:

- Economy - to support sustainable economic activity and get good value for money;
- Environment - to protect the built and natural environment;
- Social - to improve safety, accessibility and integration; and
- Public Accounts - to consider the cost to the broad transport budget.

Consideration has also been given to the specific objectives identified for the scheme, which are to:

- Reduce journey times for strategic traffic between the Eastern Seaboard (A1 Belfast / Dublin) KTC and the A2 Warrenpoint Road;
- Improve journey time reliability for strategic traffic;
- Reduce conflict between strategic and local traffic movements;
- Contribute positively to transport economic efficiency;
- Contribute positively to road safety;
- Minimise impact on the environment;
- Achieve value for money; and
- Maintain navigation of the Newry Ship Canal.

7.1.2 Findings from Previous Assessments

The Stage 1 Scheme Assessment considered five corridors within the Study Area, all originating on the A2 Warrenpoint Road and terminating at either Ellisholding Junction or Cloghogue Junction on the A1 to the south-west of Newry.

The Engineering, Traffic, Economic, Safety and Environmental impacts of each corridor were assessed before the Stage 1 Assessment concluded that Corridor 5 provided the best opportunity for a sustainable solution. However, given the limited alignment scope within Corridor 5, it was deemed prudent that Corridor 4 should also be included within the Stage 2 Assessment to consider the potential benefits that route options within this corridor could offer.

The development and assessment work during the DMRB Stage 2 process has been undertaken to enable a Preferred Route Alignment for the scheme to be identified. This work has been discussed as the subject of this report.

7.2 Conclusions

With the economic benefits of the scheme assessed and confirmed, a Preferred Route can be selected from the five route options considered. The selection process should be based on the performance of the options against the identified objectives. This section summarises the performance of the options against the identified High Level objectives for the scheme, to be read in conjunction with the Assessment Summary Tables included in the appendices of this report.

7.2.1 Assessment against High Level Scheme Objectives

7.2.1.1 Economy Objective

7.2.1.1.1 Journey Times

The traffic and economic analysis, based on an assumed Opening Year of 2023, indicates that all route options would offer journey time savings. Journeys originating from more southern regions, such as Warrenpoint, favour the Red Route, while journeys from the north favour the Blue Route options.

Given the strategic importance of Warrenpoint Harbour, the Red Route would be preferred when considering journey time savings. The Blue Route options would be least favourable.

7.2.1.1.2 Generalised cost savings

A number of two-way generalised cost savings associated with the Route Options in the 2023 assumed Opening Year were also found. Between Warrenpoint and Dublin, all route options would reduce generalised costs. Similarly, between Warrenpoint and Armagh, all route options would offer a reduction in costs. The Red and Yellow Routes would offer a reduction in costs between Warrenpoint and Camlough, and between Warrenpoint and Belfast, while the Blue Route options would increase generalised costs between these places. Between Greenbank and Dublin, the Red Route and the Blue Route options would reduce generalised costs; however, the Yellow Route would cause an increase. The Blue Route options would reduce generalised costs between Newry city centre and Dublin, while the Red and Yellow Routes would increase these costs.

Again, given the strategic importance of Warrenpoint Harbour, the Red Route would be preferred when considering journey time savings. The Blue Route options would be least favourable.

7.2.1.1.3 BCRs/NPVs

Table 7.2.1 Approved Route Options – Economic Appraisal

Item	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Net Present Value (£m's)	£49.599	£36.696	£59.924	£52.942	£59.889
Benefit to Cost Ratio (BCR)	1.828	1.660	3.055	2.381	2.906
Proposed Route Option BCR Ranking	4th	5th	1st	3rd	2nd

Note 1: Assessment is based on RTF 2015 growth with results expressed in 2010 prices.

Based on the above results, Blue Route Option 1, Blue Route Option 2 and Blue Route Option 3 would represent high value for money. The Red Route and Yellow Route would represent medium value for money.

It is therefore concluded that Blue Route Options 1 and 3 would deliver the highest overall economic returns.

7.2.1.1.4 Overall Economy Ranking

1. Blue Route Option 1
2. Blue Route Option 3
3. Blue Route Option 2
4. Red Route
5. Yellow Route

7.2.1.2 Environment Objective

7.2.1.2.1 Air Quality

The local air quality assessment concluded that implementation of any of the route options would have a net benefit with less congestion and slightly lower pollutant concentrations in Newry city centre. None of the local air quality receptor locations throughout the study area would exceed current or future UK National Air Quality Standards.

The Red and Yellow Routes would have the fewest receptors in proximity to their alignments; the Blue Route options would have the greatest. The Regional Air Quality assessment indicated a reduction in air quality with both the Red and Yellow Routes, though an improvement with any of the Blue Route options. In terms of designated ecological sites, the Red and Yellow Routes would be least preferred, due to their relative alignment in proximity to Fathom Upper ASSI.

On balance, from an air quality perspective, either the Red Route or Yellow Route would be the preferred option when collectively considering the impact on local and regional air quality, and designated sites.

7.2.1.2.2 Cultural Heritage

The Blue Route options would be in proximity to the Belvedere Tower (listed) associated with Fathom House, and potentially result in the direct loss of the Belvedere Tower (record only) associated with Ashton House.

Remains impacted by the Red and Yellow Routes would comprise a 1600's battle site on Fathom Mountain and four 18th or 19th century tree rings.

The Red Route and Blue Route options would also traverse and adversely impact on the setting of the Newry Ship Canal (a Scheduled Monument). The Blue Route options would cross the canal in a less sensitive location, adjacent to Greenbank Industrial Estate, and thus have less of an impact on setting than the Red Route.

On balance, Blue Route Option 2 or 3 would be preferred from a cultural heritage perspective, as they are comparatively shorter and avoid areas of long-established or ancient woodland. The Yellow Route would be the longest and thus most likely to impact on yet unknown archaeology, rendering it the least preferred.

7.2.1.2.3 Ecology and Nature Conservation

The preferred route, from an ecological perspective, would be Blue Route Option 2 or 3 as they would both avoid designated sites and long-established and ancient woodland parcels. Blue Route Option 1 would be the third preferred option as it follows a largely similar alignment to Options 2 & 3 but would cause direct impact to long-established woodland and two areas of the Lower Fathom Mountains and Grassland SLNCI, severing a linear parcel of woodland in Benson's Glen.

The Red and Yellow Routes would be the least preferred options as they both cross the Newry River ASSI and would cause significant direct loss and fragmentation of ancient and long-established woodland. The Yellow Route would have the greatest impact overall and would be the least favoured option ecologically.

The Blue Route options would be furthest from designated European sites.

7.2.1.2.4 Landscape and Visual Effects

A number of landscape and visual effects may occur as a result of the various route options. The river valley bridge locations for the Red and Yellow Routes would likely divide and sever the river valley into two distinct parts with the bridge for the Red Route being the least preferred as it would cross the river valley at its widest point, resulting in the greatest landscape and visual impact.

The river/canal crossing associated with the Blue Route options within Greenbank Industrial Estate would likely become a gateway / landmark between the city and the river valley further southeast due to its slightly higher elevated position. Considering its location within the urban and light industrial southern fringe of Newry, the development would be able to integrate into its urban / light industrial context and would not detract considerably from the overall character of the area.

The Red and Yellow Routes would require the felling and subsequent removal of significantly large areas of long-established woodland, as well as sections of ancient woodland, whereas, the Blue Route options would avoid the majority of long-established woodland and all areas of ancient woodland.

On balance, the Blue Route would be preferred from a landscape and visual perspective, and in particular, an option which minimises woodland loss and minimises cut & fill earthworks.

7.2.1.2.5 Land Use

The assessment has shown that property loss would be broadly similar with any of the route options.

The Red and Yellow Routes would affect the least amount of land designated in the Banbridge / Newry & Mourne Area Plan 2015. Unlike the Blue Route options, the Red and Yellow Routes would not affect any designated Community areas or facilities; however, they would affect publically-accessible woodland at Fathom Forest. The Red and Yellow routes would have by far the greatest impact on Forest Service and Non-Forest Service woodlands and long-established/ancient woodland.

The Blue Route options would traverse an area of zoned open space (Gerry Brown Park).

On balance, in light of a range of constraints, the Blue Route options are considered to have the least impact in terms of integration with existing land uses, although other routes may have performed better in individual elements of assessment.

7.2.1.2.6 Noise & Vibration

All route options would cause noise levels at a small number of properties to increase by more than 1 dB, with Blue Route Option 3 affecting slightly more properties than other route options. However, this route option would have the least number of properties exposed to changes in noise levels that would be considered as ‘Moderate’ or ‘Major’. Properties in the vicinity of the Yellow Route or Red Route would experience the greatest change in noise levels from currently.

The use of a low noise road surface would mitigate the noise impact by circa 3-5 dB. It is therefore submitted that, with the inclusion of a low noise road surface, it is possible to mitigate the impact of all route options to within the Noise Insulation Regulations (NIR) requirements. Alternatively, it would also be possible to use acoustic barriers at specific locations to reduce the impact to within the NIR requirements.

A significant number of properties, particularly in Newry city centre and on the Warrenpoint Road, would benefit slightly from a decrease in noise due to the reduction in traffic flows though the city.

Vibration levels from HGV road traffic would be less than 0.5mm/s at the majority of properties, irrespective of route option. It is considered that this represents a “low probability of adverse comment” by residents. Allowing for normal circumstances, this vibration level is not of a severity to cause structural damage to property.

There is no clear preference of route option from a noise & vibration perspective, though on balance, Blue Route Option 3, followed by Blue Route Option 1 would result in the fewest significant changes in noise levels of all route options under consideration.

7.2.1.2.7 Pedestrian, Cyclists, Equestrians & Community Effects

All route options would improve road safety for strategic and local road users, remove a bottleneck on the key network where a lack of capacity is causing serious congestion, and improve the environment by relieving the effects of heavy through-traffic in the city centre.

In terms of direct impacts upon community facilities, the Yellow Route would have an adverse impact upon the amenity of Victoria Lock, while the Blue Route options would result in the loss of Gerry Brown Park at its current location. A bascule bridge would maintain access for all boating activities for the Red and Yellow Route, while the Blue Route options, with an air draft of approximately 12m, would allow the majority of boating traffic along the canal.

The Yellow Route would have the greatest potential to adversely affect future development proposals to link the Carlingford to Omeath Greenway (i.e. the Great Eastern Greenway) with the Carlingford Lough Greenway (at Victoria Lock) and would also affect a number of the paths which zig-zag through Fathom Forest on the lower slopes of Fathom Mountain.

The Red and Blue routes would have an indirect impact on the Newry Ship Canal, as they pass over it, affecting the setting and amenity value of the Canal to some extent. However, it is envisaged that there would be no direct impact to any existing angling facilities within the study area.

On balance, provided that an alternative location for Gerry Brown Park can be accommodated, the Blue Route options would be preferred from a pedestrian, cyclist, equestrian and community perspective.

7.2.1.2.8 Vehicle Travellers

Currently, driver stress levels through the affected part of Newry are considered to be 'High', and are forecasted to reduce for those travellers that would utilise the new Southern Relief Road.

New and interesting views would be opened-up for vehicle travellers on any of the route options.

From a driver stress perspective, there is no clear preference, although the Blue Route Options would reduce driver stress over a slightly wider network than the Red and Yellow Routes.

7.2.1.2.9 Road Drainage & the Water Environment

There are likely to be impacts on sediment movements within the Newry River channel with all route options, although potential impacts on the water environment would be greatest with the Red Route as it necessitates the greatest length of river crossing. The degree of impact would depend on the number, diameter and shape of the associated bridge piers.

Floodplains would be traversed by all routes with the Blue Route options affecting the greatest area, though would benefit from the existing flood defences. The feeder stream to Benson's Glen fish hatchery would be traversed by all of the route options. Protection of this water intake from pollution would be paramount irrespective of which option is taken forward.

On balance, the Blue Route options would have the least potential for adverse impact on the water environment due to the reduced potential for direct interference with waterbodies.

7.2.1.2.10 Geology & Soils

Potential contaminated land sources have been identified within each route option. Further investigation would be required for the ultimately selected route to determine the impact it may have on suspected contaminated land sources. The Red and Yellow Routes would likely encounter the least significant sources of potential contaminated land.

Being the shortest in length, Blue Route Options 1, 2 or 3 would be preferred in terms of reducing impacts upon the underlying lithology. The Red and Yellow Routes would however be preferred from a contaminated land perspective.

Due to fault line orientation on the area, GSNI has expressed concern about the stability of the Red and Yellow Routes between Fathom Mountain and Green Island.

On balance, from a geology & soils perspective, any of the Blue Route options would be preferred as they minimise impact on the underlying lithology and avoid an area of potential instability associated with the Red and Yellow routes.

7.2.1.2.11 Overall Environmental Ranking

1. Blue Route Option 2
2. Blue Route Option 3
3. Blue Route Option 1
4. Yellow Route
5. Red Route

7.2.1.3 Social Objective

7.2.1.3.1 Accidents

The road traffic accident characteristics for the 'Do-Something' networks show there is negligible difference in the accident benefits between Blue and Red Routes, with the Yellow Route having the lowest accident benefits. The Red Route would have the highest accident benefits of £4.918M, Blue

Route Option 3 second highest with £4.618M followed by Blue Route Option 2 with £4.617M. Blue Route Option 1 would have the fourth best accident benefit of £4.513M, with the Yellow Route the lowest accident benefits of £3.114M.

7.2.1.3.2 Safety

Blue Route Option 1 would be least preferred when considering the number of Relaxations/Departures from Standard associated with the geometry. It has one additional 360m radius curve.

In terms of the vertical alignment associated with each route option, HGV drivers and the FTA may not favour Blue Route Option 3 as it would contain a maximum gradient of 8%. However, this gradient would only be experienced over a comparatively short length of 375m. The Red Route would be the preferred route with a maximum gradient of 6% maintained over the shortest distance of approximately 333m.

All five route options would entail significant earthworks. The Red Route and Yellow Route would have the most significant cutting slopes with large volumes that may require blasting to the west of Fathom Line along Fathom Lower. Blue Route Options 2 and 3 would be the most favourable when considering the amount of blasting required with each route.

Blue Route Option 1 and Blue Route Option 3 would be the preferred routes when considering the integration with Flagstaff Road. Sufficient clearance for an overbridge would be achieved without significant works to raise the existing level of Flagstaff Road. The Red and Yellow Routes would be least preferred, as they would result in significant works in order to maintain Flagstaff Road as a through route.

The Red and Yellow Routes would contain a Category 3 structure (Belfast-Dublin railway) and so would require an independent design check.

Furthermore, the Blue Route options would utilise the existing A2 dual carriageway to a fuller extent compared to the Red and Yellow Routes which would transfer traffic from a dual carriageway to a single carriageway some 2.7km and 4.4km further south respectively.

7.2.1.3.3 Accessibility

It is evident that with any of the route options, the vast majority of roads affected would be maintained to facilitate through movements. Existing access to Newry would be unaffected, and local traffic would be able to access the Southern Relief Road from the old Dublin Road, B79 Fathom Line and the A2 Warrenpoint Road. However, some local roads would be permanently diverted, or stopped-up, and new access arrangements would be required to facilitate continued local vehicle movements throughout the study area. In terms of accessibility, future amenity and community severance, the significance of effect associated with these changes would be largely neutral.

7.2.1.3.4 Severance

Mixing of strategic and local traffic would be significantly reduced for all route options, with a significant proportion of strategic traffic (which includes HGVs) bypassing the city centre, reducing the flow of traffic through Newry. The relief of some of the traffic on the urban road network may improve access to community facilities, with a possible reduction in vehicular/pedestrian conflict due to the slight easing of congestion. This would make the city more accessible, improving amenity and reducing community severance caused by traffic congestion for Newry residents.

7.2.1.3.5 Public Preference

Following the November 2017 Community Consultation Event, the feedback indicated that a Blue Route Option would be preferred.

The respondents represented a broad spectrum of users (i.e. residents, business owners, motorised and non-motorised users) who are very much reliant, in various ways on the existing A1/A2 route through Newry, both from a local and strategic perspective. Through the responses made, the respondents demonstrated their position on the scheme, flagged issues that concern them and indicated whether or not they (or others) are likely to be beneficially or adversely affected by the route options presented.

Significantly, an overwhelming majority (84.2%) of respondents were in favour of the principle of providing a relief road to the south of Newry, with less than 10% of respondents not being in favour of doing so.

Furthermore, a significant majority (61.1%) of respondents preferred the Blue Route, with the Yellow Route being second preference (17.9%) and the Red Route third preference (10.5%).

The Blue Route Options with shallower gradients (Options 1 and 2) were indicated as being preferable from the FTA, Warrenpoint Harbour and British Ports Associations' perspective.

7.2.1.3.6 Overall Social Ranking

1. Blue Route Option 2
2. Red Route
3. Blue Route Option 3
4. Blue Route Option 1
5. Yellow Route

7.2.1.4 Public Accounts Objective

The information outlined in describes how the various route options would impact on the government, including costs incurred by central or local government bodies.

Table 7.2.2 Approved Route Options - Estimated Scheme Costs

Item	Do-Something Network				
	Red Route	Yellow Route	Blue Route		
			Option 1	Option 2	Option 3
Total Scheme Cost, incl. OB (£m's)	£113.404	£105.279	£54.887	£72.481	£59.247
Preparation Cost to date(£m's)	£2.3	£2.3	£2.3	£2.3	£2.3
Total Scheme Cost (including Preparation Cost to date) £m's	£115.70	£107.58	£57.19	£74.78	£61.55
Proposed Route Option Affordability Ranking	5th	4th	1st	3rd	2nd

Note 1: Estimated scheme costs are in Q2 2017 prices, including 36.3% optimism bias.

Based on the above assessment, Blue Route Option 1 and Blue Route Option 3 would be deemed the most deliverable routes when considering scheme cost and availability of government funding.

7.3 Recommendations

Taking into consideration all of the above factors, it is recommended that Blue Route Option 3 be selected as the Preferred Option by the Department for Infrastructure. The Blue Route options are preferable in terms of economics, environment and public accounts. Blue Route Options 2 and 3 are preferable to Blue Route Option 1 in terms of the environment due to the impact on SLNCIs and areas of Long-Established Woodland. Blue Route Option 3 is preferable to Blue Route Option 2 in terms of economics and public accounts.

This option should be further developed in line with the engineering standards set out in the DMRB to a level sufficient for the completion of a Stage 3 Scheme Assessment in line with TD 37/93.

In developing the above recommended route option, the following issues should be given further detailed consideration:

- The vertical geometry, in consultation with FTA, Warrenpoint Harbour and the British Ports Association, to provide the optimum balance between geometry and associated earthworks;
- The links and junctions identified to be over-capacity in the 2037 Design year by the traffic and economic assessment;

- The proposed drainage system and outfall arrangements, in consultation with NI Water;
- The structural form and function of the proposed river/canal bridge crossing, through consultation with technical specialists and relevant stakeholders, which should include investigating the possibility of providing an opening bridge structure across the Newry Ship Canal;
- The proposed diversion of existing utilities, through consultation with utility providers;
- The temporary traffic management measures required to build the scheme whilst mitigating disruption to road users;
- The development of environmental mitigation in consultation with relevant stakeholders; and
- Optimising earthwork quantities through development of the route geometry and further ground investigation.

Table 7.3.1 AST Summary

Objective	Sub-Objective	Red Route	Yellow Route	Blue Route - Option 1	Blue Route - Option 2	Blue Route - Option 3
Environment	**Air Quality**	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial
	Cultural Heritage	Large Adverse	Large Adverse	Large Adverse	Large Adverse	Large Adverse
	Ecology & Nature Conservation	Large Adverse	Large Adverse	Large Adverse	Moderate Adverse	Moderate Adverse
	Landscape Effects	Landscape: Large Adverse to Very Large Adverse Visual: Moderate Adverse to Large Adverse	Landscape: Large Adverse to Very Large Adverse Visual: Moderate Adverse to Large Adverse	Landscape: Moderate Adverse to Large Adverse Visual: Moderate Adverse to Large Adverse	Landscape: Moderate Adverse to Large Adverse Visual: Moderate Adverse to Large Adverse	Landscape: Moderate Adverse to Large Adverse Visual: Moderate Adverse to Large Adverse
	Land Use	Slight Adverse - Large Adverse	Slight Adverse - Large Adverse	Slight Adverse – Large Adverse	Slight Adverse – Large Adverse	Slight Adverse – Large Adverse
	Noise & Vibration	Neutral – Large Adverse	Slight Adverse – Large Adverse	Neutral – Large Adverse	Neutral – Large Adverse	Neutral – Large Adverse
	Vehicle Travellers	Views: Moderate Beneficial Driver Stress: Moderate Beneficial	Views: Moderate Beneficial Driver Stress: Moderate Beneficial	Views: Moderate Beneficial Driver Stress: Moderate Beneficial	Views: Moderate Beneficial Driver Stress: Moderate Beneficial	Views: Moderate Beneficial Driver Stress: Moderate Beneficial
	Road Drainage & the Water Environment	Moderate Adverse	Moderate Adverse	Slight Adverse	Slight Adverse	Slight Adverse
	Geology & Soils	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse
Economy	**Transport Economic Efficiency**	Present Value of Benefits (PVB) = £109.5m	Present Value of Benefits (PVB) = £92.3	Present Value of Benefits (PVB) = £89.1	Present Value of Benefits (PVB) = £91.3	Present Value of Benefits (PVB) = £91.3
		Government Funding (PVC) = £59.9m	Government Funding (PVC) = £55.6m	Government Funding (PVC) = £29.2m	Government Funding (PVC) = £38.3m	Government Funding (PVC) = £31.4m
	Net Present Value (NPV)	£49.6m	£36.7m	£59.9m	£52.9m	£59.9m
	BCR	1.828	1.660	3.055	2.381	2.906
Social	**Pedestrians, Cyclists & Equestrians**	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial
	Community Severance	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
	Access to Public Transport	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
	Transport Interchange	Slight -Moderate Beneficial	Slight Beneficial	Moderate Beneficial	Moderate Beneficial	Slight Beneficial
	Land-Use Planning	Moderate Adverse - Moderate Beneficial	Moderate Adverse - Moderate Beneficial	Slight Adverse - Moderate Beneficial	Slight Adverse - Moderate Beneficial	Slight Adverse - Moderate Beneficial
	Other Government Policies	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
	Accidents PVB (Central Growth)	£4.9m	£3.1m	£4.5m	£4.6m	£4.6m
Public Account (Affordability)	**Scheme Cost (excluding O.B.)**	£83.2m	£77.2m	£40.3m	£53.2m	£43.5m
	Scheme Cost (including O.B.)	£113.4m	£105.3m	£54.9m	£72.5m	£59.3m