Newry Southern Relief Road

Stage 1 Scheme Assessment Report Final

Project Number: 60472927

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Quality information

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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 **www.infrastructure-ni.gov.uk**.

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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
DARD	Department of Agriculture and Rural Development
DfC	Department for Communities
DfE	Department for Environment
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

Abbreviation	Explanation
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
NIEA	Northern Ireland Environment Agency
NIR	Northern Ireland Railways
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

Abbreviation	Explanation
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

0. Executive Summary

0.1 Introduction

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

This report summarises the findings of a Stage 1 Assessment in accordance with the Design Manual for Roads and Bridges (DMRB) and Gateway 0 of Department for Infrastructure Policy and Procedure Guidance Note E_030 (RSPPG_E030).

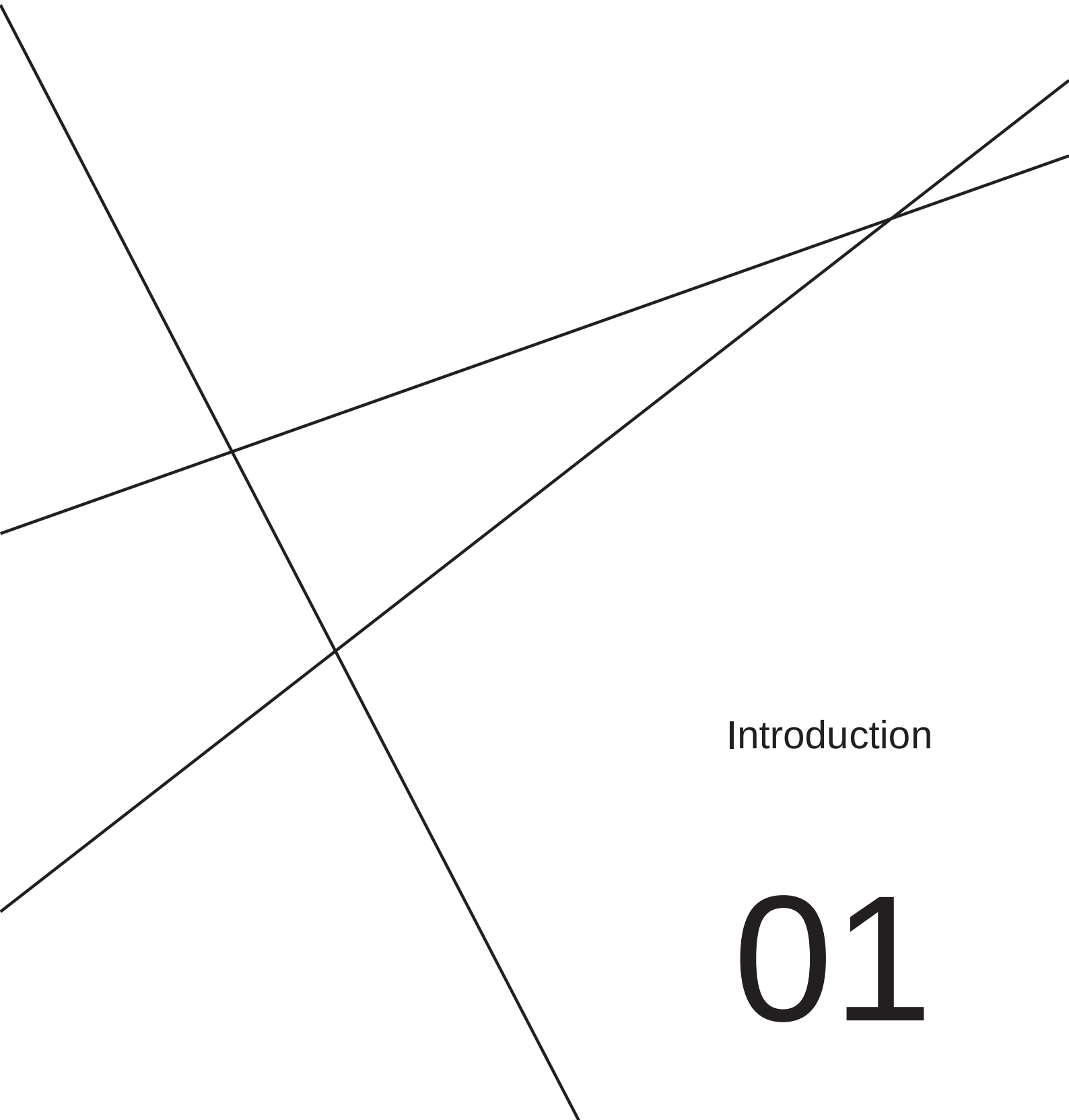
Five corridors were considered within the Study Area; all originate on the A2 Warrenpoint Road and all terminate close to either Ellisholding or Cloghogue Junction on the A1 to the southwest of Newry. Consultation was undertaken with key stakeholders and statutory undertakers. Each corridor has been assessed in Engineering, Traffic, Economic, Safety and Environmental terms. From an Engineering perspective, with the exception of Corridor 3 which does not require a potential opening structure, all corridors have similar structural and highway content. Corridors 1, 2, 4 and 5 all have the potential to require an opening structure to facilitate navigation of either the Newry River or Canal with consequent delays to strategic traffic. In order to test the Cost to Benefit Ratio, it has been necessary to include an allowance for an opening structure in these four corridors. Any future need and the funding for an opening structure should be formally established.

The Study Area contains a broad mix of natural and man-made environmental constraints, which the scheme could have significant impact on, if not avoided or mitigated as part of the design development process. Each corridor would have varying degrees of environmental impact, generally with those corridors located closer to the urban area predominantly having negative impacts upon the man-made constraints, and the more rurally located southern corridors having negative impacts upon the natural constraints.

All corridor options provide a broadly similar decrease in personal injury numbers, as well as having positive Benefit to Cost Ratios, though more significantly higher on Corridor 5.

After the Stage 1 Assessment, Corridors 1 and 2 have been discounted as they traverse an area of geological instability. Corridors 3 and 4 offer no significant advantage over Corridor 5. Currently, Corridor 5 would appear to provide the best opportunity for a sustainable solution and is expected to cost approximately £78M (including 44% Optimism Bias) at $Q2_{2015}$ prices. However, given the limited alignment scope within Corridor 5, it is prudent that Corridor 4 should also be included within the Stage 2 Assessment considering the benefits that it could offer.

It is recommended that Corridors 4 and 5, as indicated on Figure 9.1.1 in Appendix A, should be subject to a Stage 2 Assessment and report in accordance with DMRB TD37/93 which satisfies the requirements of a Preferred Options Report under RSPPG_E030.



Introduction

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1. Introduction

1.1 Background Information

In April 2015, TransportNI (now DfI Roads) appointed AECOM to undertake a Stage 1 Scheme Assessment of corridor options to provide a Newry Southern Relief Road (NSRR). A Feasibility Study Report had been completed in 2008 by URS/Scott Wilson (AECOM acquired URS on 20 October 2014). The scheme's location in a regional context is shown on Figure 1.1.1 – Regional Strategic Transport Network and a general location plan is shown in Figure 1.1.2 – Study Area in Appendix A. The scheme is part of the Strategic Road Improvement (SRI) Programme, and is currently in DfI's 10 year Forward Planning Schedule as of April 2015.

Figure 1.1.1 – Regional Strategic Transport Network

DfI Roads' general objective for the scheme is to separate strategic traffic travelling to/from the Warrenpoint Port from the traffic associated with Newry City and its busy shopping districts, which include the Quays and Buttercrane shopping centres, and other shopping developments in the area. The NSRR proposal is to provide a direct 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 in NI 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 up to 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 which are below this level further to the north of Newry. 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 strategic location of Newry and the Warrenpoint Port adjacent to the A1/N1 Belfast-Dublin Corridor escalates the importance of the scheme. Warrenpoint 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.

The scheme is referenced in the Banbridge/Newry and Mourne Area Plan 2015 where it is noted in Volume 1 that, *"A Newry Southern Relief Road is proposed as a longterm 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 Key Transport Corridor (KTC) and provide Newry City Centre with further relief from through traffic.."*

Traffic travelling through Newry, both strategic and local, converges in the Abbey Way/William Street/Kilmorey Street/Dublin Road area which results in considerable congestion and delay for road users. The scheme should reduce traffic in this area by removing a significant portion of the heavy goods vehicles (HGVs) which use the route. Strategic through traffic would benefit from reduced journey times and overtaking opportunities would be available for A1 bound traffic on the proposed relief road.

A number of broad improvement strategies in the form of 'Route Corridors' were identified for assessment. This report is conducted through a Stage 1 Assessment prepared in accordance with the Design and Manual for Roads and Bridges (DMRB), *TD 37/93 – Scheme Assessment Reporting*. Cognisance has been taken of guidance provided on the WebTAG website and Interim Advice Notes (IANs) as appropriate.

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 Regional Strategic Transport Network Transport Plan (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, as shown in Figure 1.2.1.

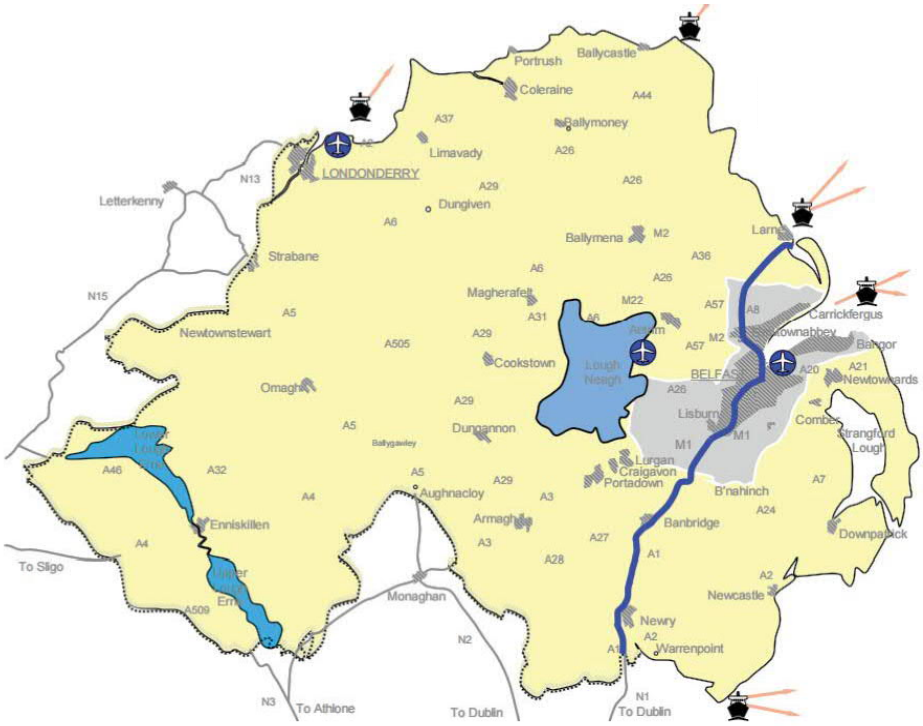


Figure 1.2.1 – Eastern Seaboard Key Transport Corridor

1.3 Strategic Road Improvements and the Investment Delivery Plan

Strategic Road Improvements (SRIs) are major projects which generally exceed £5.0m in value and seek to remove bottlenecks on the key transport network where the lack of capacity is causing serious congestion. SRIs also aim to improve the environment by providing bypasses to towns or cities situated on the RSTN, relieving the effects of heavy through traffic.

DfI Roads manages the delivery of SRIs through the following programmes:

- Forward Planning Schedule – This is a list of major road improvement schemes identified for preliminary development. The highest priority schemes that perform well when assessed will be considered for progression into the Preparation Pool.
- Preparation Pool – This is a collection of high priority schemes that DfI Roads is committed to progressing through the statutory procedures. The preparation pool is intended to advance projects up to the point where a commitment to invest in building the solution is made and subsequent progression into the Construction Programme (subject to clearing the statutory procedures, having a satisfactory economic appraisal and the availability of funds at the time).
- Construction Programme – A list of road improvement schemes under construction.

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 document how the Investment Strategy for Northern Ireland would be implemented.

Projects that have already benefited from the Expanded SRI programme in the Newry Area are:

- A1 Beech Hill to Cloghogue – 12.1km dual carriageway including 5 grade-separated junctions; and
- A1 Newry to Dundalk Link Road – 4.3km dual carriageway including 1 grade-separated junction (+10km of link road constructed in the RoI).

In addition to these schemes, the Expanded SRI Programme makes specific reference to the NSRR under a list of schemes that performed well in the assessment for inclusion into the IDP, but not currently affordable within ISNI funding envisaged to 2015, as shown in Table 1.1 - Schemes that performed well in the assessment but not affordable within 2015 ISNI funding below.

Table 1.1 - Schemes that performed well in the assessment but not affordable within 2015 ISNI funding

Scheme	Description	Location	Cost (£m)
Link Corridors and Trunk Roads			
Newry Southern Relief Road	Strategic link from Warrenpoint to the A1, avoiding Newry City centre. Proposed measures to be developed and costed in a Feasibility Study Report.	Trunk Road	Not yet Known

Source: Expanding the Strategic Road Improvement Programme

Since its inclusion in the Expanded SRI programme the NSRR has now been included in The Department for Infrastructure's Forward Planning Schedule since April 2015 and under the increased capacity through targeted investment in the road, public transport and active travel network initiative of the Programme for Government published in October 2016[1].

1.4 Relevant Policy Documents

There is currently a substantial range of policy documents in existence. The majority of these documents have been produced by the Department for Regional Development (DRD – now DfI, Department for Infrastructure). The list below outlines the policy documents which are considered relevant to this scheme:

- Regional Development Strategy 2035 (referred to as RDS);
- Regional Transport Action Strategy 2002 – 2012 (referred to as RTS);
- Regional Strategic Transport Network Transport Plan 2015 (referred to as RSTN TP);
- Banbridge, Newry and Mourne Area Plan 2015 (referred to as BNMP);
- Expanding the SRI Programme 2015 – Consultation Document & Draft Environmental Report;
- Investment Strategy for Northern Ireland 2008-2018 (referred to as ISNI);
- Investment Delivery Plan for Roads (referred to as IDP), April 2008; and
- New Approach to Regional Transportation.

1.5 Project Brief and Strategies

1.5.1 Project Brief

The Brief from The Department for Infrastructure includes the completion of a Stage 1 Assessment Report (Preliminary Options Report) for the Newry Southern Relief Road to assess a range of corridor options to provide relief to traffic in the Dublin Road, Bridge Street, William Street, Abbey Way and Warrenpoint Road area by the provision of a new road linking from the A2 Warrenpoint Road, a Trunk Road leading to Warrenpoint Port, and the A1, a Key Transport Corridor. It is identified as a Single Carriageway scheme with a section of Wide Single 2+1 Carriageway.

[1] Programme for Government, Delivery Plan – Average journey time on key economic corridors.

The primary objective of this report is to enable The Department for Infrastructure to identify a preferred corridor for a Newry Southern Relief Road. Preparation of the Stage 1 Scheme Assessment Report includes the following tasks:

- identify potential corridors for the provision of a southern relief road linking the A1 and A2;
- review and analyse the existing conditions;
- develop a traffic model to derive cost estimates for the provision of a Newry Southern Relief Road for each of the identified corridor options based on a cost model provided by The Department for Infrastructure;
- undertake a COBA assessment for each route option within each corridor option;
- prepare Assessment Summary Tables for each corridor option; and
- identify and recommend a preferred corridor option.

The information to be reviewed includes The Department for Infrastructure route documentation on Scheme Appraisal Reports for the Newry Southern Relief Road, accident, traffic conditions, and journey time information along the existing network. The analysis of the existing route will include examination of existing baseline conditions to establish road geometry, traffic flows and environmental conditions.

1.5.2 Corridor Strategies

Although the previous Feasibility Study Report proposed a range of route corridors, the initial aim of the Stage 1 Scheme Assessment was to determine the appropriate Study Area and then to identify potential corridors within that Study Area which could meet the scheme objectives. Corridor options from the Feasibility Study Report were used as an initial starting point for the scheme assessment process. These were then amended where necessary to accommodate any new constraints or additional corridors that have arisen since the Feasibility Study Report was published. The Feasibility Study Report corridors were screened during the review of documents. Minor changes to either tie-in location or alignment resulted in changes to the previously published corridors, which are detailed in Section 3.

Corridor options identified are assessed in this report in accordance with relevant DMRB standards to identify the preferred route corridor for the scheme.

1.6 Scheme Objectives

1.6.1 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.

1.6.2 The Department for Infrastructure Objectives

The key objectives of The Department for Infrastructure outlined in the New Approach to Regional Transportation are to:

- Support the Growth of the Economy;
- Enhance the quality of life for all; and
- Reduce the Environmental Impact of Transport.

1.6.3 Scheme Specific Problems

The need to consider an intervention at this location was previously identified through the work carried out to establish the Expanded SRI Programme and the 2008 Feasibility Study Report. Part of the assessment process

is to identify the transport related problems within the Study Area. Outlined below are key problems that the study will seek to improve, each of which is discussed throughout the body of the report:

- delays during 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, adding to congestion, as there is no other more reliable route to access the A1/N1 Belfast-Dublin Corridor;
- 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 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 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.

1.6.4 Scheme Specific Objectives

The following scheme specific objectives include both primary and secondary aims that are either a direct effect of the scheme or a non-direct effect which is likely to happen due to the scheme being constructed, are:

Primary Aims

- To provide a strategic link of appropriate standard for A2 traffic wishing to bypass Newry City centre to access the A1/N1 Belfast-Dublin Corridor, and vice versa;
- To provide a Southern Relief Road to Newry City between the A1 and the A2 that will deliver a net return on capital investment and Value for Money for the taxpayer;
- To support the spatial development strategy in the RDS and to develop and maintain the RSTN for all road users;
- To reduce conflict between strategic and local traffic movements by removing through traffic from the city centre, reducing town centre congestion;
- To reduce journey times for strategic traffic between the A2 Warrenpoint Road and the A1/N1 Belfast-Dublin Corridor;
- To improve journey time reliability for strategic traffic;
- To improve safety for all road users including Non Motorised Users;
- To improve access to regional (Warrenpoint Port) gateways and contribute positively to transport economic efficiency;
- To minimise the impact on the environment, conserve the existing condition within the area through which the route passes and to be prudent with the use of natural resources;
- To support and maintain sustainable economic growth and employment; and
- To ensure Newry Canal remains navigable.

Secondary Aims

- To provide an alternative route crossing of Newry River/Canal for city traffic, particularly HGVs associated with Warrenpoint Port and businesses on the south side of the city centre at Greenbank.
- To improve access to planned future development in the Study Area.
- To improve Newry City centre traffic conditions and environment through a reduction in traffic volumes.
- To provide a link to Fathom Line and the surrounding area of the Fathom Mountain for tourism.

1.6.5 WebTAG (Transport Appraisal Guidance Website) and DMRB

The Department for Infrastructure Policy & Procedure Guide *RSPPG_E030 'Major Road Improvement Schemes – Inception to Construction'* sets out the policy that is essential for the development of major road schemes and reporting procedures to fulfil the requirements of Gateway Approvals.

The reporting procedures for the Preliminary Options Report (equivalent to a Stage 1 DMRB Scheme Assessment Report) require that account should be taken of TAG (Transport Appraisal Guidance).

The TAG website (WebTAG) is the Department for Transport's website for guidance on the conduct of transport studies. The guidance provides advice on how to:

- set objectives and identify problems;
- develop potential solutions;
- create a transport model for the appraisal of the alternative solution; and
- how to conduct an appraisal which meets the Department's requirements.

The application of TAG to highway schemes is documented in Tag Unit 1.3, which details the appropriateness of the TAG methodologies to their corresponding DMRB Stages.

The detailed methodologies in TAG are more comparable to a DMRB Stage 3 Assessment; advice in TAG is that 'problem identification' will usually have been completed at Stage 1, 'identification of potential solutions' generally spans Stages 1 - 2, and the 'selection and refinement of the preferred solution' will be carried out in Stages 2 - 3.

Tag Unit A5.5 – Highway Appraisal, Section 1.1.3

'The sections in these TAG Units which deal with highway project appraisal focus on the most detailed level of appraisal and therefore provide the bridge between a TAG Plan level appraisal and a DMRB Stage 3 level assessment, normally undertaken following the identification of the preferred route. Advice is also provided on the bridge between DMRB Stage 1 and 2 levels of assessment and TAG, for schemes at a less developed stage in the process.'

Tag Unit A5.5 – Highway Appraisal, Section 1.1.4

'The DMRB assessment is an important initial step in this process as it provides the information required for a TAG appraisal and the supporting back up information and justification for the appraisal.'

Assessment Summary Tables (ASTs) are presented in Appendix B. An assessment, review and any proposed mitigation within the proposed corridors as outlined in the intervening chapters of this Stage 1 Report. ASTs are reviewed in terms of the environment, safety, economy accessibility and integration. A table, at the end of Appendix B presents a summary of the ASTs and it includes an assessment of this report's engineering chapter.

1.7 Report Structure

As stated previously the format of this report is based on the requirements for a Stage 1 Scheme Assessment as defined in TD37/93. This involves identifying engineering, environmental and traffic advantages/disadvantages and constraints associated with broadly defined improvement corridors. Completion of the Stage 1 Report and subsequent Gateway 0 approval would allow the project to progress into The Department for Infrastructure's Preparation Pool, in accordance with RSPPG_E030.

Assessment reports are not intended to replace technical reports on matters such as traffic or geotechnical issues. They are intended to act as a summary of the information available at each stage, permit consideration of the likely: environmental, social, economic and traffic effects of various proposals and to allow the public and statutory bodies to take account of these effects when commenting on the proposals.

The report will highlight the issues likely to have a major bearing on the route strategy and the choice of scheme implemented. Improvement options will be identified and the report will cover how they have been assessed with regards to the information that has been obtained, presenting the advantages and disadvantages of the various options. The report will determine and recommend a suitable corridor to be pursued through the next stages outlined in TD37/93. This corridor will subsequently be approved by the Roads and Rivers Management Group; Gateway 0 approval in accordance with RSPPG_E030.

Chapter 2 provides an assessment of the existing conditions within the Study Area including an overview of engineering, environmental and traffic conditions, and relevant policies and plans affecting the Study Area.

Chapter 3 includes details of previous work that has been carried out into the schemes feasibility up until the current Stage 1 Scheme Assessment.

Chapter 4 includes details of the consultations held with statutory authorities and other interested bodies, including details of key stakeholder workshops.

Chapter 5 includes a description of the potential corridors identified and an overview of the indicative alignment options identified within each corridor to allow a practical assessment of the main corridors.

Chapter 6 provides an engineering assessment of the proposed corridors and the indicative route options within each corridor in terms of existing carriageway, junctions and structures; topography; drainage; geology; public utilities; design standards; and an engineering overview and assessment of the corridors.

Chapter 7 provides an environmental assessment of the proposed corridors and the indicative route options within each corridor in terms of air quality; cultural heritage; disruption due to construction; ecology and nature conservation; landscape and visual assessment; land use; traffic noise and vibration; pedestrian, cyclist, equestrian and community effects; vehicle travellers; water quality and drainage; geology and soils; and policies and plans.

Chapter 8 provides a traffic and economic assessment of the proposed corridors and the indicative route options within each corridor in terms of existing conditions; indicative costs, risks and optimism bias; development of preliminary computer models; future conditions; operational assessment of corridors; economic assessment of corridors; and includes the results from a series of sensitivity tests.

Chapter 9 summarises the key issues and sets out the recommendations.

Existing Conditions

02

2. Existing Conditions

2.1 Introduction

This section of the report provides an overview of the existing engineering, environmental and traffic conditions that occur within the Study Area that relate to the proposed southern relief road between the A1/N1 Belfast-Dublin Corridor and the A2 Warrenpoint Road in accordance with the general requirements set out in the DMRB.

This section will outline conditions relating to the surrounding area and the existing roads. Particular attention will be paid to those issues which will have a direct impact on the relief road corridors and the subsequent alignment options within, that have been developed to allow for a reasonable assessment of the corridor options. A more detailed assessment of the existing conditions will be provided in later sections of this report, namely Engineering Assessment, Environmental Assessment and Traffic and Economics Assessment.

2.2 The Study Area

The Study Area is shown in Figure 1.1.2 in Appendix A.

Newry City

Newry City is positioned in a strategic location adjacent to the Eastern Seaboard Key Transport Corridor, 55km from Belfast and 110km from Dublin, forming an inter-regional gateway between NI and the RoI. Newry grew as a market town and a garrison after it was founded in 1144. In 1742 it became a port when it was linked to Lough Neagh by the first ever summit-level canal built in Ireland or Great Britain (a summit-level canal rises and falls, as opposed to lateral canals, which have a continuous fall only). In 2002, as part of the Queen Elizabeth's Golden Jubilee celebrations, Newry was granted city status.

Newry, with a population exceeding 30,000 is the main population centre in the south eastern region of NI and in the south of County Down. About half of the city (the west) lies in County Armagh and the other half (the east) lies in County Down. The Clanrye River (known as the Newry River) runs through the city and forms the historic border between Counties Armagh and Down.

The city sits in a valley and is surrounded by the Mourne Mountains to the east and the Ring of Gullion to the south-west, both of which are designated as Areas of Outstanding Natural Beauty. The Cooley Mountains lie to the south with a ridge extending northwards to Fathom Mountain. The city also lies upstream of Carlingford Lough, where the Newry Ship Canal enters via Victoria Lock.

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 RoI border bypassing Newry to the west and the A2 from Warrenpoint heading north to Newry.

There are two main shopping centres in Newry, the Quays and Buttercrane which attract a lot of visitors both from NI and from the RoI; particularly when the currency exchange is favourable. The area has generally good road infrastructure connecting with other main centres of population such as Craigavon, Armagh and Banbridge. Due to the city's strategic location, Newry acts as a focal point for services to the surrounding hinterland and smaller outlying settlements with several arterial routes radiating from the city, including:

- A1(North) to Loughbrickland – Banbridge – Dromore – Hillsborough – Lisburn/Belfast;
- A1/N1(South) to Dundalk – Drogheda – Dublin;
- A2 to Warrenpoint – Rostrevor – Kilkeel – Newcastle;
- A25 to Camlough – Belleeks – Newtownhamilton – Keady;
- A25 to Rathfriland – Castlewellan – Clough – Downpatrick – Strangford;
- A27 to Poyntzpass – Tandragee – Portadown; and
- A28 to Loughgilly – Markethill – Armagh.

Newry provides a strategic east-west crossing between the Mourne Mountains and the A1 towards either Belfast or Dublin; therefore, the town has become a major crossing point for road traffic. Newry City also suffers from the conflict between local and long-distance trips, resulting in significant congestion throughout a typical weekday.

Warrenpoint

Warrenpoint is a small town in County Down, Northern Ireland which lies on the northern shore of Carlingford Lough. Warrenpoint currently has a population greater than 7,500. Warrenpoint is known mostly for its port which due to figures accounting for freight traffic in 2013, is the second largest freight port in Northern Ireland; behind Belfast and in front of Larne and Londonderry. Warrenpoint Port, shown in Figure 2.2.1 has seen continued investment over the years due to its strategic location and close proximity to the A1/N1 Belfast-Dublin Corridor.

The original Port of Warrenpoint consisted of a wet dock and piers and was constructed in the late 1770s with the assistance of £500 of public funds. The Port continued to operate until 1971 when it was sold to the current owners; Warrenpoint Harbour Authority for £369,000.

The Port was enlarged with an initial total investment of approximately £6.7million to create the modern Port as it is known today. Until 1971 Warrenpoint Port acted as a lightering port for the Port of Newry; jointly these ports handled approximately half a million tonnes of cargo annually. Subsequently the modern Warrenpoint Port handles 5 times as much cargo on an annual basis with the Port of Newry no longer in service.

Figure 2.2.1 – Cargo handling and Aerial Photography of Warrenpoint Port

Buttercrane and the Quays Shopping Centres

Both Buttercrane and the Quays Shopping Centres are within the south-western district of the main city centre along the Buttercrane Quay and Albert Basin roads respectively; they are separated by Bridge Street.

The Buttercrane Shopping Centre has 1,000 car parking spaces providing suitable on-site parking, with some 700 of these spaces within a multi-storey car park, fully serviced by three lifts. Occupying a prominent city centre location, alongside the historic Newry Canal, Buttercrane Centre provides some 269,000sq. ft. of retail space which accommodates most major high street retail brands. Buttercrane is anchored by Marks & Spencer, Dunnes Stores and Primark, and consists of 60 stores in total.

The Quays Shopping Centre has parking spaces for over 1200 cars. The Quays Shopping Centre which was opened in 1998 is a major retail and leisure development overlooking the canal in the historic Albert Basin area of the city. The Quays has maximised its border location on the Belfast-Dublin economic corridor and has a tenant mix which includes major retail brands from UK & Ireland.

Fathom Mountain and associated mountains

Fathom Mountain and other adjacent mountains are a major obstacle to overcome within this study as they lie directly between the A1 and A2 carriageways. Fathom Mountain is approximately 250m in height and sits within a small ridge line along the western side of Newry River/Canal, and can be seen in Figure 2.2.2. Mountains on either side of Fathom Mountain reduce in height. The mountain closest to Newry rises to approximately 220m in height and plateaus close to the Flagstaff/Barracric Road at approximately 140m in height which is approximately the level of Ellisholding junction, one of the western proposed road tie-in locations considered in this report.

Figure 2.2.2 – View of Fathom Mountain and other associated mountains from the A2 Warrenpoint Road

2.3 Existing Road Network

Newry City 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 on the western reaches of the Study Area. 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. The existing road network, indicating all major roads within the Study Area, is detailed in Figure 2.3.6 – 2.3.8 in Appendix A.

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;
- U5328 Barracric Road; and
- U5328 Windy Road.

2.3.1 A1/N1 Belfast-Dublin Corridor

The A1/N1 strategic corridor to the west of Newry has been subject to of 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 in each direction and hard shoulders. 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, is shown in Figure 2.3.1 & Figure 2.3.2. 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 for traffic wishing to travel to Newry from the A1/N1 Belfast-Dublin Corridor use an off-slip diverge arrangement.

Figure 2.3.1 – Cloghogue Roundabout junction southern merge/diverge arrangements

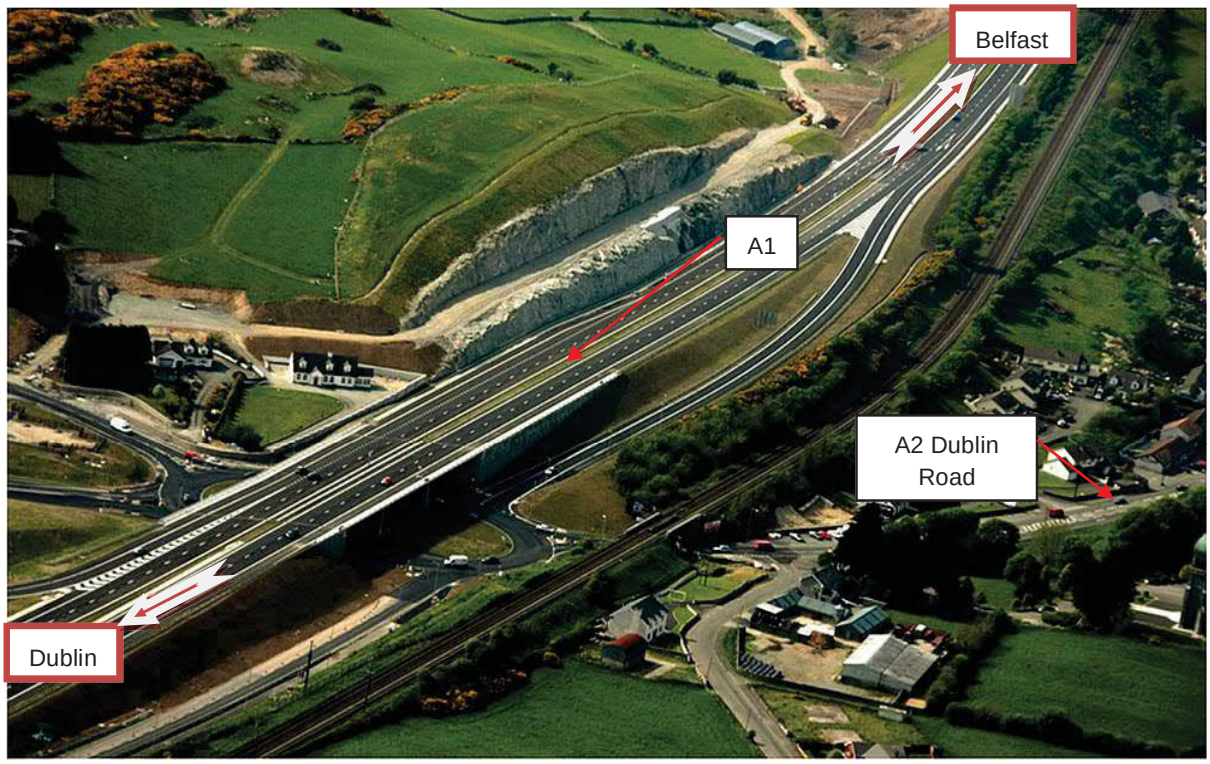


Figure 2.3.2 – Cloghogue Roundabout Junction northern merge/diverge arrangements

The grade-separated junction at Ellisholding is, a 'half diamond' layout, which has limited traffic movements and is shown in Figure 2.3.3. 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 arrangement provides links to the old A1 Dublin Road, Ellisholding Road and Upper Fathom Road.

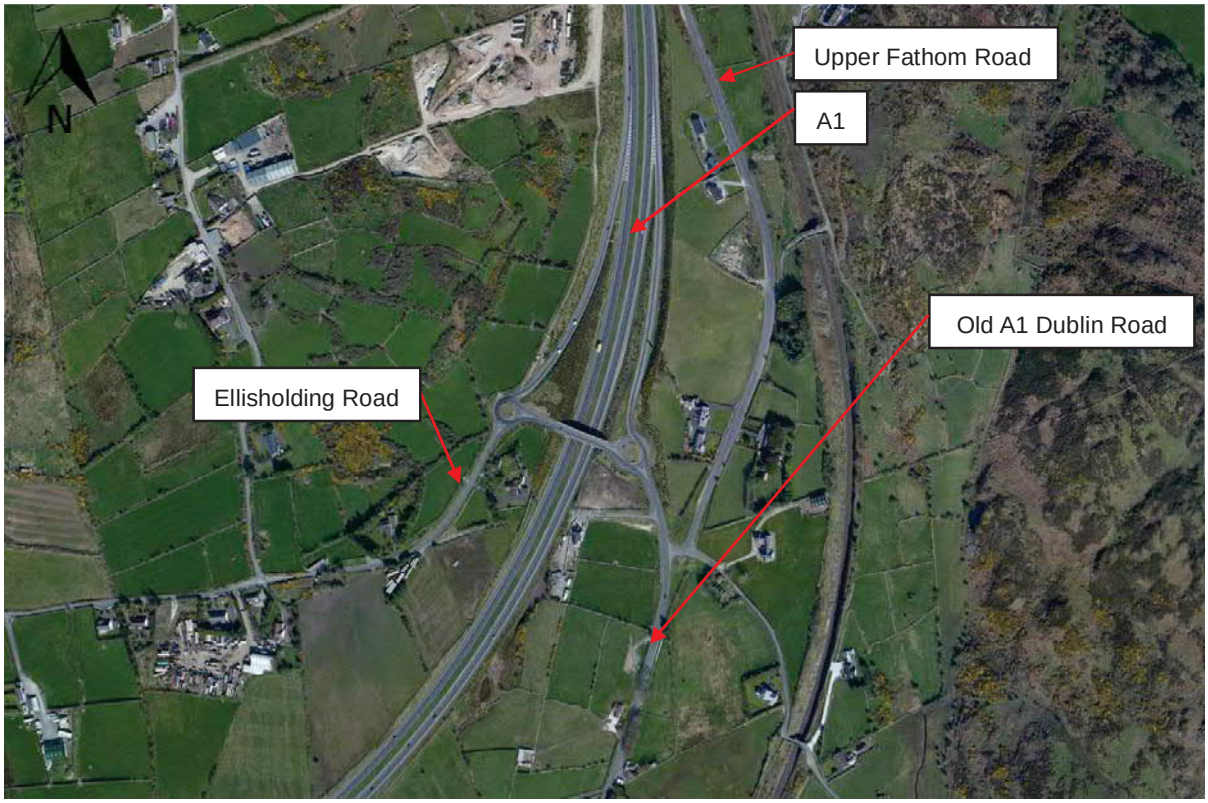


Figure 2.3.3 – Ellisholding junction showing 'half diamond' layout (AECOM Map Portal)

A1 Newry Bypass Junctions

The nearest northerly junction on the A1 outside of the Study Area is Chancellor's Road junction which serves the northern reaches of Newry City; it connects a new access road and the Chancellor's Road to the strategic road network. Chancellor's 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 City, connects A28 Belfast Road and existing A1 Dublin Road (outside Study Area) – 3.2km to Carnbane junction;
- Carnbane junction– north of Newry City, 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 City, connects to the A25 Camlough Road and Craigmore Way (outside Study Area) – 2.0km to Chancellor's Road junction;
- Chancellor's Road junction – west of Newry City, connects to the Chancellor's 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 City, connects to Ellisholding Road and existing A1 Dublin Road – 3.1km to the RoI border and subsequently the Dromad junction which straddles the border.

2.3.2 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 long 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 2.3.4.

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.

Figure 2.3.4 – A2 Warrenpoint Road (Image showing gap/cross over type junction)

2.3.3 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 two lanes narrow to a traditional single, two-way carriageway toward Newry City centre travelling 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, either use River Street or A2 Kilmorey Street, both roads turn left toward the A2 Dublin Road, Kilmorey Street via a signalised junction and River Street 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.

2.3.4 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.

2.3.5 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.

2.3.6 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 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 property.

The A2 Dublin Road, surfaced in asphalt with footways 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).

2.3.7 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. Travelling south from Newry from the junction with the B79 Drumalane Road, 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 and a large quarry is located close to its junction with B79 Drumalane Road to the west.

2.3.8 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.

2.3.9 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. Travelling north using the Ferryhill Road, (towards the A1/N1 Belfast-Dublin Corridor) 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; being little more than a vehicle wide for most of its length and includes passing bays. The asphalt surface dressed 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 to 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 closed up approximately 400m from its junction with Flagstaff Road and closed up approximately 750m from its junction with B79 Drumalane Road. Other unclassified rural roads that are sub-standard in aspects of engineering design criteria include: Barracric Road and Windy Road.

2.3.10 Summary of Existing Conditions in Newry City

There are significant congestion problems in relation to strategic and local traffic using the same route through Newry City centre. Congestion occurs in the city centre at peak times. Congestion and consequent delays on existing traffic flows are discussed further in Chapter 8.

2.4 Road Safety

Section 8.4.8 provides a detailed review of the existing accident data. Collision records held by The Department for Infrastructure were interrogated and data for collisions within the Study Area were obtained for the previous four years to 2015/16. The data comprised of some basic information describing the collision location, severity, road conditions, and a general description of the collision.

2.5 Topography and Land Use

2.5.1 Topography

The general topography of the Study Area is described as hilly. The area is dominated by the Fathom Mountain and other adjacent mountains to the west of the Study Area which peaks at approximately 250m AOD. The area is also controlled by the tidal Newry River and navigable Newry Canal (approximately 5m AOD). The Newry River sits at the head of Carlingford Lough with the Newry Canal entrance at Victoria Lock a further 3-4km upstream of Carlingford Lough. Both the Newry River and Canal lie within a valley; the valley is deep with a wide valley floor and hilly sloping sides to the east and west.

This topography has resulted in watercourses within the Study Area flowing generally 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 instantly 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 parts of the Study Area is wooded, rises less steeply 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.

2.5.2 Land Use

The Study Area contains a mixture of private residential properties, commercial/industrial properties and agricultural outbuildings within a rural landscape, to the south of Newry City. There are three clusters of residential housing developments within the proposed Study Area: 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.

A significant proportion of land within the Study Area is dedicated to retail which includes the Quays and Buttercrane Shopping Centres. Newry City 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 Study Area to the east of Newry River/ Canal, south of Newry City. There are sections within the Study Area that have Statutory Designations. 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
- Environment and Conservation – 33 zones

Figure 2.5.1 – Rural context of Study Area (scattered rural dwellings throughout the Study Area)

In addition to these developments there are scattered rural dwellings throughout the study area, along the Flagstaff Road and the Ferryhill Road which can be seen in distance in Figure 2.5.2.

2.5.3 Man Made Constraints

Newry Canal and Victoria Lock

The Newry Canal was built to link the Tyrone coalfields (via Lough Neagh and the River Bann) to the Irish Sea at Carlingford Lough near Newry. It was the first ever summit level canal to be built in Ireland or Great Britain and was opened in 1742. Newry Canal is currently used by leisure craft and as a means of accessing Newry City from the Irish Sea via Carlingford Lough while passing by the commercial shipping port of Warrenpoint. It is entered on its seaward approach via Victoria Lock. The Lock was automated in May 2007 and was closed for repairs between July 2015 and April 2016.

Within the Study Area 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. This is the site of a deep water quay at Albert Basin. A more detailed assessment of the number of openings of Victoria Lock for boats is provided in Chapter 6.

Disused Dundalk, Newry and Greenore Railway

A disused railway line, part of the London & North Western Railway, passes through the Study Area running south from Newry towards Greenore; parallel to the B79 Fathom Line before continuing west to Dundalk along Dundalk Bay is shown in Figure 2.5.2 coloured in red. The railway was built in the 1860's, it was 42km in length and travelled between Newry and Dundalk at which point it linked to other local rail lines.

The railway connected the London & North Western Railway Port at Greenore to the Holyhead Ferry. The railway was closed in 1951. The old route can still be seen cutting through the landscape in certain locations, however, it is mostly hidden and has become overgrown and dilapidated.

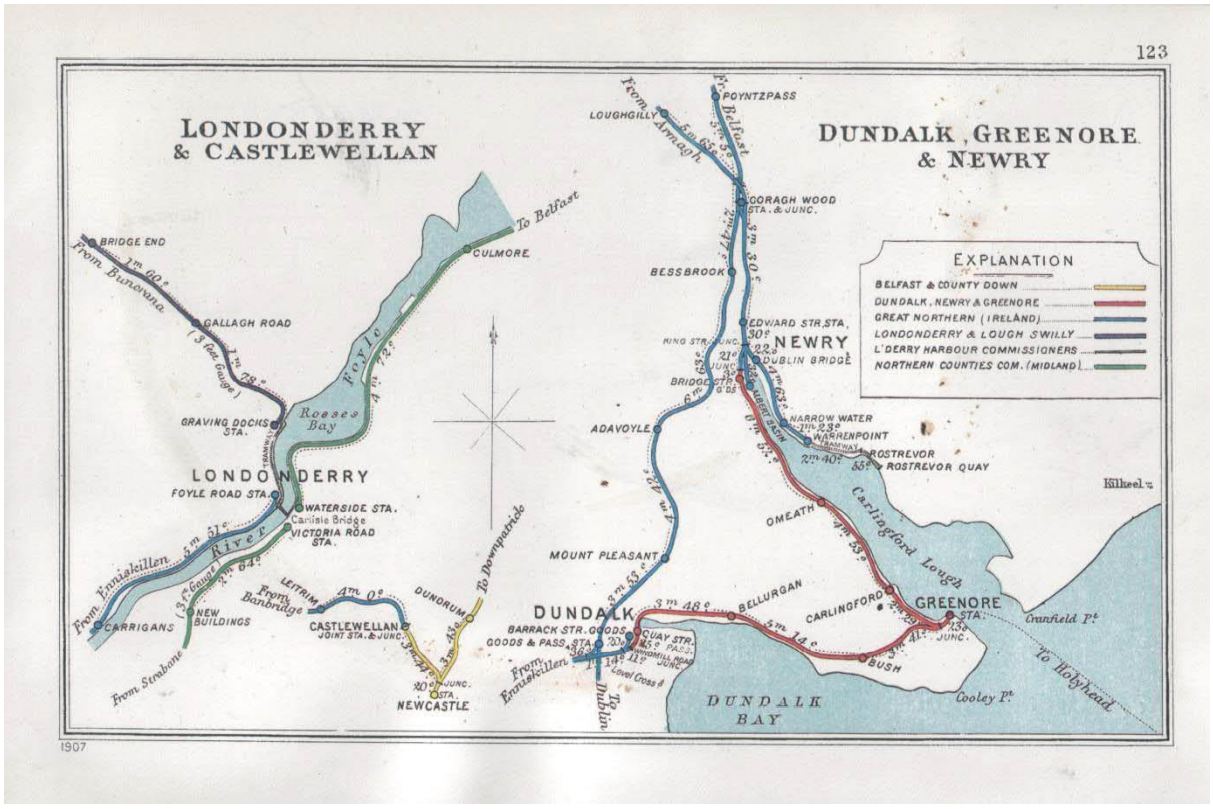


Figure 2.5.2 – Dundalk, Newry and Greenore Railway (L&NWR) Source: Library of Railway History

Disused Great Northern Railway

A disused railway line, part of the Great Northern Railway (Ireland), passes through the study area running southeast from Newry towards Warrenpoint; parallel to the A2 Warrenpoint Road, shown in Figure 2.5.2 coloured in blue. The railway line from Newry to Warrenpoint was built by the Newry-Warrenpoint and Rostrevor Railway Company and it was 11km in length.

The line was completed in 1849 with an extension to Albert Basin added in 1861. It closed on 14 January 1965. The line is now predominantly under the A2 dual carriageway.

Narrow Water Castle

Narrow Water Castle (keep) and courtyard was built in 1212, to prevent river-borne attacks on Newry. In the 1560s, the tower house on the banks of the Newry River (Clanrye River) was built. It is a typical example of the tower houses built throughout Ireland from the 14th until the early 17th century; normally rectangular in plan and three or more storeys high. The tower house juts out from the bank of the Newry River and is sited approximately 7km south of Greenbank Roundabout on the A2 Warrenpoint Road. It is not anticipated that Narrow Water Castle will be directly affected as it currently lies outside of the Study Area, however, land belonging to the estate currently falls with the Study Area along its south-eastern boundary.

National Cycle Network

National Cycle Route 9 which travels from Queen Elizabeth Bridge in Belfast to Slieve Gullion (south of Newry) via Lisburn, Craigavon, Portadown and Scarva, is the nearest route to the Study Area. The route passes through Newry City centre just north of the Study Area and travels south to Slieve Gullion Forest Park skirting around the west of Newry. The route uses the Newry Canal towpath from Newry to Portadown.

There is a proposal to provide a Greenway cycle/pedestrian route on the east bank of the ship canal between Newry and Victoria Lock.

2.6 Geology

2.6.1 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 (70^0 - 80^0) 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 7.11.1 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 mapping, shown in Figure 7.11.1 in Appendix A. 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.

2.6.2 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. 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 7.11.2 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.

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.

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.

2.6.3 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 as shown in Figure 7.11.5 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 may have disturbed ground surrounding the quarry which displays evidence of 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 which are further discussed in Chapter 6.

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 points coincides with quarrying operations at Drumalane Quarry.

2.7 Rivers, Watercourses and Drainage

Throughout the Stage 1 Assessment, information on existing rivers/watercourses was sought to assess the existing drainage pattern of the Study Area. The main watercourse that will require to be crossed is the Newry River/Canal and there are further minor watercourses throughout the Study Area.

A more detailed assessment of existing utilities is undertaken in Chapter 6 detailing the effect each corridor is likely to have on the existing rivers/watercourses. Also Chapter 6 details a more comprehensive list of all the consultees that information was sought from within the Stage 1 Assessment process.

2.8 Environmental Conditions

2.8.1 Local Context

The study area is centred 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 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 City occupies a strategic location on the Eastern Seaboard Corridor, 60km from Belfast and 100km from Dublin, forming an inter-regional gateway between Northern Ireland and the Republic. The cross border rail link between Northern Ireland and the Republic 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 settlement.

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 internationally and locally. 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, Jamaica, 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 Industry & Commerce

Newry currently has a broad base of manufacturing companies operating in the area. These range from large electrical companies such as Glen Dimplex (Glen Electric), 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 Building Supplies, Anglo Beef Processors (ABP) Group, First Derivatives (software development company) and FM Environmental.

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 NI and the RoI, particularly when the currency exchange rate is favourable.

2.9 Existing Utilities

Over the course of this Stage 1 Assessment information on existing utilities was sought from all utility providers that operate within the Study Area. Information from the following major utility providers has been received:

- Northern Ireland Water;
- British Telecom;
- Northern Ireland Electricity;
- Cable and Wireless;
- Firmus Gas, and
- Phoenix Gas (No apparatus in the Study Area).

A more detailed assessment of existing utilities is undertaken in Chapter 6 detailing the effect each corridor is likely to have on the existing utilities. Also Chapter 4 details a more comprehensive list of all the consultees that were consulted within the Stage 1 Scheme Assessment process.

2.10 Traffic Conditions

To the west of Newry, the A1 has recently undergone a major improvement scheme with the provision of a high standard dual carriageway to the south of Cloghogue Roundabout, which carries up to 18,310vpd. To the north of Cloghogue Roundabout the Newry bypass carries up to 15,580vpd.

To the south of the city, the A2, a 7.4 kilometre section of high standard dual carriageway links Newry with Warrenpoint and carries up to 12,500vpd.

Traffic conditions within the city are influenced significantly by the large volume of traffic, which includes a significant 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 leads 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.

General location plans of the main roads/streets within the Newry area are shown in Figure 2.3.6 in Appendix A.

A detailed examination of traffic conditions are examined in Chapter 8 including examination of the traffic survey results and analysis.

2.11 Public Transport

There are various public transport facilities within and surrounding the Study Area. They include; a bus station located in Newry City centre providing a range of bus services and a rail station located in on the outskirts of Newry City centre which also provides a park and ride facility. Both of these are described below.

2.11.1 Rail Stations and Services

Newry railway station is a terminus for the NI Railways 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 finally closing in 1942. The railway station was reopened in 1984 and was later modernised in 2009 providing a much needed update to the facility. 334 car parking spaces are included in an adjacent Park and Ride facility.

Stations to the north of Newry within NI, on the main Dublin to Belfast Enterprise service line, includes: Portadown, Lurgan, Moira, and Lisburn. Local services operated by Northern Ireland Railways (NIR) on Mondays to Fridays provide a half-hourly service towards Portadown or 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 passes through the western side of the Study Area and the Portadown-Newry-Warrenpoint Railway which lies under the A2 Warrenpoint Road; see Section 2.5.3 for more details.

2.11.2 Bus Services and Park and Share Facilities

The closest bus station to the Study Area is located in Newry City, and is called the Newry Bus Centre. The main bus services typically run from this location to local Newry City services, surrounding towns and villages or on to major towns and cities, including Belfast and Armagh.

The public transport operator Translink runs a number of services via 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 2.1study area.

Table 2.1 – 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

2.11.3 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.

Previous Work undertaken and Design Development

03

3. Previous work undertaken and Design Development

3.1 Feasibility Study Report

In 2008, Scott Wilson (now AECOM since October 2014) undertook a study to assess the feasibility of a NSRR on behalf of Roads Service (now The Department for Infrastructure). As part of the Feasibility Study Report, an assessment of the existing traffic, engineering and environmental conditions within the Study Area was undertaken for a proposed new link road (between the A1/N1 Belfast-Dublin Corridor and the A2 Warrenpoint Road) in accordance with the DMRB requirements.

An important part of the Feasibility Study Report involved consultation with a number of statutory bodies including: Environmental Consultees; Services/Utilities; and Other Consultees. The responses from the consultees were considered during the design development and indicative alignments were developed within the corridors to assist with preliminary cost estimate preparation. An assessment of the indicative options was undertaken which considered the then Government's five central objectives for Transport: Environment, Safety, Economy, Accessibility and Integration.

The environmental constraints within in the Study Area were found to be significant. The study determined that the impact on the majority of environmental constraints would be, slightly adverse with air quality and pedestrians receiving a slight improvement within Newry City centre. The impact on ecology and nature conservation would be adverse due to the impact of crossing the Newry River/Canal within the Carlingford Lough Area of Special Scientific Interest and the Narrow Water Forest Site. The impact on landscape effects was also adverse due to the rural environment within the Study Area which overlays an Area of Outstanding Natural Beauty.

The Feasibility Study Report determined that each of the indicative options would provide significant savings in the overall number of accidents. It was estimated that over the 60 year economic life span of the scheme between 310 and 428 traffic accidents could be avoided.

The scheme would have a positive impact on the economy through significantly reduced peak and off-peak journey times on the road network by providing a new strategic transport link. The scheme positively impacted on transport economics with each option boasting a positive Benefit to Cost Ratio (BCR).

The Report established that the strategic traffic currently passing through Newry represents a significant problem for local transport conditions and strategic traffic. This adds to the congestion within the city causing delays along Dublin Road, Bridge Street, William Street and Abbey Way. The provision of a strategic traffic route would improve the road network and provide relief to traffic in the Dublin Road, Bridge Street, William Street, Abbey Way and Warrenpoint Road area of the city of Newry.

A number of significant challenges were identified within the Study Area that included; the proximity of alignments to the Drumalane Quarry and suitable access arrangements onto the A1at Cloghogue Roundabout Junction. A substantial amount of disruption, throughout the city of Newry, is caused by HGVs travelling to and from Warrenpoint Harbour; the NSRR would provide an alternative strategic route for this traffic, thus reducing traffic delays and congestion within the city.

In summary, the Feasibility Study Report concluded that the delivery of a new strategic link between the A2 Warrenpoint Road and the A1 Belfast-Dublin Corridor is feasible. Furthermore, it would be expected to provide significant economic benefits. However, a number of substantial engineering and environmental challenges would be associated with crossing Newry River/Canal and negotiating Fathom Mountain.

3.2 Narrow Water Bridge

3.2.1 Background

The Narrow Water Bridge (NWB) proposal is to build a restricted vehicle (restricted access for HGVs) bridge across Newry River linking the A2 Warrenpoint Road in NI to the R173 in the RoI.

In October 2008, a preferred bridge location was chosen; from the three river crossings proposed by Roughan and O'Donovan, working on behalf of Louth County Council. The preferred bridge is proposed at the southern end of the A2 dual carriageway, south of Narrow Water Castle approximately 1km north-west of Warrenpoint. The carriageway crosses the Newry River, approximately perpendicular to the banks linking the roundabout on the A2 Warrenpoint Road – which is adjacent to the Warrenpoint Golf Club – to the R173. The alignment of the crossing connects to the bank of the Newry River in the RoI just south of an existing watch tower.

In July 2011, the Irish Government announced that the scheme would not be progressed within the Irish National Development Plan. It was then progressed independently by Louth County Council, who secured EU INTERREG funding for the project in October 2012 to the value of €17.4m. In May 2013, three sources of funding were finalised for the scheme between the NI Executive, Louth County Council and EU INTERREG IVA programme providing approximately €21.7m in total. Subsequently, in July 2013, the project was suspended due to the escalating costs of the tenders. The EU withdrew their funding in November 2013 as the completion date of June 2015 was unlikely to be met.

In June 2015, Louth County Council produced a small paper suggesting that the NWB and NSRR projects could be combined. The paper outlined three route options and their associated cost estimates that could connect the proposed NWB bridge to the A1/N1 Corridor. Consequently, in November 2015, the NI executive and the UK and Irish governments published, 'A Fresh Start – The Stormont Agreement and Implementation Plan' in which there is a commitment to "undertake a review of the Narrow Water project with a view to identifying options for its future development, for consideration by the North South Ministerial Council in June 2016".

3.2.2 Revised Louth County Council Narrow Water Bridge Proposals

AECOM was requested to comment upon a '*Revised Narrow Water Bridge and Road Improvement Project'* paper prepared by Louth County Council. It outlined three options that could hypothetically be used to connect the NWB to A1/N1 Belfast-Dublin Corridor.

AECOM reviewed the paper and concluded that none of the options proposed would be suitable as they did not appear to fulfil an economic or strategic objective.

3.3 Current Corridor Development

At this stage the assessment is limited to five corridors, four of which have been developed from the Feasibility Study Report (which are displayed on Figure 5.2.1 in Appendix A):

- Corridor 1;
- Corridor 2;
- Corridor 3;
- Corridor 4; and
- Corridor 5.

Corridor 1

Corridor 1 has evolved from the 2008 Feasibility Study's Greenbank Corridor. Corridor 1 has been extended to the west to eschew potential risks associated with the Drumalane Quarry and would be the subject of geological and geotechnical surveys to be undertaken at a later stage in the scheme assessment process.

Alternative tie-in options have been developed also, they include: the existing tie-in to the A2 at the Greenbank Roundabout and an alternative tie-in location, 350m south of the Greenbank Roundabout. The alternative tie in was developed in an attempt to mitigate engineering challenges associated with connecting to the A2 at the Greenbank Roundabout and Corridor 1 has been extended to accommodate this development.

Since the Feasibility Study Report, Cloghogue Junction on the A1/N1 corridor has been developed, and consequently some of the indicative alignments are no longer feasible. Corridor 1 has been developed to extend from a location in the vicinity of Greenbank Roundabout to Ellisholding Junction, where a tie-in is much more feasible.

Corridor 2

Corridor 2 has evolved from the Area Plan Corridor in the 2008 Feasibility Study Report. Corridor 2 has been extended to the west to eschew potential risks associated with the Drumalane Quarry and would be the subject of geological and geotechnical surveys to be undertaken at a later stage in the scheme assessment process.

Since Corridor 2 has been been located further to the west of the Drumalane Quarry it lengthens the alignment and moves the A2 tie-in location further to the south to reduce the earthworks whilst maintaining a gradient that complies with TD 9/93.

Corridor 3

The High Corridor considered in the 2008 Feasibility Study Report has evolved into Corridor 3. An indicative alignment with a reduced skew was developed which resulted in the reduction of the structure's length by over 300m which consequently decreased the visual impact and the cost associated with the structure. As a result of the reduced skew, the tie-in location on the A2 has moved approximately 700m to the north. The connection onto the A1 through Ellisholding Junction remains the most practical location for this corridor. Corridor 3 has been expanded to reflect these developments. Corridor 3 is the only route considered that provides uninterrupted flows to vehicular traffic irrespective of marine vessel movements.

Corridor 4

Corridor 4 has evolved from the 2008 Feasibility Study Report Low-Medium Corridor. The corridor has been extended further to the south in order to accommodate a shorter spanning bridge across Newry River; therefore, two indicative alignment options have been developed within this corridor (Option A and B). Corridor 4 Indicative Option A offers a crossing located approximately midway between those of Corridor 2 and 3. The corridor spans both the Newry River and Canal before climbing the side of Fathom Mountain to connect into Ellisholding Junction. It is also proposed that the corridor connects to Fathom line via an online roundabout to the west of the canal crossing. Corridor 4 Indicative Option B offers a crossing location at Rough Island which provides considerable benefits by avoiding the historic heritage of the Newry Canal. The shorter span is cost-effective as it provides a significant decrease in the fixed structure length. This option also offers a connection to Fathom Line which would provide significant benefits to the scheme. The corridor extends almost as far south as the border with RoI.

Corridor 5

Corridor 5 was developed since the 2008 Feasibility Study Report as a result of the consultation process and recognising a number of engineering challenges associated with Corridors 1 and 2. The proximity to the Drumalane Quarry represents a major risk for both Corridors 1 and 2 while connecting to the A1 through Cloghogue Junction would also be challenging. Corridor 5 is located between Greenbank Industrial Estate and Ellisholding Junction. The indicative alignment would connect to the A2 through a new roundabout adjacent to Greenbank Industrial Estate. The alignment crosses Newry River/Canal to the south of Drumalane Quarry before travelling south before turning to the west, climbing Fathom Mountain and connecting into the Old Dublin Road. Corridor 5 attempts to mitigate the risks associated with the Drumalane Quarry and offer a suitable tie-in location to the A1/N1 Belfast-Dublin Corridor through Ellisholding Junction. A feasible connection to Fathom Line is also achievable within this option.

Consultations and Workshops

04

4. Consultations and Workshops

4.1 Stage 1 Consultations and Stakeholder Engagement

To establish relevant constraints and factors that should be taken into account when considering the corridor options, stakeholder consultation was undertaken in July 2016, with follow-up reminder letters to those who hadn't responded, issued in late August 2016. The responses gave the opportunity for relevant interested bodies to register concerns, constraints, or particular requirements during the assessment process. Based on consultee feedback, and ongoing design development; the options were developed further, with Corridors 1 and 2 widened, and Corridor 5 introduced. A secondary round of consultation was undertaken in October 2016, with follow-up reminder letters to those who hadn't responded, issued in late November 2016, with the consultation period ending on 07 December 2016.

Responses received identified a variety of issues and constraints, which contributed to the overall assessment process and ultimately towards the selection of the preferred corridor. Furthermore, the consultation also contributed to the identification of other stakeholders with an interest in the Scheme.

Statutory and non-statutory environmental bodies, local authorities, other public authorities, service and utilities and other key stakeholders were consulted who were likely to have views on the scope of Stage 1 Assessment. It is good practice, particularly in the case of Environmental Impact Assessment (EIA), to consult with these groups to ensure that the issues are appropriately addressed in the evolving scheme design.

4.2 Stage 1 Consultees

4.2.1 Environmental Consultees

An integral element of the preliminary environmental assessment included consultation with statutory authorities and various other bodies that may potentially have specific environmental interest in the study area. Consequently, the following environmental bodies, including key Republic of Ireland consultees, were consulted in the course of this assessment:

- Birdwatch Ireland;
- Council for Nature Conservation and the Countryside (CNCC);
- Commissioners of Irish Lights;
- Confederation of Community Groups – Newry & District;
- DAERA – Air & Environmental Quality Unit;
- DAERA – Countryside Management – Operational Development Branch;
- DAERA – Direct Regional Office;
- DAERA – Marine and Fisheries Division;
- DAERA – Marine Historic Environment;
- DAERA – NI Forest Service;
- DAERA – NIEA Natural Environment Division;
- DAERA – NIEA Resource Efficiency Division, Waste Management (Land and Groundwater Team);
- DAERA – NIEA Water Management Unit;
- Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs;
- DfC – Historic Environment Division;
- DfC – Regional Development Office – South Eastern Team;
- DfC – Regional Development Office – Southern Team;
- DfC – Statutory Advisory Councils Secretariat;
- DfE – Geological Survey of Northern Ireland;
- DfI – Planning Policy Division;

- DfI – Rivers Agency;
- DfI – Strategic Planning Division;
- DfI – Sustainable Transport Branch;
- Down Gaelic Athletic Association (GAA);
- Environmental Protection Agency – Office of Environmental Assessment;
- Inland Fisheries Ireland;
- Irish Whooper Swan Study Group;
- Loughs Agency – Foyle, Carlingford and Irish Lights Commission;
- Louth County Council – Chief Executive;
- Mourne Heritage Trust;
- Mourne, Gullion & Lecale Rural Development Partnership;
- National Parks and Wildlife Service;
- National Trust;
- Newry & District Anglers Association;
- Newry Coarse Fish Angling Club;
- Newry Maritime Association;
- NI Greenways;
- NMDDC – Active and Healthy Communities;
- NMDDC – Biodiversity Officer;
- NMDDC – Enterprise, Regeneration & Tourism;
- NMDDC – Local Planning Office;
- NMDDC – Parks & Grounds Manager;
- NMDDC – Regulatory and Technical Services (RTS);
- NMDDC – Strategic Planning and Performance (SPP);
- Northern Ireland Agricultural Producers Association;
- Northern Ireland Badger Group;
- Northern Ireland Bat Group;
- Northern Ireland Housing Executive;
- Ring of Gullion Landscape Partnership Scheme;
- RSPB Northern Ireland;
- Southern Health & Social Care Trust;
- Sustrans;
- Ulster Angling Federation;
- Ulster Farmers' Union;
- Ulster Wildlife;
- Warrenpoint, Burren & Rostrevor Chamber of Commerce; and
- Woodland Trust.

4.2.2 Services Consultees

An integral element of the preliminary engineering assessment included consultation with service/utility organisations that may potentially have utilities infrastructure within the study area. Consequently, the following service/utility providers were consulted in the course of this assessment:

- Atlas Communications;
- BT;
- Cable & Wireless;
- Eircom UK;
- Everything Everywhere Limited (EEL);
- Firmus;
- NI Water;
- NIE Networks;
- Phoenix Natural Gas Limited;
- Vodafone & Telefonica (Vodafone Limited); and
- Virgin Media.

4.2.3 Other Consultees

The consultation process included consultation with bodies that would potentially have a general interest in the study area or scheme in general. Other bodies which were consulted in the course of this assessment included:

- British Ports Association;
- Confederation of British Industry;
- Department of Education;
- DfI – Cycling Unit;
- Disabled Drivers Association;
- East Border Region Ltd.;
- Education Authority – Southern Region;
- Freight Transport Association;
- Invest NI;
- Ministry of Defence;
- Newry Chamber of Commerce & Trade;
- Newry City Athletic Football Club;
- Newry Mitchels Gaelic Football Club (GFC);
- Newry & Mourne Co-operative Enterprise Agency;
- Newry Shamrocks Gaelic Athletic Club (GAC);
- NMDDC – Chief Executive;
- Northern Ireland Ambulance Service;
- Northern Ireland Fire & Rescue Service;
- PSNI – Road Policing Unit;
- PSNI – Road Policing Development Branch;
- Road Haulage Association;
- Tourism NI ;

- Translink (Service Delivery Manager);
- Translink (Translink Network – Technical Support);
- Translink – Infrastructure Division and
- Warrenpoint Harbour Authority.

4.3 Risk Management Workshop

A Risk Management Workshop was held on 23 March 2016 in Marlborough House, Craigavon, County Armagh. This was used as a basis on which to develop the Scheme's Risk Register. The risks identified were quantified and included in the scheme cost estimates. A scheme overview was provided and supported with input from a range of disciplines with key points and areas of concern highlighted. After the key problems and issues were identified, the Scheme Objectives were discussed and produced.

The items on the Risk Register were input into the '@Risk' programme. This programme enables the risks to be analysed using a Monte Carlo simulation and results in the creation of a risk distribution for the total risk premium.

The Risk Workshop successfully identified risks in order to develop the Risk Register and associated cost estimates. It was recommended that the individual corridor Scheme Estimates include a Risk Allowance that ranged from £4.6M to £6.7M, depending on the level of risk identified in each corridor and that Optimism Bias of 44% was appropriate at this stage of scheme development.

4.4 Design Workshop

During the course of the Stage 1 Preliminary Options Assessment, two design workshops were held to discuss the development and assessment of corridors and indicative alignment options for the NSRR. Representatives from The Department for Infrastructure attended both workshops and were satisfied that the general approach to the development and assessment of the various corridors was reasonable.

Assessment of Broadly Defined Improvement Corridors

05

5. Assessment of Broadly Defined Improvement Corridors

5.1 Introduction and Study Area

The project brief outlined the requirement to identify a preferred corridor within the indicative Study area. It is anticipated that the scheme will link the A1/N1 Belfast Dublin Strategic Corridor to the A2 Warrenpoint Road.

The A1 and A2 are well established transport routes and are part of the strategic road network; with the A1 connecting Larne, Belfast and Lisburn to the south west of NI and the RoI border, and the A2 connecting Warrenpoint to Newry.

The A1/N1 dual carriageway has already seen a significant number of improvements, including the ongoing provision of grade-separated junctions along the route (A1 in NI) to the north of Newry. These are incrementally providing safer access for local traffic in both directions to towns and destinations along the route including Banbridge, Dromore, and Hillsborough.

The A2 Warrenpoint Road dual carriageway on the eastern edge of the Study area terminates to the north of Warrenpoint. The route serves a number of residential accesses and the surrounding hinterland, and provides access to Warrenpoint Port.

The DMRB Stage 1 Assessment for road improvements involves the identification and consideration of broadly defined improvement strategies. These strategies should be described in general terms, highlighting major features as appropriate. As part of this study, a number of broadly defined potential route corridors were therefore identified to assist in defining the preferred route corridor.

At the outset of the Stage 1 Assessment, the process for identification of these route corridors involved the joint participation of The Department for Infrastructure at a series of preliminary design meetings, where it was necessary to confirm the precise extents of the Study Area.

The western part of the study area covers the A1/N1 Belfast-Dublin Corridor which includes the tie-in locations of Cloghogue Roundabout and Ellisholding junctions. The eastern part of the Study Area covers both sides of the Newry River, the A2 Warrenpoint Road and the B79 Fathom Line. To the north, the Study Area extends just north of the Greenbank Industrial Estate and the southern limits extend to just north of Narrow Water and the RoI border, the Study Area is displayed on Figure 1.1.2 in Appendix A.

5.2 Route Corridor Options within the Study Area

Following the definition of the Study Area, site visits were undertaken by specialists to familiarise themselves with the critical areas and establish the existing baseline conditions. Following further examination of the baseline conditions and further desk studies, the key constraints within the Study Area were identified. This process led to route corridor options being developed for further examination and assessment.

Reference to the scheme objectives indicated that, in view of the dual purposes of the scheme, i.e. removal of through traffic within Newry City in a cost effective manner and to improve access to regional gateways such as Warrenpoint Port, corridors that were reasonably close to the city would be required. Corridors too close to Newry City would not be ideal due to congestion rendering them unfavourable to strategic traffic. Corridors which were further from the city would inevitably be longer in length, prove to be a less attractive route for city traffic and may only be favourable to Warrenpoint Port traffic.

Within the Study Area initial obvious constraints were identified so that preliminary corridor options could be identified. The mountainous topography of the land and the presence of various man-made and natural features, such as: existing residential areas, Drumalane Quarry and Cloghogue Roundabout junction, severely limit the options for corridor choice to the northern limits of the Study Area. Five potential corridors were identified which are shown in Figure 5.2.1 in Appendix A.

5.3 Description of Broadly Defined Improvement Corridors

The following potential Broadly Defined Improvement Corridors have been considered. To assist in the assessment of the corridors, an indicative alignment option was prepared for each. These indicative alignment options were prepared to demonstrate that a viable alignment could be developed in order to enable a reasonable preliminary assessment of the corridors.

5.3.1 Corridor 1

Corridor 1 is located just to the south of Newry running southwest from the A2 Warrenpoint Road. The corridor spans from the vicinity of Greenbank Roundabout through the Greenbank Industrial Estate, over the Newry River/Canal then southerly toward Ellisholding junction onto the A1 Dual Carriageway. One indicative alignment option has been considered within this corridor. The general layout of Corridor 1 and an indicative alignment is shown in Figure 5.3.1 in Appendix A.

5.3.2 Corridor 2

Corridor 2 is located to the south of Newry running in a north-westerly direction from the A2 Warrenpoint Road. The corridor starts on the A2 Warrenpoint Road south of the Greenbank Industrial Estate, crossing the Newry River/Canal heading northward towards Cloghogue Roundabout junction onto the A1 Dual Carriageway. One indicative alignment option has been considered within this corridor. The general layout of Corridor 2 and an indicative alignment is shown in Figure 5.3.2 in Appendix A.

5.3.3 Corridor 3

Corridor 3 contains a high level crossing over the estuary approximately 38.5m above an observed high water level (2.5m O.D. on 9th April 1997). This corridor is located further to the south of Newry than the previous two corridors. The corridor connects to the A2 Warrenpoint Road in the vicinity of its junction with Aghnamoira Road and Green Island; it then continues west crossing the Newry River/Canal heading towards Ellisholding junction. One indicative alignment option has been considered within this corridor. The general layout of Corridor 3 and an indicative alignment is shown in Figure 5.3.3 in Appendix A.

5.3.4 Corridor 4

Corridor 4 is again located further to the south of Newry and is the southernmost corridor. The corridor starts on the A2 Warrenpoint Road between the Aghnamoira Road/Green Island to Rough Island and on crossing the estuary/canal heads in a northerly direction onto the Ellisholding junction onto the A1 Dual Carriageway. Each bridge alignment option would terminate at a proposed roundabout on or connecting to the B79 Fathom Line. The general layout of Corridor 4 and indicative alignments are shown in Figures 5.3.4 & 5.3.5 in Appendix A. Two indicative alignment options that have been considered within this corridor:

- Corridor 4 Option A; and
- Corridor 4 Option B.

5.3.5 Corridor 5

Corridor 5 is located in a similar setting to Corridor 1 running west from the A2 Warrenpoint Road spanning the Newry River/Canal heading toward Ellisholding junction onto the A1 Dual Carriageway. The corridor starts on the A2 Warrenpoint Road on the frontage of Greenbank Industrial Estate and crosses the Newry River/Canal to the south of Drumalane Quarry. One indicative alignment option has been considered within this corridor. The general layout of Corridor 5 and an indicative alignment is shown in Figure 5.3.6 in Appendix A.

5.3.6 Constraints corresponding to all alignments

At the eastern side of the study area each option would start at a proposed roundabout on or connecting to the A2 Warrenpoint Road. Newry River/Canal would be bridged over with a structure that could facilitate navigation of craft on the canal or river. Based on the discussion in the Feasibility Report and the topography approaching the western tie in area, the bridge structure would consist of a S2 standard carriageway cross-section with the remainder of each corridor, climbing Fathom Mountain, including a WS2+1 carriageway cross-section that would link to the A1/N1 Dual Carriageway either utilising the Cloghogue Roundabout or Ellisholding junctions.

The two types of carriageway standard used throughout the scheme are displayed in Figure 6.6.1 in Appendix A and they are;

- S2 – 9.3m wide single carriageway, comprising: 2 x 3.65m wide running lanes (one lane in each direction of travel), 2 x 1m wide hard strips and 2.5m wide verges on each side of the carriageway, and
- WS2+1 – 13.5m wide, wide single 2+1 carriageway that includes 3 x 3.5m wide running lanes (two lanes of travel in one direction and a single lane in the opposite direction), 2 x 1m hard strips, 1 x 1m

wide separation zone between the running lanes in the opposite direction and the addition of 2.5m wide verges on either side of the carriageway.

5.4 Development of Indicative Alignment Options for Assessment

5.4.1 Corridor 1 Indicative Alignment

The indicative alignment in Corridor 1 would extend from a new roundabout constructed 350m south of Greenbank Roundabout on the A2 Warrenpoint Road and continue to a new roundabout at the Ellisholding grade-separated junction. The alignment comprises a 2.95km long single S2/WS2+1 standard carriageway with a mid-level single carriageway bridge structure over the Newry River that may include an opening section over the Newry Canal. This option does not include a direct link between the NSRR and B79 Fathom Line; however a link could be created with various other side roads or utilize the existing Dublin Road Bridge which would also offer a connection to the B79 Fathom line.

5.4.2 Corridor 2 Indicative Alignment

The indicative alignment in Corridor 2 would extend from a new roundabout on the A2 Warrenpoint Road dual carriageway south of the junction with Old Warrenpoint Road and continue to the vicinity of Cloghogue Junction where it will terminate at a new roundabout on the Dublin Road adjacent to Patrician Park. The alignment comprises a 2.55km long single S2/WS2+1 standard carriageway, with a mid-level single carriageway bridge structure over the Newry River that may include an opening section over the Newry Canal. This option does not include a direct link between the NSRR and B79 Fathom Line; however, a link could be created with various other side roads which could connect to the B79 Fathom line.

5.4.3 Corridor 3 Indicative Alignment

The indicative alignment in Corridor 3 would be a high-level alignment extending from a new roundabout on the A2 Warrenpoint Road dual carriageway to the south of Green Island which would continue to a new roundabout at the Ellisholding grade-separated junction. The alignment comprises a 3.3km long single S2/WS2+1 standard carriageway with a high-level fixed structure across the Newry River/Canal. This option does not include a direct link between the NSRR and B79 Fathom Line; however, a link could be created with various other side roads which could connect to the B79 Fathom line. This is the only alignment not interrupted by road closures to facilitate marine traffic in either the Newry River or Canal.

5.4.4 Corridor 4 Option A Indicative Alignment

The indicative alignment in Corridor 4, Option A, would extend from a new roundabout on the A2 Warrenpoint Road dual carriageway to the south of Green Island and continues to a new roundabout at the Ellisholding grade-separated junction. This option comprises a 0.45km long single carriageway low-level structure across the Newry River which may include an opening section across the Newry Canal leading to a proposed roundabout on the B79 Fathom Line. From here a 3.4km long single S2/WS2+1 standard carriageway links to the junction at Ellisholding. This option would include a direct link between the NSRR and the B79 Fathom Line.

5.4.5 Corridor 4 Option B Indicative Alignment

The indicative alignment in Corridor 4, Option B, would extend from a new roundabout on the A2 Warrenpoint Road to the south of Green Island to the east of Rough Island on the western bank of the Newry River. This alignment would continue to a new roundabout at the Ellisholding grade-separated junction. This option includes a 0.25km long single carriageway low-level structure across the Newry River, including an opening section, leading to a roundabout on the B79 Fathom Line (this option; south of Victoria Lock does not bridge over the canal). From here a 5.15km long single S2/WS2+1 standard carriageway links to the Ellisholding junction; 1.6km of this alignment would be an upgrade to the existing B79 Fathom Line which will involve widening and possible re-alignment. This option includes a direct link between the NSRR and the B79 Fathom Line.

5.4.6 Corridor 5 Indicative Alignment

The indicative alignment in Corridor 5 would extend from a new roundabout on the A2 dual carriageway in the vicinity of the Greenbank Industrial Estate and would continue to a new roundabout at the Ellisholding grade-separated junction. This option comprises a 0.45km long single carriageway link road from the A2 leading to a low-level structure across the Newry River which may include an opening section over the Newry Canal, then

leading to a roundabout adjacent to Fathom Line. From here a 2.15km long single S2/WS2+1 standard carriageway links into the de-trunked A1 Dublin Road with a roundabout junction before continuing to a new roundabout at Ellisholding Junction; some upgrading of the old A1 Dublin Road would be required. This option may include a direct link between the NSRR and the B79 Fathom Line.

Engineering Assessment

06

6. Engineering Assessment

6.1 Introduction

This section of the report assesses the engineering aspects of both; the general conditions that are prevalent to all corridors, and any additional conditions that may be more prominent in certain corridors to give a rational comparison. An engineering assessment of the existing conditions and the standards used for assessment is given within this section.

Indicative route alignments were identified within the process of design development. It should be noted these route alignments are indicative and are only used as a means to assess each route corridor.

The topography in the Study Area is challenging and required a detailed engineering design process be undertaken to confirm each route alignment satisfied geometrical requirements set out in TD 9/93 and achieve an acceptable balance of cut and fill in earthworks. It should be noted that, at this stage, a broad assessment of the engineering issues is made and further refinement of the preferred corridor would be undertaken at future stages.

Five corridors with six indicative route alignments were identified. The corridors and their indicative route alignments are shown on Figure 6.1.1 in Appendix A. Whilst permutations of these indicative route alignments are possible, it was considered that these are representative within each corridor.

6.2 Existing Road Network

6.2.1 Horizontal Alignment

The Design Speed used in assessing the layout and standard of the existing road is based upon the speed limit applied to the section of carriageway under analysis and the requirements, in particular, of TD 9/93. The Design Standard TD 16/07: *Geometric Design of Roundabouts* is also referenced in the following text. The existing road network was assessed along its length, starting from the eastern interface with the A2, running along the length of the current route taken to the western interface with the A1. A & B-class roads are evaluated in this section. Local roads within the Study Area were reviewed and determined to be below the desirable minimum standard required; however, these roads are expected to carry local traffic only and should not be affected by the scheme.

6.2.1.1 A2 Warrenpoint Road Dual Carriageway

The A2 Warrenpoint Road dual carriageway is currently subject to a speed limit of 70mph. In accordance with TD 9/93, this equates to a design speed of 120kph. The existing alignment was assessed against this design standard and overall conforms well; however there are a couple of locations where the highway is subject to horizontal radii which are below standard for a modern 120kph alignment.

Heading north towards Newry from Warrenpoint starting from the south eastern boundary of the Study Area, the horizontal alignment of the A2 comprises a right-hand curve with a radius of approximately 960m which is one step below the current minimum acceptable for a Design Speed of 120kph. The A2 is then reasonably straight for 300m, with a left-hand curve radius greater than 9000m. The A2 then has a right-hand curve with a radius of approximately 1,100m which is acceptable for a Design Speed of 120kph.

The A2 then continues straight for a distance of approximately 250m when it undertakes a series of reverse curves, which comprises a left-hand curve of approximately 1,020m radius immediately followed by a right-hand curve of approximately 1,440m radius before leading into a left-hand curve of approximately 720m radius. These radii would be within standard apart from the 720m radius curve which is one-step below current desirable minimum standard. The A2 then continues straight for a distance of approximately 310m when it undertakes reverse curvature, which comprises of a left-hand curve of approximately 1,440m radius followed by a right-hand curve of approximately 2,040m radius. These radii are within standard. The A2 continues north predominantly via large radii or straight geometry for a distance of approximately 1,860m until it reaches Greenbank Roundabout.

6.2.1.2 Greenbank Roundabout

Greenbank Roundabout is a 60m Inscribed Circle Diameter (ICD) roundabout with a circulatory carriageway width of 9m and four arms. The northward arm is the A2 Warrenpoint Road/Kilmorey Street, eastward arm is the Old Warrenpoint Road, southward arm is the A2 Warrenpoint Road dual carriageway and the westward arm

leads into the Greenbank Industrial Estate using Ballincraig Way. The roundabout appears to conform to TD 16/07 standard but a detailed analysis would need to be carried out to confirm this.

6.2.1.3 A2 Warrenpoint Road/Kilmorey Street and River Street

The A2 Warrenpoint Road reduces to wide single carriageway, with one lane in each direction, on the exit from Greenbank Roundabout heading north towards Newry City centre. The speed limit is reduced to 30mph at a point approximately 100m north of Greenbank Roundabout which equates to a 50kph Design Speed.

The alignment exits Greenbank Roundabout on a left-hand curve of approximately 255m radius and continues reasonably straight for a distance of approximately 280m. In accordance with TD 9/93, this 255m radius would be four steps below desirable minimum standard (120kph Design Speed). Reverse curvature is introduced at this point using a right-hand curve of approximately 127m radius. In accordance with TD 9/93, this radius is one step below desirable minimum standard (50kph Design Speed). This right-hand curve ends at the junction with Home Avenue and where the A2 Warrenpoint Road changes to the A2 Kilmorey Street.

Kilmorey Street

Kilmorey Street is located within the 30mph speed limit zone which equates to a 50kph Design Speed. The A2 Kilmorey Street alignment begins with a left-hand curve of approximately 150m radius and leads into another left-hand curve of approximately 360m radius. Reverse curvature is again introduced to allow a right-hand curve of approximately 255m radius, leading up to the signalised junction with A1 William Street. In accordance with TD 9/93, only the 150m radius curve would be one step below desirable minimum standard.

River Street

River Street begins on a straight from its junction with A2 Kilmorey Street for a distance of approximately 120m. A right-hand curve of approximately 90m continues the alignment finishing with a straight of approximately 30m in length. In accordance with TD 9/93, this 90m radius curve would be two steps below desirable minimum standard.

6.2.1.4 A28 William Street, A2 Dublin Bridge and A2 Bridge Street

This section of road is located within the 30mph speed limit zone which equates to a 50kph Design Speed – City Centre location. From its junction with A2 Kilmorey Street, heading south west, A28 William Street terminates and A2 Dublin Bridge commences it has straight geometry for a distance of approximately 170m up to its junction with A2 Bridge Street. A2 Bridge Street has similar horizontal geometry to A28 William Street with a straight distance of approximately 340m leading up to its junction with A2 Dublin Road at the B79 Drumalane Road.

6.2.1.5 A2 Dublin Road/Bridge Street junction to Cloghogue Roundabout

This section of road is located within the 30mph speed limit zone which equates to a 50kph Design Speed. This horizontal alignment is predominantly straight with single curves used at the end of each straight section until it reaches Cloghogue Roundabout. The alignment of A2 Dublin Road begins on a straight for a distance of approximately 240m and leads into a left-hand curve of approximately 100m radius. In accordance with TD 9/93, the 100m radius would be two steps below desirable minimum standard.

The alignment continues on a straight of approximately 390m in length. At this point reverse curvature is introduced. A right-hand curve of approximately 255m radius is followed by a left-hand curve of similar radius. These are quite short curves and are within standard. The road continues on another straight of approximately 325m in length. The speed limit changes from 30mph to 40mph which equates to a Design Speed of 70kph approximately midway along this straight (close to Hawthorn Hill), heading north towards Cloghogue Roundabout. The straight section then leads into a left-hand curve of approximately 180m radius which is two steps below desirable minimum standard. A straight section of road follows this curve for approximately 160m. A right-hand curve of approximately 300m radius (one step below desirable minimum standard) leads to another straight section of road approximately 345m in length.

At this point, a left-hand curve of approximately 100m radius (four steps below desirable minimum standard) is introduced followed by a straight approximately 160m in length and a right-hand curve approximately 125m radius (four steps below desirable minimum standard). The A2 Dublin Road continues for a straight distance of approximately 50m, passing under an existing railway bridge with a height restriction of 4.8m, until it reaches Cloghogue Roundabout.

6.2.1.6 Cloghogue Roundabout

Cloghogue Roundabout is a 60m ICD elongated roundabout with a circulatory carriageway width of 9m and six arms. Four arms accommodate merge and diverge slip lane arrangements to/from the A1/N1 Belfast-Dublin Corridor that passes overhead and the other two arms accommodate the A2 Dublin Road from the east and B113 Forkhill Road to the west. The Cloghogue Roundabout appears to conform to TD 16/07 but a detailed analysis would need to be carried out to confirm this.

6.2.1.7 A1/N1 Dublin Corridor Dual Carriageway

Travelling southbound from Cloghogue Roundabout, the on-slip lane emerges on to the A1/N1 Belfast-Dublin Corridor approximately 440m south of Cloghogue Roundabout. This section of dual carriageway, up to Ellisholding junction, consists of a short right-hand curved section beyond the merge lane of approximately 1020m radius followed by a straight section approximately 350m in length. Another right-hand curve of approximately 1,075m radius extends the dual carriageway alignment up to Ellisholding diverge slip arrangement. This dual carriageway is subject to a 70mph speed limit which equates to a 120kph Design Speed. The curves used in this part of the alignment are within standard in accordance with TD 9/93.

6.2.1.8 B79 Fathom Line and U5284 Fathom Line

The B79 Fathom Line is currently derestricted, and is therefore subject to a speed limit of 60mph which equates to a Design Speed of 100kph. The B79 Fathom Line is a horizontally sub-standard alignment. From the south-western boundary of the Study Area, at the border with RoI, the alignment continues straight for approximately 400m and then into a right-hand curve of 450m radius (two steps below desirable minimum standard). A relatively straight portion of road follows this curve which is 400m long. Following the straight is a series of reverse curves approximately 880m radius (within standard). The alignment then encounters further reverse curves just opposite Green Island approximately 1,500m radius (within standard). From this point another series of reverse curves are present with radii between 200m and 400m (two to three steps below desirable minimum standard). The alignment then has a straight section for approximately 700m and beyond this point are another series of reverse curves with radii between 70m – 400m (between two and seven steps below standard).

A straight length of approximately 785m brings the B79 Fathom Line up to the B79 Drumalane Road and a priority junction arrangement means that U5284 Fathom Line continues north, adjacent to Newry Canal towards Newry City centre. A 40mph speed limit is imposed at this point which equates to a Design Speed of 70kph. This section of Fathom Line has a straight section approximately 620m in length. A 30mph speed limit is imposed approximately half way along this part of the road alignment. A right-hand curve of approximately 255m (one step below desirable minimum standard) follows this straight section and leads into another straight section approximately 810m in length where the Fathom Line approaches its junction with A1 William Street and A28 Bridge Street.

6.2.1.9 B79 Drumalane Road

This section of road extends from the priority junction with B79 Fathom Line/U5284 Fathom Line, heading north towards the A2 Dublin Road junction and is subject to a 40mph speed limit which equates to a Design Speed of 70kph. The alignment begins with a straight section of approximately 170m in length followed by a series of reverse curves. This set of reverse curves comprises a left-hand curve approximately 600m radius (within standard), a right-hand curve approximately 240m radius (two steps below desirable minimum standard) and left-hand curve approximately 320m radius (one step below desirable minimum standard). The alignment continues on a straight of approximately 370m in length where the speed limit changes to 30mph which equates to a Design Speed of 50kph. This straight section of road is followed by reverse curvature consisting of a right-hand curve approximately 90m radius (two steps below desirable minimum standard) and a left-hand curve approximately 240m radius (within standard). A short section of straight geometry follows for a distance of approximately 40m before a left-hand curve of approximately 150m radius (two steps below desirable minimum standard) leads the road back to a predominantly straight alignment for a distance of approximately 125m up to its junction with A2 Dublin Road.

6.2.2 Vertical Alignment

The existing vertical alignment is reasonably satisfactory on the majority of the existing route and the roads roughly follow the natural topography of the landscape. An assessment has been carried out using a digital terrain model (DTM) obtained from Ordnance Survey of Northern Ireland (OSNI). This data consists of digital elevations for ground positions at 10m grid intervals and is translated into contours at varying height differences. The DTM is derived from OSNI's Ortho-photography dataset. All height measurements refer to elevation in metres above Ordnance Datum, Belfast. The accuracy of DTM data is as follows:

- 65% of data is within +/-1.0m accuracy;
- 95% of data is within +/-2.0m accuracy;
- 99% of data is within +/-3.0m accuracy, and
- within forests, accuracy will be reduced as ground height can only be estimated.

Using the DTM data, a coarse assessment was carried out on the vertical alignment of the existing routes.

6.2.2.1 A2 Warrenpoint Road Dual Carriageway

An initial assessment of the existing vertical alignment has shown the route comprises a number of large radius crest and sag curves with shallow vertical grades that conform to TD 9/93 curvature standards. The route has a level difference of approximately 3m between the southernmost point of the study just southeast of Rough Island and Greenbank Roundabout so this area is considered relatively flat.

6.2.2.2 A2 Warrenpoint Road/Kilmorey Street, River Street, A28 William Street and A2 Dublin Bridge

These existing road alignments occur within a built-up area; made up of large radius crest and sag curves with shallow vertical grades which should be within TD 9/93 curvature standards. The level difference is approximately 2m between Greenbank Roundabout and the A28 William Street/A2 Dublin Bridge junction. A2 Dublin Bridge/Bridge Street rises approximately 6m in height from its junction with A28 William Street to its junction with A2 Dublin Road. The average gradient over this section of road is approximately 1.8%. A short gradient of over 4% occurs near the junction of A2 Bridge Street with A2 Dublin Road which is still within the TD9/93 standard.

6.2.2.3 A2 Dublin Road/Bridge Street junction to Cloghogue Roundabout

This section of road climbs quite steeply from its junction with A2 Bridge Street and B79 Drumalane Road up to Cloghogue Roundabout. There is a level difference of approximately 95m in height between these two points. This equates to an average gradient of 5% over this route length. It should be noted that a significant length of this route is at a gradient of approximately 6% which complies with TD 9/93.

6.2.2.4 A1/N1 Belfast Dublin Dual Carriageway

This newly constructed piece of road is relatively flat in grade. It consists of a number of large radius crest and sag curves with shallow vertical grades. The road rises approximately 25m in height from Cloghogue Roundabout to Ellisholding junction. This equates to an average gradient of approximately 1.6%.

6.2.2.5 B79 Fathom Line and U5284 Fathom Line

The B79 & U5284 Fathom Line alignment is adjacent to Newry Canal and therefore is relatively flat in gradient. There are some localised shallow crest and sag curves that may be up to three steps below desirable minimum standard in accordance with TD 9/93 (using a Design Speed of 100kph).

6.2.2.6 B79 Drumalane Road

This vertical alignment rises approximately 14m over the first 350m travelling from its junction with Fathom Line making a gradient of approximately 4%. The road then flattens out with no significant changes in gradient over the next 400m. From this point the alignment falls approximately 8m in height until it reaches its junction with A2 Dublin Road and comprises localised sections of road at approximately 4% gradient that complies with TD 9/93.

6.2.3 Alignment Overview

Table 6.1 shows an overview of the various segments within the route identified and gives a brief overview of their current standard.

Table 6.1 – Overview of route segments and their current standard

Route Segment	Design Speed	Horz. Alignment		Vert. Alignment		Design Speed Steps Below Minimum Standard
		Actual	TD9/93	Actual	TD9/93	
A2 Warrenpoint Road Dual Carriageway	120kph	720m*	1,020m**	Note 1	C=100 S=37	Horz. = 1 Vert. = Note 1
A2 Warrenpoint Road	120kph	255m*	1,020m**	Note 1	C=100 S=37	Horz. = 4 Vert. = Note 1
	50kph	127m*	180m**	Note 1	C=6.5 S=9	Horz. = 1 Vert. = Note 1
Kilmorey Street	50kph	150m*	180m**	Note 1	C=6.5 S=9	Horz. = 1 Vert. = Note 1
River Street	50kph	90m*	180m**	Note 1	C=6.5 S=9	Horz. = 2 Vert. = Note 1
A1William Street, Dublin Bridge & A28 Bridge Street	50kph	N/A	180m**	Note 1	C=6.5 S=9	Horz. = OK Vert. = Note 1
A2 Dublin Road/Bridge Street junction to Cloghogue Roundabout	50kph	100m*	180m**	Note 1	C=6.5 S=9	Horz. = 2 Vert. = Note 1
	70kph	125m*	360m**	Note 1	C=17 S=20	Horz. = 4 Vert. = Note 1
A1/N1 Belfast-Dublin Corridor Dual Carriageway	120kph	1020m*	1,020m**	Note 1	C=100 S=37	Horz. = OK Vert. = Note 1
B79 Fathom Line and U5284 Fathom Line	100kph	70m*	720m**	Note 1	C=155 S=26	Horz. = 7 Vert. = Note 1
	70kph	255m*	360m**	Note 1	C=17 S=20	Horz. = 1 Vert. = Note 1
	50kph	N/A	180m**	Note 1	C=6.5 S=9	Horz. = OK Vert. = Note 1
B79 Drumalane Road	70kph	240m*	360m**	Note 1	C=17 S=20	Horz. = 2 Vert. = Note 1
	50kph	90m*	180m**	Note 1	C=6.5 S=9	Horz. = 2 Vert. = Note 1

** Lowest actual standard throughout that segment of the road relating to the Design Speed*

*** Desirable Minimum Standard required correlating to the Design Speed*

Note 1 – Vertical alignment would require further analysis to ascertain K values

Source: Table 3 TD9/93: Highway Link Design (Volume 6: Section 1, Part 1)

6.3 Geotechnical Assessment

6.3.1 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 land-take. Due to the general site topography some of the earthworks may cover a large footprint, particularly for alignments located on the side of Fathom Mountain and therefore measures may be required to reduce these.

It may be possible to steepen the side slopes where the cuttings are to be formed in rock which would reduce the overall footprint of the earthworks and the subsequent land-take at key locations. Additional stabilisation measures may be required to facilitate the cuttings in rock; to be determined following a ground investigation.

Where embankments are to be constructed on weak ground, 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 in subsequent assessment stages 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. Similarly the toes of the higher embankments could be smoothly graded to blend into the landscape and avoid a harsh, geometric shape. Earthworks design detail would be developed when a more fixed alignment is chosen in future stages.

6.3.2 Significant Geotechnical Risks

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

The footprint of this quarry is vast and there have been historical reports of instability of the quarry face and on ground movements west of the quarry. These movements were considered to cause part of the collapse of existing Hillhead Road towards the quarry, leading to the decision to close a section of the road in 2005. Following remedial works the road was reopened for a short period but was 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 has indicated further movement has occurred since the road was closed.

Corridor 1 and 2 are within the zone of known historical instability along Hillhead Road. This is an area deemed to be of significant geotechnical risk. Corridor 5 passes through the Drumalane quarry floor and route options developed at a later date will require careful consideration to ensure that it is outside of any areas of instability.

6.3.3 Contaminated land

Due to the past and present site uses of land within the proposed corridors, there is a possibility of potential ground contamination. Information on historical land was sourced from the historical ordnance survey mapping and the NIEA land use database. Current site activities were also reviewed for potential contamination sources 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/pathway must exist. The impact of any confirmed potential contamination source with respect to identified sensitive receptors can be quantified and remediation/mitigation measures designed to address unacceptable risks.

6.3.4 Structures Foundations

The Newry River/Canal will be the main structural crossing, required for all Corridors. There will also be a requirement, on most of the corridors, to construct a bridge over the existing Dublin to Belfast Railway line along with some local road crossings. The main Newry River/Canal crossing will require detailed land and marine based ground investigations in order to assess the foundations both within the river and on-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 20m in places. These alluvial deposits will not provide adequate bearing capacity for shallow structures foundations. For all affected Corridors, the construction of the Newry Canal and/or River crossing is likely to require deep piled foundations to support the structure and the piers.

All Corridors, except Corridor 2, require a crossing of the Dublin to Belfast railway line in the vicinity of Ellisholding Junction. As Corridor 2 would tie in to the A2 Dublin Road to the east of the railway line it would not require a new crossing of the railway. At these locations 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 which would require ground investigations to determine the foundation requirements.

6.4 Structures

6.4.1 Introduction & General Issues

The structures requirements vary between the different indicative alignments but all options generally require the following main bridge structures, unless otherwise stated, which will be considered in detail:

- Mainline crossing of Newry River and Newry Canal (all Corridors except Corridor 4 Option B, river only);
- Mainline bridge over Dublin/Belfast railway line (all Corridors except Corridor 2); and
- Overbridge for local road crossing (area between A1/N1 and Newry River/Canal).

Other ancillary structural elements which may be required include culverts for small watercourses and earth retaining structures. These elements will not be explored in detail at this early stage of assessment but an allowance will be included in the cost estimate as appropriate for the anticipated requirements. The primary physical constraints affecting this scheme, which in turn influence the nature and scale of 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 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 structure.
- The Newry River/Canal which requires maintenance of navigation for a variety of vessels including tall sailing ships. Victoria Lock is the southern entry point of the canal and the navigation requirement applies to the canal north of the lock and the open river to the south. Navigation could be facilitated by either providing an opening bridge giving unrestricted height for navigation consistent with current conditions, or a high level fixed bridge set at a minimum 37m above the highest water level.
- With the exception of Corridor 2, all alignments cross over the existing Belfast to Dublin railway line. Most of these 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 and it is envisaged that an overbridge will be required for all corridors in order to maintain connectivity for local traffic.
- The Drumalane Quarry on the western bank of the Newry River and the suspected instability of the surrounding land represents a major obstacle for route options within Corridors 1 and 2.

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 bridge structures, both in terms of the finished permanent structures and the construction methods adopted.

The square width of the mainline underbridges to be adopted for costing purposes is 14.8m which is the total width including parapet plinths, based on the configuration shown in the indicative cross section in Figure 6.4.1.

The specific details of the three primary bridge types will be discussed in the following sections. The construction cost estimates will be based on all-in rates for cost per m^2 of gross bridge deck plan area, which is the typical approach adopted for this stage of assessment. Overall bridge dimensions will be provided below and the cost rates adopted will be discussed further in Section 6.4.6.

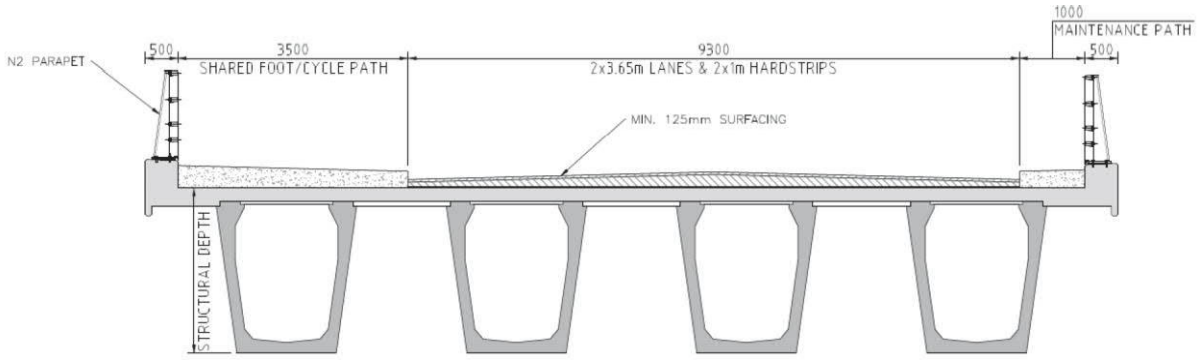


Figure 6.4.1 – Indicative mainline underbridge cross section

6.4.2 Newry River/Canal Bridge

In order to provide a link between the A1/N1 and A2 roads within the Study Area to the south of Newry, all routes involve a crossing of Newry River and routes traversing north of Victoria Lock must also span the Newry Canal. The crossing of the Newry River and Canal is the single most significant engineering element on this scheme and the structural form and scale of the bridge varies considerably between the different alignment options.

There are a number of factors that will influence this structure but the most significant is a desire by Newry Mourne and Down District Council to maintain navigation on the canal north of Victoria Lock and on the open river to the south of the lock. The Council indicated in 2008 that, *"The minimum clearances for a moveable bridge will be those that allow the tallest of ships with large masts (up to an air draft of 30m plus)"*. Therefore a minimum vertical clearance between high water level and bridge deck soffit of 37m for these vessels was adopted for assessment. This means that fixed bridges crossing the navigation channel would require >37m vertical clearance and all lower level bridges would require an opening span, assumed to be a single leaf bascule structure for the purposes of this assessment. The bascule section of the bridge, which entails a section of deck rotating vertically about a pivot mechanism at one support, will provide unrestricted clearance above the navigable channel.

Consultations to date have indicated that physical impacts on the canal, including its banks and bed, will not be permitted due to its status as a Scheduled Monument. Therefore the bascule section will have to provide a clear span of the canal with bridge supports set-back from the banks. The opening section will also require a sizeable pier at the pivoting end to house the back span counterweight beyond the pivot point, the rotating mechanism and the associated mechanical and electrical services. It is proposed that an additional 15m in length should be added to the clear width of the canal to allow for setback and the bascule pier; this total length is to be used for costing purposes. For example for a square crossing, given a clear canal width of 35m and 15m additional length, a 50m length would be used for calculating the deck area for costing purposes. The width of the canal is not constant and varies from 27m to 40m square width at the crossing points considered for NSRR. For the alignment options which cross the navigable section of the river, i.e. Corridor 4 alignments crossing north of Victoria Lock, a total bascule section length of 55m is proposed for costing purposes.

In scenarios where the mainline crosses the canal at a skew, the bridge supports for the bascule span will have to remain square to the road alignment in order to facilitate the vertical rotation. Therefore, in these situations the effective clear span of the canal will have to allow for an additional width for the setback of the square supports.

Based on the alignment options developed for assessment, only the Corridor 3 alignment has sufficiently high clearance over the canal to avoid having an opening section. Allowing for structural depth of the deck this alignment provides a minimum of 38.5m of clearance over the navigable channel. However the height of this option results in a long structure and the horizontal alignment results in horizontal curvature on the deck.

A summary of other factors which add complexity and cost to the river/canal crossing are detailed below with adjustments to the base rate also provided. Also details of the specific characteristics of the river/canal bridges, for each of the alignment options are shown below.

6.4.2.1 River/Canal Bridge Summary

The following Table 6.2 provides a summary of bridge dimensions based on the information above, to be used for developing cost estimates. The overall bridge length has been rounded to the nearest 5m and the bascule section length is rounded to the nearest 1m.

Table 6.2 – Summary of Newry River/Canal Bridge dimensions

Corridor	Overall Length (m)	Bascule Length (m)	Fixed Length (m)
1	345	45	300
2	485	55	430
3	800	N/A	800
4 (A)	415	55	360
4 (B)	200	55	145
5	145	45	100

6.4.3 Railway Bridge

A mainline crossing of the Dublin/Belfast railway line is required for Corridors 1, 3, 4 & 5 in the vicinity of Ellisholding Junction. Corridor 2 ties-in to the Dublin Road to the east of the railway line and therefore does not require a railway crossing.

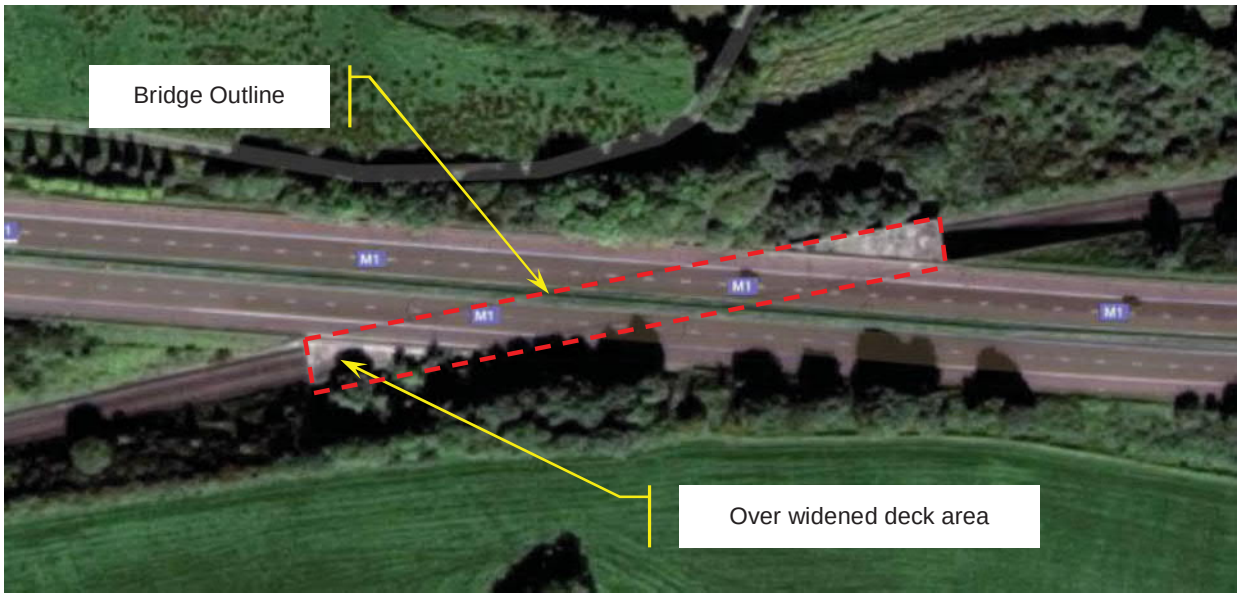


Figure 6.4.2 – M1 crossing Belfast - Portadown railway line on an over widened underbridge

The railway line is dual track at this location but the length of the bridge varies considerably between corridors as a number of the routes cross at a very high skew angle. A square span of 20m is assumed for this bridge but if a skewed crossing is required the span would increase with skew angle and the deck area is calculated from 'skew span' x 'square width'. Typically the preferred integral bridge construction is not permitted when skew exceeds 30^{o} and very high skews can lead to structural problems with bearings and movement joints and result in inefficient design. In very high skew underbridges with short square spans, it is normally more efficient to provide a square spanning bridge and over widen it to accommodate the road crossing at a skew. An example of this type of bridge is where the M1 motorway crosses the Belfast to Portadown railway line at approximately 70° skew between Lurgan (Junction 10) and Moira (Junction 9), as shown in Figure 6.4.2.

The main benefits of this type of construction are that the square span permits integral construction (eliminating bearings, thus removing the need for access along the railway for bearing inspection and maintenance) and simplifies movement joints. It also minimises the span which reduces the structural depth of the deck. For example given a square span of 20m, a skew angle of 60° would result in a skew span of 40m which would increase deck structural depth by approximately 1m. This could be significant on this scheme as achieving headroom clearance over the railway is a constraint. It is recommended for NSRR that this type of square spanning over widened deck is assumed for costing purposes for structures with skew angles >45°. The overall width of a bridge of the type shown in Table 6.3 – Railway Crossing Dimensions is a function of skew and a summary of the railway crossing skew angles and proposed bridge dimensions for the NSRR indicative routes which is shown in Figure 6.4.3.

Table 6.3 – Railway Crossing Dimensions

Corridor	Skew (°)	Span (m)	Overall Width (m)	Deck Area (m²)
1	68°	20	89	1780.2
2	**No Rail Crossing**			
3	61°	20	66.6	1332.2
4 (A)	61°	20	66.6	1332.2
4 (B)	61°	20	66.6	1332.2
5	No Skew	20	14.8	296

6.4.4 Overbridge for existing roads

The indicative alignments cross the existing local road network in several locations in the area between the A1/N1 and the Newry River. Typically the roads affected are Flagstaff Road, Hillhead Road, Barracric Road and Brogies Road. It is anticipated that redirection of some of these roads would be possible such that provision of crossings can be minimised. The following is a summary of proposed bridges required for local road crossings:

- Corridor 1 – Flagstaff Road Overbridge (Brogies Road redirected).
- Corridor 2 – Hillhead Road Overbridge.
- Corridor 3 – Flagstaff Road Overbridge (Barracric Road redirected).
- Corridor 4 – Flagstaff Road Overbridge (Barracric Road redirected).
- Corridor 5 – Flagstaff Road Overbridge (Barracric Road redirected).

The indicative alignments would also either cross or tie-in with Fathom Line Road. The mainline cross section at the crossing locations identified above would be the 'Wide Single 2+1' configuration shown below in Figure 6.4.3, with 18.5m overall width including verges. For the purposes of assessment the overbridges are assumed to be three span open type structures of 50m overall length (20m main span and 2x15m side spans) and 12m overall width. These structures are all in an area where rock is expected at typically <3m depth below existing ground level and therefore foundation conditions are expected to be favourable. The structures are typically low skew and are anticipated to be relatively straightforward integral bridges.

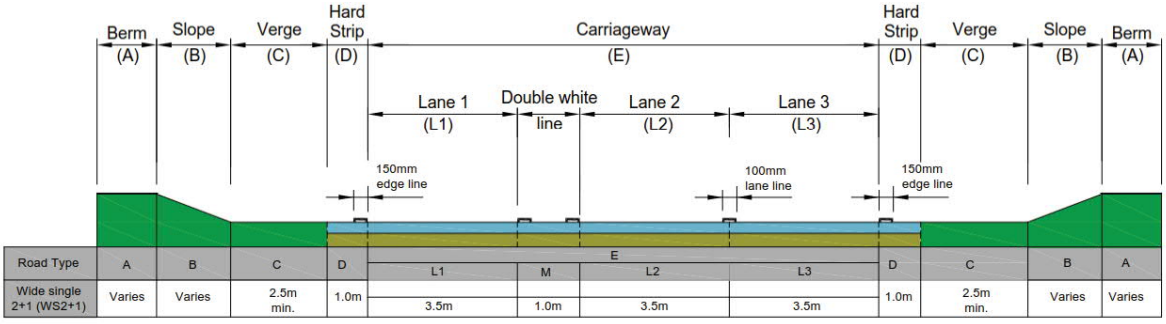


Figure 6.4.3 – DMRB TD 70/08, Figure 3/1, Cross-Section Width for WS2+1 Road

6.4.5 Headroom at structures

It is assumed that NSRR 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 road bridges, in accordance with DMRB TD 27/05: *Cross-sections and Headrooms*. This headroom would be adopted for both overbridges and underbridges over side roads. Structures which are vulnerable to vehicular impact, such as signal/sign gantries or footbridges would require minimum headroom of 5.7m plus allowances for structural deflection and sag curves. A minimum vertical clearance of 37m is required for fixed bridges over navigable sections of the Newry River and the Newry Canal.

6.4.6 Indicative Bridge Cost Estimate

As discussed previously, the construction cost estimates will be based on all-in rates for cost per m2 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 NI and it is proposed that a baseline rate of £2,000/m2 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 NSRR. This rate will be adjusted for particular features of the individual structures as described below.

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 6.4.

Table 6.4 – 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/m2 was 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.

As the cost of an opening structure significantly increases the cost of the respective bridges by up to 80%, then the need for an opening structure would have to be fully investigated in any future study.

A summary of factors which add complexity and proposed adjustments to the base cost rate are as follows:

- Bascule opening span – base rate x 10 = £20,000/m2 applied to footprint of span and bascule pier.
- High level construction – defined as >15m above existing ground level, add 25%.
- Poor ground conditions – difficult/complex foundations e.g. close to or crossing river; add 20%.
- Construction in river/flood plain – environmental constraints, additional complexity and temporary works, possible seasonal working, difficult access; add 20%.
- Horizontal curvature on deck will add to the complexity and limit use of precast - add 10%.

Based on these proposed adjustments, the suggested rates to be adopted for fixed bridge construction over the river/canal for the different indicative routes are as follows:

Corridor 1 – Does not cross floodplain but poor ground conditions expected (add 20%); Considered high level as significant portion >15m above EGL (add 25%); Deck curved on plan (add 10%); Total add 55% » £3,100/m2.

Corridor 2 – Crosses floodplain (add 20%); Poor ground conditions (add 20%); Deck curved on plan (add 10%); Total add 50% » £3,000/m2.

Corridor 3 – High level as majority >15m above EGL (add 25%); Crosses floodplain (add 20%); Poor ground conditions (add 20%); Deck curved on plan (add 10%); Total add 75% » £3,500/m2.

Corridor 4 – Crosses floodplain (add 20%); Poor ground conditions (add 20%); Total add 40% » £2,800/m2.

Corridor 5 – Does not cross floodplain but poor ground conditions likely (add 20%); Total add 20% » £2,400/m2.

Another aspect to consider is the operation and maintenance costs of the bascule bridge which are over and above standard maintenance costs associated with fixed bridges. It is proposed that an operating cost of £26,000 per annum should be included for assessment of bascule bridges, broken down as follows:

- Routine quarterly service on the bridge's mechanical and electrical equipment – £10,000 per annum.
- Non-routine maintenance, i.e. part replacement or call-outs for breakdowns – £5,000 per annum.
- Fees to operatives opening the bridge of £10,000 per annum.
- Other running costs for electricity generator, sump pumping etc. – £1,000 per annum.
- No allowance has been made for the cumulative effect of additional complexity factors.

It is recommended that a premium of 25% be added to the baseline rate for the railway crossing to allow for added complexity and constraints associated with working adjacent to and over a live railway. Works over the railway would require track possessions which would likely result in phased construction and work outside of normal hours, i.e. at weekends and during the night. Therefore a rate of £2,500/m2 is proposed for this structure.

The overbridges for local roads are anticipated to be relatively straightforward integral overbridges and the baseline cost rate of £2,000/m2 is proposed for costing these structures. A summary of total bridge costings for the tree main structure types on each corridor is given in Table 6.5 below.

Table 6.5 – Bridge Crossing Indicative Cost Estimates for each Corridor

Corridor	River/Canal Bridge	Railway Bridge	Local Road Bridge	Total Cost (£/M)
1	£27.3M	£4.5M	£1.2M	**£33.0M***
2	£35.6M	N/A	£1.2M	**£36.8M***
3	£41.4M	£3.3M	£1.2M	**£46.0M**
4 (A)	£31.2M	£3.3M	£1.2M	**£35.8M***
4 (B)	£22.3M	£3.3M	£1.2M	**£26.9M***
5	£16.9M	£0.7M	£1.2M	**£18.9M***

* These routes have a bridge opening section requiring an allowance of £26,000 per annum for operation

6.5 Rivers, Watercourses and Drainage

6.5.1 Introduction & General Issues

The DMRB recognises that adequate drainage is essential to the performance of a new road scheme and can be used to limit its associated impact on the surrounding environment. This section examines the current drainage within the area. The impact of scheme options and how they will affect the existing drainage regime will be shown in Section 6.9 which shows the number of watercourse crossings associated with each route corridor.

Information about watercourses is provided by the Rivers Agency. The watercourses found in the Study Area are both designated and undesignated watercourses. A designated watercourse is maintained by the Rivers Agency using public funding and an undesignated watercourse is maintained by the landowner.

The Newry River is a main regional watercourse in the area; and is also a designated watercourse. It flows under the famous Newry Town Hall to the head of Carlingford Lough. The Clanrye River breaks away from the Newry River near Drummillar. The Clanrye curls around from its sources in the foothills of the Mourne Mountains then progresses under the main existing Belfast to Dublin A1/N1 road at Sheepbridge and onward toward the Mayobridge Road at the Crown Bridges and Ashtree Cottages.

The Newry Canal continues from Lough Neagh through various lock gates and under bridges. The canal is fed by the River Bann which spans from Lough Neagh to Portadown. The River Bann splits south of Portadown to form the: River Bann, Cusher River and Newry Canal. At this point the Newry Canal heads southwards bypassing to the west of Gilford, through Scarva, Poyntzpass and Jerrettspass and then entering Newry at the north running parallel to the Tandragee Road. See Figure 7.10.1 in Appendix A for watercourses.

There are many crossings of the Newry River/Canal including the A1/N1 crossing at a point to the north of Newry, west of Sheepbridge junction/Tandragee Road. The Newry River/Canal crosses into the Study Area dissecting it down the centre; therefore, a crossing would be required for each corridor. There are also a number of tributaries located on the eastern and western banks of the Newry River/Canal within the Study Area, shown in Figure 1.1.2 in Appendix A.

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 adjacent to the Newry River/Canal. These are the main drainage channels in the Study Area. Minor watercourses on the western side of the Study Area generally flow from west to east, to the point where they connect into the Newry River/Canal which flows from north to south before they outlet into Carlingford Lough. On the eastern side of the Newry River/Canal the ground has a more gentle profile with water draining from east to west. Within the Study Area, Newry River is affected by the tidal fluctuations in Carlingford Lough.

All route options cross watercourses which, apart from the Newry River/Canal, are not of significant size; however, these would be accommodated by installing culverts beneath the new road; with the exception of the Newry River/Canal which would be crossed by a bridge structure. Where the proposed route alignment crosses

a watercourse this represents an opportunity to outfall road drainage. Discharge consent will be required from Rivers Agency and Northern Ireland Environment Agency (NIEA).

Under Schedule 6 of the Drainage Order 1973, approval is required for any discharge to a watercourse. Typically the proposed rate of storm runoff should be no greater than the existing rate. The Rivers Agency uses the value 10 litres/sec/hectare for green field run-off. If this is exceeded then a Flood Risk Assessment (FRA) should be developed to demonstrate that there will be no negative downstream impact as a result of increased discharge.

Any drainage proposals for the options which involve construction of additional roundabouts and slip roads at Ellisholding junction could be discharged to watercourses in the vicinity of the junction. Corridor 4 and Ellisholding Tie-in Corridor Options have the highest number of crossings, equating to the highest number of culverts being required, these also present the greatest number of discharge opportunities. Corridors 1 & 2 have the lowest number of crossed watercourses.

The principal objective of the Drainage Assessment, at this stage, is to establish the existing drainage regime and to consider possible drainage proposals for the various scheme options, which include drainage outfall options.

Drainage systems are required to be installed within all trunk roads to:

- Assist with the speedy removal of surface water to provide safety and prevent flooding of the highway;
- Provide effective sub-surface drainage maximising pavement longevity and its associated earthworks;
- Minimise the impact of the runoff on the receiving environment, and
- Provision of effective sub-surface drainage to prevent groundwater build-up.

Through consultation and engineering assessment the drainage design will be progressed with the objective being to achieve an agreed and approved drainage system, which: minimises the environmental impact; has minimal impact on the receiving location, gives best value for money, whilst satisfying third party requirements.

Table 6.6 – 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	Through Newry City	Significant canal flowing from Lough Neagh	Carlingford Lough, to the Irish Sea
Newry River/Canal Tributaries – Western part of Study Area			
Undesignated	In the vicinity of the A2 Dublin Road area	Minor watercourse running parallel to the north of A2 Dublin Road. Culverted from the Quays development towards Newry Canal	Newry Canal
Undesignated	In the vicinity of B79 Fathom Line/B79 Drumalane Road priority junction	Minor watercourse running between the Hillhead Road and developments at Cloughogue Roundabout	Newry Canal
Undesignated	In the vicinity of Barracric Road, close to the A1/N1 Newry Bypass heading eastwards; 1.7km south of B79 Fathom Line/Drumalane Road junction	Minor watercourse running through Fathom Lower Wood (possibly fed by road drainage from Newry Bypass)	Newry Canal
Undesignated	2.7km south of B79 Fathom Line/B79 Drumalane Road priority junction	Minor watercourse running through a wooded area	Newry Canal
Undesignated	2.9km south of B79 Fathom Line/B79 Drumalane Road priority	Minor watercourse running through a	Newry Canal

Name	Location	Description and comments	Outfall Location
	junction	wooded area	
Newry River/Canal Tributaries – Eastern part of Study Area			
Undesignated	In the vicinity of the Greenbank industrial Estate running parallel on the eastern side of the A2 Warrenpoint Road	Minor watercourse running parallel in a ditch on the east side of the A2 Warrenpoint Road	Newry River
Undesignated	In the vicinity of the Old Warrenpoint Road junction with the A2 Warrenpoint Road	Minor watercourse that runs parallel to the west of the A2 Warrenpoint Road	Newry River
Undesignated	300m south of Old Warrenpoint Road junction with A2 Warrenpoint Road	Minor watercourse running through a wooded area	Newry River
Undesignated	750m south of Aghnamoira Road junction with A2 Warrenpoint Road	Minor watercourse running through a wooded area	Newry River
Undesignated	950m south of Aghnamoira Road junction with A2 Warrenpoint Road	Minor watercourse running through a wooded area	Newry River
Undesignated	1.2km south of Aghnamoira Road junction with A2 Warrenpoint Road	Minor watercourse running through a wooded area	Newry River

Source: Rivers Agency

6.5.2 Methodology

In accordance with the requirements of DMRB Volume 4, Section 2 (Drainage), the steps taken include:

- Consultation with the relevant drainage authorities to obtain information on the location and nature of all existing drainage. These authorities include Rivers Agency and NI Water; and
- An analysis of the information supplied by the service providers and the creation of a figure detailing the existing drainage, Figure 6.7.5 in Appendix A.

The study culminated with an assessment being undertaken which examined drainage proposals for each of the different Scheme Options, outlined in Section 6.9 below.

6.5.3 Flood Risk Issues

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. Rivers Agency has produced a strategic flood map for the area giving an indication of the likely future flooding patterns as a result of climate change. These levels show large areas 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 floodplain area available – the mudflats to the Newry River banks. See Figure 7.10.1 in Appendix A for flooding issues.

6.5.4 Stage 2 Hydraulic Modelling

To accurately assess the above, at Stage 2, hydrological and hydraulic modelling of the watercourses will need to be carried out to accurately determine the Q_{100} flood levels and confirm any effects on flood levels as a result of

the proposed river crossings associated with the Preferred Corridor. Hydraulic modelling is recommended to be carried out using a 1Dimensional unsteady model, as the flooding mechanisms incorporate significant volume elements. Assessment of the floodplain storage and calculation of appropriate compensation storage design where required should be carried out.

6.5.5 Drainage

There is likely to be extensive existing drainage associated with the main road corridors, which would need to be considered in detail once the preferred corridor is chosen. It is considered unlikely that any significant attenuation facilities are currently provided along these route options. Therefore, additional attenuation may need to be provided for any drainage flows from existing roads which are affected by any proposed corridors. See Figure 6.7.5 in Appendix A for scheme drainage.

6.6 Design Standards

6.6.1 Horizontal and Vertical Alignment

The Newry Southern Relief Road will extend from a point on the A2 Warrenpoint Road dual carriageway and link to the A1/N1 Dual carriageway (A1/N1 Corridor). The indicative route alignments cross the environmentally sensitive Newry River/Canal area with the final section of the alignment passing through mountainous and rolling terrain, some of which is classified as an Area of Outstanding Natural Beauty (AONB).

There is the need for consistency when applying design standards across the scheme. As well as satisfying basic Design Standards, the indicative route alignments have been designed to integrate into the surrounding landscape, with a smooth and natural appearance, which has been an objective during design development.

6.6.2 Selection of Design Standards

The selection of design standards is related to road function, volume of traffic and terrain, with additional procedures for the recognition and appropriate treatment of potential hazards. Opportunities for the relaxation of standards have also been identified for each route alignment considered.

A basic assumption in the approach is that drivers receive clues about the standard of the road from local surrounding features such as the terrain, levels and types of flow, as well as geometric elements. Additional design consideration or special signing will only be necessary where the information available to the driver may lead to incorrect interpretation and consequent danger.

It is acknowledged that there will be some degree of physical impact on the surrounding landscape during construction; however, much of the alignment impact should be reduced by detailed design analysis of a particular route alignment. This would be given appropriate consideration at any future stages.

6.6.3 Cross-sectional Considerations

The carriageway cross-section forms part of the total road design and is inter-dependant with other design aspects which can influence the choice of cross-section, including:

- the verge width - relates to the sight distance available due to vertical and horizontal alignments;
- the pavement surface treatment;
- anticipated link gradients and their effect on HGV vehicles;
- adjoining lane widths;
- landscaping features, and
- predicted traffic volumes and composition.

A holistic approach must be taken which must have regard for traffic flows carried by the proposed link. High flows may carry a greater risk of queues and standing traffic approaching junctions in the peak period. Conversely, lower flows might encourage higher speeds. Cross-sections, chosen for route alignments considered, conform to TD 27/05 and details are provided in Section 6.6.11 and Figure 6.6.1 in Appendix A.

6.6.4 Design Speed

The Design Speed of a road has a specific impact on: cost, safety, quality and the environment. A higher Design Speed necessitates increased geometric parameters, which can create complexities when designing the alignment to fit inside the landscape and topographical constraints of the Study Area. In the indicative route alignments considered, the Design Speed selected was as high as practicable to attain a specified degree of safety, mobility and efficiency while taking into consideration constraints of environmental quality, social and political impacts, economics and aesthetics.

Design Speed is used as an index which links: road function, traffic flow and terrain to the design parameters of sight distance and curvature. Design Speed is used to ensure that a driver is presented with a reasonably constant speed environment that is consistent with what drivers are likely to expect on a given road.

In addition, within each route alignment considered, the chosen Design Speed is applied consistently throughout the section keeping in mind the speed drivers are likely to expect. The proper use of Design Speed creates consistent roads and expectations for the driver. The Design Speed chosen for each route alignment is presented in Section 6.6.4.

6.6.5 Safety Considerations

6.6.5.1 Safety in Design

To achieve a high standard of road safety, the route alignments considered have been optimised by linking geometric elements to a Design Speed, so that the resulting geometry has a consistency which reduces the likelihood of a driver being presented with an unexpected situation. This concept of driver expectation forms part of the design practice adopted in this route alignment design.

6.6.5.2 Safety Barrier Provision

The design of a road restraint system is an important detail that will contribute to the overall look or theme of the design; therefore, in addition to safety, the selection of an appropriate barrier design should include aesthetic considerations.

All safety barriers must meet crash-testing guidelines for the type of road being designed. Crash-testing guidelines have different levels, depending on the class of road and the type of vehicles that will use that road. The requirements of Design Standard TD 19/06: *Requirement for Road Restraint Systems* should be complied with for all safety barrier requirements on a particular route alignment.

Given these options, decisions based on safety, cost, and aesthetics must be balanced with the standard of route alignment achieved. This process will be investigated in more detail when further refinement is made to the route options considered at future stages.

6.6.5.3 Vehicle Arrester Bed Provision

Vehicle arrester beds assist heavy vehicle drivers who lose control of their vehicle due to overheating of brakes on long descending grades. Heavy vehicles must travel slowly downhill to minimise braking as the vehicles' brakes may overheat causing the driver to lose control due to loss of braking ability if they are applied too frequently. Where long descending grades exist or where topographic controls require such grades on a new alignment, the design and construction of an emergency escape ramp at an appropriate location may be desirable for the purpose of slowing and stopping an out of control vehicle away from the main traffic stream.

An escape ramp could be provided on a long downgrade which is present on all indicative route alignment options. Rather than continuing down a grade out of control, the driver can choose to enter the escape ramp where an arrester bed can bring the vehicle to a safe stop.

The design and construction of escape ramps involve a number of considerations and there is specific guidance given in TD 19/06. This Design Standard advises that the provision of an arrester bed requires agreement with the Overseeing Organisation and should be supported by a risk assessment. The provision of an arrester bed will require further detailed analysis and this work will be undertaken at future stages to determine arrester bed requirements on the chosen route alignment.

6.6.5.4 Carriageway Lighting

The decision whether or not to provide road lighting will require reference to TA 49: *Appraisal of New and Replacement Lighting on the Strategic Motorway and All Purpose Trunk Road Network* and will be considered at future stages.

6.6.6 Relaxations and Departures from Standard

The DMRB contains both technical advice and direction on relaxations and departures. The standards define a sequence of parameter values in the form of a hierarchy of geometric design criteria related to Design Speeds. This three-tier hierarchy enables a flexible approach to be applied to a range of situations where the strict application if the Desirable Minimum Standards would lead to disproportionately high construction costs or severe environmental impact upon people, properties or landscapes.

Designs that conform to Desirable Minimum requirements will produce a high standard of road safety which was the initial objective when developing all indicative route alignment options. The road standard is satisfactory on the indicative route alignment options and does not become unsafe where values have been reduced.

The limit for Relaxations is defined by a given number of Design Speed Steps below a specific benchmark, usually the Desirable Minimum. Relaxations vary according to the type of road – motorway or all-purpose, and whether the Design Speed is at the upper or lower limit of each Design Speed Category band.

In situations of exceptional difficulty, which cannot be overcome by Relaxations, it may be possible to overcome them by the adoption of Departures, the third tier of the hierarchy. Proposals for Departures from Standard must be submitted to the Overseeing Organisation for approval before incorporation into a design layout to ensure that safety is not significantly reduced. Where required, Relaxations and Departures would be considered in detail during Scheme Specimen Design and processed in accordance with The Department for Infrastructure standard procedures.

6.6.7 Provision of Lay-bys and Rest Areas

Given the strategic nature of the route alignments considered together with the spectacular views available from Fathom Mountain, the provision of lay-bys and/or rest areas would be an important consideration. Guidance on the location and layout of lay-bys and rest areas is contained in TA 69/07: *The Location and Layout of Lay-bys and Rest Areas* and TA 57/87: *Roadside Features* and DEM 129/11 *Location of Lay–bys and Rest Areas*. A number of the route alignments considered open up potential view points over the valley that have previously been inaccessible on Fathom Mountain. Consideration should be given to the location of a lay-by or picnic area as part of future stages for a chosen route alignment.

6.6.8 Earthworks

As will be appreciated all options involve the provision of an indicative route alignment on a steep sided valley. One consequence of this is a significant earthwork outline requiring both embankments and cuttings. Current practice, in the absence of detailed geotechnical information, is to provide 1:2.5 (vertical: horizontal) side slopes for highway cross sections and this has been used in preparation of route alignment options unless otherwise stated. Some of the earthworks outlines were considered excessive when imposed on the original topography particularly for route alignments located on the side of Fathom Mountain and an alternative cross section was developed based on the assumption that there would be rock at or near the surface of the valley side. An alternative side slope of 1:1 was proposed on these valley sections of the indicative route alignments in cuttings to minimise excessive land take.

There are drawbacks associated with steep rock slopes and detailed geotechnical information is essential to achieve an economic solution. Where a 1:1 slope is considered in proposed options an extra cost has been included for any necessary rock cutting, pinning or netting likely to be required for stabilisation.

The earthworks design will be further developed in subsequent assessment stages order to harmonise the highway landscape with the local topography as far as possible. Where appropriate the tops of cutting 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. This level of earthworks design detail can be developed when a preferred alignment is chosen in future stages.

6.6.9 Engineering Constraints

The design proposals take into account the following physical constraints:

- existing local and strategic road network;
- existing Belfast to Dublin railway line;
- the steep nature of the existing topography;
- existing Newry Canal;
- existing Newry River; and
- Drumalane Quarry.

6.6.10 Junction Spacing & Weaving Lengths

The existing A1 corridor has a number of major junctions within or close to the Study Area. Spacing between some of these is less than the desirable minimum for a high standard dual carriageway. Currently, DMRB standard TD22/06: *Layout of Grade-separated junctions* requires a minimum weaving length of 1km for a Rural All-Purpose dual carriageway such as the existing A1/N1. The distance between Cloghogue Roundabout and Ellisholding junction is 1.6km which produces a weaving length less than 1km; a lane gain is used to compensate for this which widens the A1/N1 carriageway along this section to three lanes wide. The introduction of an additional junction would create significant road safety issues. It is therefore proposed to link the indicative alignments into existing junctions as opposed to constructing new junctions along the A1/N1.

Along the A2 Warrenpoint Road dual carriageway siting of new roundabouts will be dependent on the traffic volumes which would determine queue lengths. Currently on the A2 Warrenpoint Road dual carriageway between Greenbank Roundabout and the south-easternmost point of the Study Area at Warrenpoint there seems to be no restriction as currently the distance between these points is 6.4km with two side road junctions: the Old Warrenpoint Road and Aghnamoira Road currently sited 2.3km and 3.2km respectively from Greenbank Roundabout. Therefore, siting of new roundabouts should not be limited and could, at the right location, even incorporate an existing side road improving road safety onto the existing A2 Warrenpoint Road dual carriageway.

6.6.11 Geometric Design Standards

The DMRB standards that have been used throughout the engineering assessment of the corridors, includes:

- TD 9/93 – *Highway Link Design*;
- TD 70/08 – *Design of Wide Single 2 + 1 Roads*;
- TD 16/09 – *Geometric Design of Roundabouts* , and
- TD 27/05 – *Cross-Sections and Headroom*.

Table 6.7 and Table 6.8 illustrate the geometric design standards adopted for the preliminary design of the indicative route alignments. They indicate values suitable for the mainline alignments only from A2 Warrenpoint Road dual carriageway, over the Newry River and Newry Canal, to Ellisholding/Cloghogue Roundabout or old A1 Dublin Road junction. Three cross-section types have been identified, further information on these is provided in Figure 6.6.1 in Appendix A.

Table 6.7 – Cross-section standards adopted in Indicative route alignment design

Indicative route alignment design details	Cross-section Classification	
	S2	WS2+1
Design Speed (kph)	100	100
Speed limit (mph)	60	60
Lane width	2 x 3.65m lanes	3 x 3.5m lanes

Indicative route alignment design details	Cross-section Classification	
	S2	WS2+1
Hardstrip (L+R)	1.0m	1.0m
Minimum Verge width (L+R)	2.5m	2.5m
Median strip width	n/a	1.0m
Overall Carriageway width	9.3m	13.5m
Central reserve	n/a	n/a

Source: DMRB standards

Table 6.8 – Standards adopted in Indicative route alignment design

Geometrical Design Element	Design Standard Adopted	
Horizontal alignment - radii	Desirable Minimum	720m
	Two steps below	360m
Vertical alignment	Desirable Minimum Crest K value	100
	One step below Desirable Minimum Crest K value	55
	Absolute Minimum Sag K Value	26
Gradient	Minimum	0.5%
	Maximum	6%
Superelevation	Maximum	7%
Stopping sight distance (SSD)	Desirable Minimum	215m
Vertical clearance	Minimum clearance under structures	5.3m

Source: DMRB standards

6.7 Public Utilities

This section of the report details the existing utilities which are located within the Study Area. Section 6.9 further examines the impact of the proposed road scheme options on existing utilities apparatus.

Various utilities are in existence within the route corridors and are likely to be affected as a result of the construction of any of the route options which are being assessed. Due to the generally rural nature of the land, the density of utilities infrastructure is limited. In general the various elements of utility infrastructure is impacted by the route corridors traversing the different apparatus, either in cutting, on embankment or by bridge structures. However in the location of the east and west tie-ins to the existing road, associated with each of the route corridor alignments, there is some utilities apparatus located within the existing road which runs in or alongside the road and is therefore affected by some of the route corridors over relatively short lengths.

Over the course of this Stage 1 Assessment information on existing utilities was sought from all utility providers that operate within the Study Area. Information provided by the following major utility providers has been received in electronic format:

- Northern Ireland Electricity (NIE);
- Northern Ireland Water (NIW) - Watermains, Sewerage (storm, foul and combined systems);
- Communications (British Telecom, Virgin Media and Eircom and CTIL);
- Cable and Wireless (Vodafone);
- Firmus Gas, and
- Any other considerations.

Consultations indicate that there are several utility companies likely to be affected by the proposed Newry Southern Relief Road. Figures 6.7.1 to 6.7.4 in Appendix A shows the approximate locations of utility services and equipment, following an enquiry dated July 2016.

It should be noted that at the time of writing responses have not been received from: Atlas Communications and Everything Everywhere Limited (EEL). Typically these service providers have minimal infrastructure that would affect the selection of a preferred corridor. All service providers will be contacted again at later stages within the scheme development process.

6.7.1 Northern Ireland Electricity (NIE)

There are a number of high-voltage NIE lines located within or close to the NSRR Study Area which include 11kV services, 33kV services and MV services, shown in Figure 6.7.1 in Appendix A.

A 33kV high voltage line crosses the A2 Warrenpoint Road and passes through Greenbank Industrial Estate (approximately 500m south of Greenbank Roundabout) on the east of the Study Area heading in a westerly direction crossing the Newry River/Canal. The line then crosses the U5284 Fathom Line and B79 Drumalane Road close to its priority junction. The line continues in a south-westerly direction towards Ellisholding Junction and Belfast/Dublin Railway line. The 33kV high voltage line then follows parallel with the railway line outside of the Study Area. There is another 33kV high voltage line located within Newry, however, it is located outside of the Study Area just north of the Greenbank Roundabout running in an east to west direction.

The lower voltage, 11kV and MV lines are prevalent throughout the Study Area. They typically cater for the regional and local transmission as well as provide local connections to the power network for both domestic properties and the industrial or retail areas within the Study Area.

There are several 11kV services crossing the Study Area, which can be interpreted into zones. Two zones cross the northern boundary of the Study Area at Greenbank Roundabout and throughout Greenbank Industrial Estate. Another zone exists running parallel to the eastern side of the Study Area, on the eastern side of the A2 Warrenpoint Road in the vicinity of its junction with the Aghnamoira Road. Three further zones exist on the western side of the Study Area. One zone is in the vicinity of B79 Fathom Line and B79 Drumalane Road priority junction. Another 11kV line runs parallel to A2 Dublin Road from Newry City to Cloghogue roundabout Junction. The third zone zigzags across the A1 Newry Bypass between Cloghogue Roundabout and Ellisholding Junctions eventually following close to the old A1 Dublin Road.

There are several minor spurs off each of the 11kV mainlines to serve various areas throughout the Study Area. The 11kV services within the Study Area feed into a number of smaller MV supplies which in turn feed local dwellings, industrial and retail areas, and farms.

6.7.2 Northern Ireland Water (NIW)

There are a number of NIW utilities located within or close to the NSRR study area which include watermains and sewerage lines, shown in Figure 6.7.2 in Appendix A.

Watermains

Watermains located within the Study Area are small diameter distribution mains which vary in size from 50mm to 150mm diameter. A 250mm diameter watermain is located on the A2 Warrenpoint Road at the Greenbank Roundabout. The majority of the watermains within the Study Area are gravity mains.

Within the Study Area there are a limited number of water mains in the existing minor roads, supplying existing properties.

Watermains are located along the: A2 Warrenpoint Road, B79 Fathom Line, B79 Drumalane Road, old A1 Dublin Road, Flagstaff Road and in the vicinity of Greenbank Industrial Estate and Greenbank Roundabout. The main distribution watermains running along these roads will provide connection to the regional water network for local dwellings, industrial and retail area, and farms.

Sewerage

There are various sewerage lines, including foul, storm and combined sewers, servicing Newry. There is also a wastewater treatment works within the Study Area, located in Greenbank Industrial Estate.

The majority of sewers within the Study Area are small scale foul and storm water sewers of 150 to 225mm diameter. Once outside of the city limits, in the rural setting, there is minimal storm or foul water sewers, as most storm water will either be piped to local soakaways or drain overland to existing streams and ditches, and any foul sewage will be collected in septic tanks and collected at specified time intervals. There is an existing 150mm diameter foul sewer and an existing 225mm diameter storm sewer at the west tie-ins to A2 Dublin Road and Cloghogue Roundabout Junction.

In addition, there is a foul sewage pumping main immediately east of the Newry River to the north of Greenbank Industrial Estate. This pumping main appears to lead to the Newry Wastewater Treatment Works. It should be noted that the sewerage layout, from NI Water records does not include road drainage or culvert locations.

6.7.3 Communications

There are a number of communication utilities located within or close to the NSRR study area which include BT, Virgin Media, Eircom and CTIL, shown in Figure 6.7.3 in Appendix A.

British Telecom (BT)

The British Telecom (BT) network within the Study Area consists of underground cables and overhead lines.

The majority of BT lines within the Study Area, of an urban context, are underground also including those lines running parallel to main roads such as A2 Warrenpoint Road, B79 Fathom Line (within close proximity to Newry City centre), B79 Drumalane Road and old A1 Dublin Road. Other BT lines that are within a rural setting are generally overhead.

BT Services are extensive throughout the Study Area and are on both side of the Newry River/Canal (A2 Warrenpoint Road and B79 Fathom Line). These services are underground for the most part with several road crossings to other minor roads.

BT services are also located on minor roads within the Study Area. These services are all overhead and connect into private dwellings. All BT services within the route corridor, whether overhead or underground, may be affected by construction works. Underground services may also include fibre optic cables.

Virgin Media and Eircom

Apparatus within the Study Area consists of a broadband connection running from Newry City parallel to A2 Dublin Road, through Cloghogue Roundabout Junction and continuing along B113 Forkhill Road.

Cornerstone Telecommunications Infrastructure Ltd (CTIL)

This is a joint venture company owned by Telefónica UK Limited and Vodafone Limited. They currently have one piece of apparatus within the Study Area, which is a telecommunications mast, adjacent to Newry City AFC grounds within Greenbank Industrial Estate.

6.7.4 Cable and Wireless

Vodafone, who acquired Cable and Wireless Communications in 2012, have stated that they currently have no plant in the area.

6.7.5 Firmus Gas

There are gas utilities located within or close to the NSRR study area which involves Firmus Energy, shown in Figure 6.7.4 in Appendix A.

Phoenix Gas has no apparatus within the study area. Firmus Energy, however, has apparatus within the Study Area. There is a 180mm diameter 4bar medium pressure pipeline running up the central reservation of the A2 Warrenpoint Road from Warrenpoint towards Newry. There is other apparatus within Newry, mostly medium pressure gas mains less than 100mm in diameter, however, this is outside of the Study Area.

Within the Study Area the 180mm diameter gas mains pipeline continues into the Greenbank Industrial Estate serving various industrial and retail units and then heads on towards the Greenbank Roundabout and towards Newry City.

6.7.6 Other Considerations – The Department for Infrastructure Street Lighting

There are street lights located on the A2 Warrenpoint Road in the vicinity of the Greenbank Roundabout which continues into Newry City and at the Old Warrenpoint Road junction onto the A2 Warrenpoint Road. There is street lighting to Cloghogue Roundabout and Ellisholding Junctions on the A1/N1 Belfast-Dublin Corridor. There is also street lighting within the Greenbank Industrial Estate.

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. The location of this plant is such that is considered unlikely to be a significant factor in corridor selection.

6.8 Health & Safety and Construction Risks

This section summarises each of the main risks considered to the health, safety and well-being of workers and the general public.

6.8.1 Interfaces with Live Traffic

When the proposed NSRR is being constructed adjacent to existing carriageways, the danger of operatives, construction plant and materials coming into conflict with passing vehicles is possible, during the process of construction.

These areas of conflict cannot be avoided at the tie-ins to existing roads or where a road has to pass over a road or railway line. The risk to the welfare, health and safety of workers in these areas therefore must be managed through the implementation of traffic management measures, which may include:

- implementation of lower speed limits at road works;
- use of safety zones between live traffic and the work site; and
- the appropriate design of temporary traffic diversions.

Safe routes for non-motorised users through the works must be designed and arranged to proactively manage the risks to vulnerable road users during the construction stage.

6.8.2 Interfaces with Underground and Overhead Services

The construction of roads frequently is affected by the location of existing services located alongside the road edge. The highest risk comes from high voltage cables but significant risks also arise from other services such as gas mains and foul sewers.

It is normal practice in road design to eliminate some of these risks by diverting services away from the work areas in advance of construction activities so that excavation may proceed without needing to work around a live service. The methods of construction will also be documented and followed to ensure that where services do need to be left in place, the risks are reduced by clearly identifying the location of the services, before commencing any construction activity.

6.8.3 Falls from Height

This risk is particularly associated with the construction of bridges but may arise where any significant difference in height exists at the worksite. The design will as far as possible reduce the requirement for structures which introduce differences in height; however, bridging structures will be required if a free-flow road is to be achieved.

Operatives would therefore be protected from these risks by the implementation of safe working practices during construction. Methods of construction should be planned and documented in advance, in order that all the necessary safety precautions can be implemented.

6.8.4 Working over Water

When working in or near rivers, construction sites are more at risk of flooding from rising water levels – the risk involved here is one of drowning after accidently entering a body of water. Similar to the above, all instances of this nature cannot be removed in design if the scheme has to cross rivers/canals (Newry River/Canal) or is to be built adjacent to a body of water. In this case, the risks will be restricted to the location of river crossings. However, management of the work through the implementation of the best practice methods of working near water should reduce the risks to acceptable levels.

Water can also cause various issues and uncertainties surrounding construction by exerting pressure onto structural elements and could possibly jeopardise the project quality.

6.8.5 Safety of Road-Users

The safety of road users is usually governed by the compliance with the current standards for road design which are documented in the DMRB. The system of road safety auditing (also set out in the DMRB) allows for a third party review and audit of the design and the actual road after construction. These measures ensure that the majority of risks to the road users are reduced to an acceptable level during design.

6.8.6 Safety of Maintenance Workers

The risks to operatives carrying out maintenance work are controlled by compliance with standards for road design in the DMRB and the associated road safety audits. When the road has been opened to traffic, the road authority should put into place a maintenance plan which will outline how routine maintenance shall be undertaken to ensure the safety of their workforce. Emergency procedures should also be planned to ensure that accidents and unplanned events can be dealt with safely. Routine maintenance will be required if an opening bridge structure is to be required to bridge the Newry River/Canal.

6.8.7 General Assessment of the Impacts on Health and Safety

Most corridors have similar interfaces with existing roads. The longer corridors have a greater number of locations where these risks can occur due to the increased frequency of side road crossings. Therefore, the shorter corridors will reduce the risks associated with falls from heights and working over water.

The safety of road users and maintenance workers is affected by any reduction in standards used in the design. These issues are discussed later under the assessment of the engineering for each corridor; preference for any of the proposed corridors cannot be defined by the assessment of the health and safety issues.

6.8.8 Construction Risks

The bridge bascule section is a key risk item as there is currently only one other bascule opening bridge in Coleraine, Northern Ireland on the railway line over the River Bann. The technical aspects of its construction and complex equipment needed to operate the bridge may be limited to a few suppliers. There may not be a lot of competition for this item of the works; therefore, construction costs may rise owing to its complexity.

6.9 Engineering Assessment of Corridors

This Section presents a detailed engineering assessment of the route corridor options in terms of highway alignment, junction layouts, structures, earthworks and compliance with Design Standards. Significant engineering difficulties associated with route options are also identified.

6.9.1 Methodology of Engineering Assessment of Corridors

Each of the corridor options will be examined in detail to gather relevant information which may influence the selection of the preferred corridor option.

For a Stage 1 Assessment, only a broad assessment of engineering issues is required; subjects including, the road pavement condition and highway structures, topography, geology and drainage should have been

considered. Other problems such as difficult ground conditions or probable difficulties in alignment should also have been identified.

The existing conditions have been set out in detail in Section 2 of this report and some aspects are revisited as part of the engineering assessment. The engineering assessments which have been undertaken for each of the corridors cover the following:

- Junction Layouts and Local Road Network;
- Topography, Earthworks, Geology;
- Utilities;
- Drainage;
- Structures, and
- Construction Issues.

Under the above headings each of the corridors is generally assessed along its length, starting from the eastern interface with the A2, running along the length of the corridor to the western interface with the A1/N1.

6.9.2 Corridor 1

Corridor 1 is shown in Figure 5.3.1 in Appendix A. The corridor runs south-west from the locality of Greenbank Roundabout on the A2 Warrenpoint Road towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor.

The length of road construction required is approximately 3.55km, with an at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and connecting into the existing grade separated Ellisholding junction in the west, providing free flow movement for the strategic traffic.

6.9.2.1 Junctions and Local Road Network

A2 Warrenpoint Road Junction

This Corridor connects to the A2 Warrenpoint Road in the locality of Greenbank Roundabout. There were two options considered for tying into the existing A2 Warrenpoint Road at this location either directly into the existing Greenbank Roundabout or to construct a new roundabout approximately 350m south of the existing Greenbank Roundabout.

Various constraints exist for both of the tie-in options under consideration, notably the high density of sports grounds, industrial and retail units within the Greenbank Industrial Estate, which will inevitably be affected by this corridor. Another constraint at this location is the gathering of services within the Greenbank area and close proximity to housing on the eastern side of the A2 Warrenpoint Road.

For the second option, spacing between the existing Greenbank Roundabout and the new roundabout may be of concern both from a geometric and traffic perspective. Spacing between roundabouts should be a minimum of 1.5 times the SSD for the Design Speed. With a Design Speed of 120kph on the existing A2 Warrenpoint Road corresponding to a SSD of 295m this would require the new roundabout to be sited approximately 440m from the existing Greenbank Roundabout. This may be able to be reduced to one Design Speed step below the desirable minimum SSD to 215m requiring the roundabouts to be spaced 320m apart which could allow for the proposed alternative arrangement. In terms of traffic, the spacing between roundabouts could increase queueing at this location due to: driver indecision, weaving traffic over a short distance and an imbalance of flows using the roundabout arms.

A1/N1 Belfast-Dublin Corridor Junction

Corridor 1 would tie into the A1/N1 Belfast-Dublin Corridor at the existing Ellisholding junction. The arrangement would involve tying into the Ellisholding dumbbell roundabout on the east side of the junction and upgrading the various side roads surrounding the junction to bring them up to standard. Two new south-facing slip roads would be constructed to make Ellisholding a full movement grade-separated junction, i.e. current layout provides a northbound on-slip merge toward Belfast and a southbound off-slip diverge from Newry.

There are no relaxations or departures from standard anticipated for this option at Ellisholding junction. The existing horizontal curves on the north-facing interchange links correspond with design standards for an interchange link road.

Local Road Network

Corridor 1 crosses: two major roads – B79 Drumalane Road and old A1 Dublin Road; three minor side roads – U5284 Fathom Line, Hillhead Road and Flagstaff Road, some minor accommodation and farm access roads. It is envisaged that a number of the minor side roads and accesses could be either stopped up or linked to nearby side road crossings, thus eliminating some structures. At side road crossings, some reconstruction may be expected. The need to provide at-grade accesses to the numerous properties on the side roads is likely to prevent significant changes to vertical alignment of these existing roads.

It is anticipated that on the western side of the Newry Canal the U5284 Fathom Line and B79 Drumalane Road will not be affected as the Newry River/Canal crossing structure will pass overhead and would require minimal work to accommodate these roads. The Flagstaff Road as shown in the indicative alignment would be carried over the new carriageway on a bridge structure as the new carriageway is in a cutting at this location. Other side roads/accommodation lanes would then be accessed either from B79 Fathom Line or from Flagstaff Road.

Where the new carriageway crosses the Flagstaff Road, it is approximately between 5.7 to 6.2m wide. The Flagstaff Road connects to the A2 Dublin Road at its northern end and to the Ferryhill Road in the south, outside

the Study Area. It is expected to carry more traffic than the other minor side roads which cross Corridor 1; therefore, significant upgrade works may be required to this road.

6.9.2.2 Topography, Earthworks and Geology

Corridor 1 has an area of raised deposits in the vicinity of Greenbank and then crosses recent marine deposits on the valley floor. The remainder of the corridor is formed over glacial tills or areas where bedrock is expected close to or at the surface (Figure 7.11.2 in Appendix A). In terms of the solid geology, Corridor 1 would largely traverse the granodiorites except in the vicinity of Hillhead Road where it would pass over the greywacke and shale exposure. On the approach to the Ellisholding, the Corridor would cross an area underlain by felsite (Figure 7.11.1 in Appendix A).

Corridor 1 passes an area of known instability to the west of Drumalane Quarry. As the cause of failure and the extents of any movement are unknown, this option is thought to be a significant geohazard. Corridor 1 also passes close to the historical Cloghogue Quarry and an un-named quarry close to the railway line towards the south of the Corridor.

Potentially contaminated land site areas covering the corridor options study area are indicated on Figure 7.11.4 in Appendix A. The source locations shown have been identified from a review of the NIEA contaminated land database, historic and current maps. The Corridor 1 option would traverse the following potentially contaminated land sources:

- Sewage works & sewage farms (source no. 34);
- Formula Karting within corridor and garage/fuel stations adjacent to corridor (source nos. 37, 35 & 36);
- Engineering works: mechanical engineering and ordnance works (source no. 38);
- Electrical substation (source no. 39);
- Smithy (source no. 71);
- Waste recycling: metal recycling site (source no. 72);
- Unspecified: industrial works and a tobacco pipe manufacturing works (source nos. 74 & 75);
- Mineral workings and a possible quarry (source nos. 81 & 82);
- The current Belfast –Dublin Railway Line to the west of the corridor and two historical railway lines, either side of the Newry River (Newry and Greenore Railway; Newry to Warrenpoint Railway); and
- Mineral workings (source no. 66) and a cemetery (source no. 70) are in close proximity to the corridor boundary near its western section and may potentially impact the corridor.

The Corridor 1 route may also be impacted from additional works/factories in the vicinity of the industrial estate to the east of the Newry River. In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land, may also give rise to potential contaminated site areas.

6.9.2.3 Utilities

Corridor 1, being the closest to Newry City centre, has the most interaction with utility service apparatus. Table 6.9 shows the number of service crossings within the corridor. Service crossings are likely to be straightforward at various locations within the rural setting; however, it will become more difficult to accommodate the services working close to and around live junctions.

Table 6.9 – Number of service crossing for Corridor 1

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	4
	11kV	9
	33kV	1

Existing Services		No. of Service Crossings
Northern Ireland Water	Watermains	6
	Sewerage	3
Communications	BT	O/H = 1 U/G = 5
	Virgin Media and Eircom	N/A
	CTIL	N/A
Firmus Gas		1

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

6.9.2.4 Drainage

Corridor 1 has two main watercourse crossings of the Newry River and Canal. There are a further three minor watercourse crossings; a ditch at Greenbank Roundabout running parallel to the A2 Warrenpoint Road, a ditch running between Hillhead Road and developments at Cloughogue Roundabout and a ditch running through Fathom Lower Wood. The Newry Canal is the outfall point for each of these minor watercourses.

These watercourses would act as the main outfalls for the drainage of the proposed road. It is envisaged that the mainline drainage would follow the existing topography flowing generally towards the Newry Canal. Some other minor watercourses run across the proposed corridor and depending on their size may be directed towards a main culvert crossing. Environmental consent and a Drainage Order would be required to allow any diversion of the watercourses.

This corridor crosses existing roads at five locations and links into two existing roads with existing drainage infrastructure. At each of these locations any existing drainage that may be present would need to be considered further when designing the proposed link.

Records show that flooding occurs in the vicinity of the proposed link near the proposed junction with the A2 Warrenpoint Road at Greenbank Roundabout. Pollution control or attenuation facilities would need to be located outside this flood plain. Compensatory flood areas may be required to replace areas of the flood plain lost to embankment. The vertical alignment of the road at these locations would need to have sufficient elevation to ensure that drainage outfalls can be accommodated above any future flood levels.

6.9.2.5 Structures

Table 6.10 lists the structures required as part of the construction of the indicative route within Corridor 1. There are three main obstacles which require to be bridged; the Newry River/Canal, the Flagstaff Road crossing and the railway bridge that runs parallel to the A1/N1 Belfast-Dublin Corridor at Ellisholding Junction.

Table 6.10 – Major Structures Required for Corridor 1

Description/Location	Bridge Type	Total Span (m)	Width (m)	Skew (degrees)
Newry River/Canal – fixed bridge	Underbridge	305	14.8	<5
Newry River/Canal – bascule opening section	Underbridge	45	14.8	<5
Flagstaff Road Crossing	Overbridge	50	12	10-15

Railway Bridge Crossing	Underbridge	20	89	70

This corridor has the most northerly crossing of the river and canal and the channels are relatively narrow at 35m and 27m respectively, based on square widths. The crossing traverses the Greenbank Industrial Estate on the eastern bank of the river and therefore does not cross the flood plain mud flats, which reduces the need for temporary works and the potential for environmental impact during construction. However as this area is reclaimed flood plain it is anticipated that ground conditions would be poor which would require piled foundations.

The longitudinal gradients on the indicative alignment are necessarily steep in order to achieve the level difference over this relatively short route. The longitudinal gradient on the bridge is 6% and the bridge is at a relatively high level over the canal with a clearance of approximately 17m between water level and bridge soffit. Due to topographical constraints within the study area, the crossing is skewed, which increases effective spans and has horizontal curvature on the deck which would increase the cost and complexity of the design. It is anticipated that there will no requirement for a column in the Newry River/Canal due to its narrow width which could be spanned with common construction techniques.

Due to its elevation the road would extend on the bridge for over 100m on the western bank before returning to land and therefore it would also cross the existing Fathom Line and Drumalane Roads. The skew width of the canal is 30m based on a skew of 26^{o} and the effective clear width allowing for square bridge supports on the bascule section is 37m. The total bridge length is 350m including an allowance of 45m for the opening section which is the third shortest crossing with the second shortest Newry Canal opening structural span.

The Flagstaff Road crossing, over the proposed mainline would have a single carriageway width of 12m with a small skew angle between 10 – 15^{o}. The total length would be approximately 50m. The railway bridge width of 89m is due to the 70^{o} skew angle where the indicative alignment intersects the railway line and will increase the construction cost in contrast to a bridge with no skew. Other structures that will be required are culverts to minor watercourses and retaining walls where cutting or embankment slopes become excessive.

6.9.2.6 Construction Issues

Due to the topography and proximity of Drumalane Quarry, one large cutting (approximately 20m deep) and one large embankment (between 10 to 15m in height) are anticipated. The indicative alignment option within Corridor 1 has been pushed to the western extents of the corridor due to unknown ground stability risks to the west of Drumalane Quarry; in doing so this has pushed the indicative alignment closer to a hill where deeper cuttings are now required. These earthworks would be of a significant height and it may be desirable to locally steepen side slope angles using geotechnical solutions or conversely to reduce the slopes to blend into the topography.

The A2 Warrenpoint Road and the A1 Newry Bypass junctions would require significant traffic management, as it is anticipated that there would be delays during construction. Delays will be caused by the necessity to reduce the speed limits to lessen the risks to workforce safety. The intention would be to keep two running lanes open in both directions for the entirety of the construction period. The corridor crosses five local roads which would require traffic management and may also need diversions while any bridges are under construction.

6.9.3 Corridor 2

Corridor 2 is shown in Figure 5.3.2 in Appendix A. The corridor runs north-west from the locality of the Old Warrenpoint Road gap junction, on the A2 Warrenpoint Road, towards A2 Dublin Road and continues on to Cloghogue Roundabout junction on the A1/N1 Belfast-Dublin Corridor.

The length of road construction required is approximately 2.5km, with a new at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and a new at-grade roundabout on A2 Dublin Road heading towards Cloghogue Roundabout junction in the west, providing free flow movement for the strategic traffic.

6.9.3.1 Junctions and Local Road Network

A2 Warrenpoint Road Junction

This Corridor connects to the A2 Warrenpoint Road south of Greenbank Industrial Estate in the locality of the Old Warrenpoint Road junction. It is proposed to construct a new roundabout approximately 300m south of the existing Old Warrenpoint Road gap junction. It would be possible to include the Old Warrenpoint Road into the roundabout design; therefore, closing the existing gap junction on the A2 Warrenpoint Road.

Various constraints exist at this location including: close proximity to the surrounding housing developments, an airstrip, a minor watercourse 300m south of the Old Warrenpoint Road junction running through a wooded area and a small ditch that is present along the western edge of the A2 Warrenpoint Road at the airstrip. The airstrip is located close to the existing junction and there may be an issue with low flying aircraft.

Another constraint at this location is the Old Warrenpoint Road gap junction on the A2 Warrenpoint Road. Should a suitable tie-in arrangement not be achieved for the Old Warrenpoint Road, its close proximity to the new roundabout junction is likely to be unsatisfactory from both a geometric and traffic perspective. With a Design Speed of 120kph, the existing A2 Warrenpoint Road has a SSD of 295m which would require the new roundabout to be sited approximately 440m away from the Old Warrenpoint Road which could be achieved but would require a larger skew angle on the bridge structure hence increasing the overall cost. In terms of traffic the spacing of the junctions could increase queueing at this location due to driver indecision, weaving traffic and an imbalance of flows using the roundabout arms.

A2 Dublin Road and A1/N1 Belfast-Dublin Corridor Junction

Corridor 2 would tie into the A2 Dublin Road at a new roundabout to the North East of Cloghogue Roundabout. It is not anticipated that a new junction is required to connect onto the A1/N1 Belfast-Dublin Corridor. The arrangement would involve tying into the A2 Dublin Road at its junction with Patrician Park on the north-eastern side of the existing height restricted railway bridge. Various local roads will require amendments and upgrading surrounding the proposed junction to bring them up to standard. After travelling through the new roundabout on the A2 Dublin Road traffic will continue on to A1/N1 Belfast-Dublin Corridor via Cloghogue Roundabout junction.

Various constraints at this location are the numerous services within the A2 Dublin Road footprint. Also travelling to the A2 Dublin Road roundabout siting location there are numerous constraints to avoid, including: the Church of the Sacred Heart – church and cemetery grounds, Cloghogue Pitch and Putt golf grounds, Cloghogue Heights housing development and other single dwellings.

In relation to Cloghogue Roundabout junction, there are no relaxations or departures from standard anticipated for this option in relation to weaving length or geometric design parameters. The existing horizontal curves on all of the interchange links comply with design standards for an interchange link road.

Local Road Network

Corridor 2 crosses: one major road – B79 Fathom Line; one minor side road – Hillhead Road, and also crosses some minor accommodation and farm access roads. It is envisaged that a number of the minor side roads and accesses could be either stopped up or linked to nearby side road crossings, thus eliminating some structures.

At side road crossings, some reconstruction should be expected. The need to provide at-grade accesses to properties on the side roads is likely to prevent significant changes to vertical alignment of these existing roads. It is expected that on the western side of the Newry Canal the B79 Fathom Line will not be affected as the Newry River/Canal crossing structure will pass overhead and will require minimal work to accommodate this road.

Any farm lands access required will be via the northern end of the Hillhead Road. Other side roads/accommodation lanes will then be accessed either from B79 Fathom Line or from Flagstaff Road.

6.9.3.2 Topography, Earthworks and Geology

Corridor 2 mainly traverses through areas of glacial till or where bedrock is expected to be at or close to the surface. Similar to the other Corridors, it also crosses the recent marine deposits on the valley floor (Figure 7.11.2 in Appendix A). Corridor 2 would begin within the granodiorites at the eastern extent but is generally underlain by greywackes and shales. The Corridor would then traverse the granodiorites and a felsite intrusion towards Cloghogue and the tie-in with the A1/N1 corridor (Figure 7.11.1 in Appendix A).

Corridor 2 passes an area of known instability at and to the west of Drumalane Quarry. As the cause of failure and the extents of any movement are unknown this option should be avoided as it is thought to be a significant geohazard. Corridor 2 also passes over the historical Cloghogue Quarry.

The potentially contaminated land site areas covering the corridor options study area are indicated on Figure 7.11.4 in Appendix A. The source locations shown have been identified from a review of the NIEA contaminated land database, historic and current maps. The Corridor 2 option would traverse the following potentially contaminated land sources:

- Landing place/ docks (source no. 18);
- Mineral workings and Drumalane Quarry (source nos. 66 & 69);
- Cemetery (source no. 70);
- Smithy (source no. 71);
- Waste recycling: metal recycling site (source no. 72); and
- The Belfast – Dublin Railway Line to the west of the corridor and two historical railway lines, either side of the Newry River (Newry and Greenore Railway; Newry to Warrenpoint Railway).

In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land, may also give rise to potential contaminated site areas.

6.9.3.3 Utilities

Corridor 2 has less interaction with utility service apparatus than Corridor 1; however, this corridor comes into contact with a telecommunications fibre on A2 Dublin Road. Table 6.11 shows the number of service crossings within the corridor. Service crossings are likely to be straightforward at various locations within the rural setting; however, it will become more difficult to accommodate the services working close to and around live junctions.

Table 6.11 – Number of service crossing for Corridor 2

Existing Services		No. of Service Crossings	
Northern Ireland Electricity	MV	4	
	11kV	2	
	33kV	1	
Northern Ireland Water	Watermains	5	
	Sewerage	2	
Communications	BT	O/H = 1	U/G = 3
	Virgin Media and Eircom	1	
	CTIL	N/A	
Firmus Gas		1	

The impact on utilities is deemed to be relatively minor within the corridor when compared to other road schemes of a similar scale. Given the above information, service diversions should 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.

6.9.3.4 Drainage

Corridor 2 has two main watercourse crossings; the Newry River and Canal. A further two minor watercourse crossings; a ditch running between Hillhead Road and developments at Cloughogue Roundabout and a ditch running 300m south of Old Warrenpoint Road junction with A2 Warrenpoint Road. The Newry Canal is the outfall point for the minor watercourse continuing from Hillhead Road and the Newry River is the outfall point for the minor watercourse south of the Old Warrenpoint Road junction.

These watercourses would act as the main outfalls for the drainage of the proposed road. It is envisaged that the mainline drainage would follow the existing topography and would flow generally from west to east towards the Newry Canal. Some other minor watercourses run across the proposed corridor and depending on their size

may be directed towards a main culvert crossing, including a ditch running parallel to the A2 Warrenpoint Road on the western side within the airstrip which has numerous collection points along its length. Environmental consent and a Drainage Order would be required to allow any diversion of the watercourses.

This corridor crosses existing roads at two locations and links into two existing roads with existing drainage infrastructure. At each of these locations any existing drainage that may be present would need to be considered when designing the proposed link.

Records do not show any flooding within the extents of the corridor, however, the vertical alignment of the road at low-lying locations would need to have sufficient elevation to ensure that drainage outfalls can be accommodated above any future flood levels.

6.9.3.5 Structures

Table 6.12 lists the structures required as part of the construction of the indicative route within Corridor 2. There are two major obstacles which are required to be bridged; the Newry River/Canal/Fathom Line and the Hillhead Road crossing.

Table 6.12 – Major Structures Required for Corridor 2

Description/Location	Bridge Type	Total Span (m)	Width (m)	Skew (degrees)
Newry River/Canal – fixed bridge	Underbridge	435	14.8	<5
Newry River/Canal – bascule opening section	Underbridge	55	14.8	<5
Hillhead Road Crossing	Overbridge	50	12	10-15

The river and canal bridge in this corridor crosses just south of the Greenbank Industrial Estate and therefore crosses the flood plain mud flats. Again the ground conditions are expected to be poor which would necessitate piled foundations. The river channel is wide at this point at approximately 315m and the canal is 34m wide, based on square widths.

The longitudinal gradient on the bridge varies from 2% to 4% and the clearance between water level and bridge soffit over the canal is approximately 9m. The bridge would require an opening section over the canal and it would also span over the existing Fathom Line Road on the western bank before the road returns to land. Due to topographical constraints within the study area, the corridor is curved traversing the Newry River/Canal, requiring the bridge deck to be curved which will increase the cost and complexity of the design.

This alignment crosses the canal at a skew of approximately 32^{o} resulting in a skew canal width of 40m and an effective clear canal width of 49m allowing for square bridge supports on the bascule section. Allowing for skew the total bridge length is 490m including an allowance of 55m for the bascule opening section which is the second longest crossing when compared to the rest of the corridors with the longest Newry Canal opening section. The deck would also have horizontal curvature at its western end in order to achieve the required alignment. Other structures that will be required are culverts to minor watercourses and retaining walls where cutting or embankment slopes become excessive.

The Hillhead Road crossing, over the proposed mainline would have a single carriageway width of 12m with a small skew angle between 10 – 15^{o}. The total length would be approximately 50m.

6.9.3.6 Construction Issues

Due to the topography and proximity of Drumalane Quarry, two large cuttings (approximately 20m deep) are anticipated. The indicative alignment option within Corridor 2 has been pushed to the western extents of the corridor due to the unknown risks involved with ground stability surrounding Drumalane Quarry. These earthworks would be of a significant height and it may be desirable to steepen side slope angles using geotechnical solutions or conversely to reduce the slopes to blend into the topography.

The construction of the junctions on the A2 Warrenpoint Road and the A2 Dublin Road will require significant traffic management to alleviate driver stress since it is anticipated that there would be delays during construction. Some delays will be caused by the necessity to reduce vehicle speeds to lower the risks on workforce safety. The intention would be to keep two running lanes open in both directions for the entirety of the construction period. The corridor crosses two local roads which would require traffic management and may also need diversions while any bridges are under construction.

6.9.4 Corridor 3

Corridor 3 is shown in Figure 5.3.3 in Appendix A. The corridor runs west from the locality of Aghnamoira Road on the A2 Warrenpoint Road towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor.

The length of road construction required is approximately 3.9km, with an at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and connecting into the existing grade separated Ellisholding junction in the west, providing free flow movement for the strategic traffic.

6.9.4.1 Junctions and Local Road Network

A2 Warrenpoint Road Junction

This Corridor connects to the A2 Warrenpoint Road south of Greenbank Industrial Estate in the locality of the Aghnamoira Road junction. The proposal is to tie into a new roundabout approximately 100m south of the existing Aghnamoira Road gap junction. It may be possible to include the Aghnamoira Road into the roundabout design; to enable the closure of the existing gap junction on the A2 Warrenpoint Road.

A constraint at this location is the close proximity to the surrounding single dwellings, accessed from the Aghnamoira and A2 Warrenpoint Roads. There is an airstrip located close to the junction which may cause issues regarding low flying aircraft. Another constraint at this location is the Aghnamoira Road gap junction on the A2 Warrenpoint Road. A suitable tie-in arrangement should be achievable which would require the re-alignment of Aghnamoira Road. Similar issues to Corridor 1 and 2 above arise if a suitable tie-in cannot be achieved; the close proximity of the Aghnamoira Road junction to the proposed roundabout junction would probably be unsatisfactory.

A1/N1 Belfast-Dublin Corridor Junction

Corridor 3 would tie into the A1/N1 Belfast-Dublin Corridor at the existing Ellisholding junction as discussed previously under Corridor 1.

Local Road Network

Corridor 3 crosses: three major roads – A2 Warrenpoint Road, B79 Fathom Line and the old A1 Dublin Road; two minor side roads – Flagstaff Road and Barracric Road, and it also crosses some minor accommodation and farm access roads. It is envisaged that a number of the minor side roads and accesses could be either stopped up or connected to nearby side road crossings, thus eliminating some structures. At side road crossings, some reconstruction should be expected. The need to provide at-grade accesses to properties on the side roads is likely to prevent significant changes to vertical alignment of these existing roads.

It is expected that on the either side of the Newry River/Canal, the A2 Warrenpoint Road and B79 Fathom Line, will not be affected as the Newry River/Canal crossing structure will pass overhead and will require minimal work to accommodate these roads. The Flagstaff Road as shown in the indicative alignment will be carried over the new carriageway on a bridge structure as the new carriageway is in a cutting at this location. Other side roads/accommodation lanes will then be accessed either from B79 Fathom Line or from Flagstaff Road.

Where the new carriageway crosses the Flagstaff Road, it is approximately 3.5m wide. The Flagstaff Road connects to the A2 Dublin Road at its northern end and to the Ferryhill Road in the south outside the Study Area. It is expected to carry more traffic than the other minor side roads which cross Corridor 3; however, significant upgrade works may be required to this road.

6.9.4.2 Topography, Earthworks and Geology

Corridor 3 originates, on the eastern side of the valley, in the glacial tills before crossing over areas where bedrock is expected at or close to the surface. Glacial tills are likely to be encountered towards the tie in near the Ellisholding junction. Similar to the other Corridors, it also crosses the recent marine deposits on the valley floor

(Figure 7.11.2 in Appendix A). On the eastern flanks of the Newry River, Corridor 3 would largely traverse greywackes and shales from the Hawick Group and the granodiorites. On the western extents this corridor would pass over intrusive dykes before crossing granodiorites and felsites (Figure 7.11.1 in Appendix A).

Corridor 3 passes over a number of historical quarries which include and an un-named quarry close to the railway line towards the south of the Corridor and two locations south western extents close to Green Island. It is possible that these locations were in fact one quarry in operation at different times.

The potentially contaminated land site areas covering the corridor options study area are indicated on Figure 7.11.4 in Appendix A. The source locations shown have been identified from a review of the NIEA contaminated land database, historic and current maps. The Corridor 3 option would traverse the following potentially contaminated land sources:

- Mineral workings and gravel pits east of Newry River (source nos. 8, 9, 10, 11 & 13);
- Dockyards & docklands (source no. 15);
- Mineral workings and a possible quarry (source nos. 81 & 82);
- The current Belfast –Dublin Railway Line to the west of the corridor and two historical railway lines, either side of the Newry River (Newry and Greenore Railway; Newry to Warrenpoint Railway); and
- An oil storage depot is in close vicinity to the corridor at the western river crossing (source no. 16).

In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land, may also give rise to potential contaminated site areas.

6.9.4.3 Utilities

Corridor 3 has, overall in terms of crossings, less interaction with utility service apparatus than Corridor 1 and similar to Corridor 2. Table 6.13 shows the number of service crossings within the corridor. Service crossings are likely to be straightforward at various locations within the rural setting; however, it will become more difficult to accommodate the services working close to and around live junctions. It is clear to see that Corridor 3 lies within a more rural context as there are no sewerage main line systems being crossed within the corridor. Most dwellings will have a septic tank instead as providing such a system for so few houses is uneconomical.

Table 6.13 – Number of service crossing for Corridor 3

Existing Services		No. of Service Crossings	
Northern Ireland Electricity	MV	4	
	11kV	4	
	33kV	1	
Northern Ireland Water	Watermains	5	
	Sewerage	0	
Communications	BT	O/H = 3	U/G = 3
	Virgin Media and Eircom	N/A	
	CTIL	N/A	
Firmus Gas		1	

The impact on utilities is deemed to be relatively minor within the corridor when compared to other road schemes of a similar scale. Given the above information, service diversions should 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.

6.9.4.4 Drainage

Corridor 3 has two main watercourse crossings of the Newry River and Canal. There is a further two minor watercourse crossings of the same watercourse; a minor watercourse running through Fathom Lower Wood (this watercourse may be being fed by road drainage from Newry Bypass).

The Newry Canal is the outfall point for the minor watercourse continuing from Barracric Road. These watercourses would act as the main outfalls for the drainage of the proposed road. It is envisaged that the mainline drainage would follow the existing topography flowing generally towards the Newry Canal. Some other minor watercourses run across the proposed corridor and depending on their size may be directed towards a main culvert crossing, including a ditch running parallel to the A2 Warrenpoint Road. Environmental consent and a Drainage Order would be required to allow any diversion of the watercourses.

This corridor crosses existing roads at five locations and links into two existing roads with existing drainage infrastructure. At each of these locations any existing drainage that may be present would need to be considered when designing the proposed link.

Records do not show any major flooding of infrastructure or lands within the extents of the corridor (except the floodplain storage on the mud flats); however, the vertical alignment of the road at low-lying locations would need to have sufficient elevation to ensure that drainage outfalls can be accommodated above any future flood levels.

6.9.4.5 Structures

Table 6.14 lists the structures required as part of the construction of the indicative route within Corridor 3. There are three major obstacles which require to be bridged; the Newry River/Canal, the Flagstaff Road crossing and the railway bridge that runs parallel to the A1/N1 Belfast-Dublin Corridor at Ellisholding Junction.

This is the only corridor where the bridge crossing has sufficient clearance over the navigable channel and has no need for an opening section. The structure would be imposing in the landscape, with a maximum level difference of approximately 41m between the bridge's finished road level and existing ground level. As the majority of the bridge supports are in or near the river floodplain, poor ground conditions are anticipated.

The bridge would cross both Fathom Line Road on the western side and the existing A2 on the eastern side. The elevation of the bridge combined with the location and topography of the surrounding land would result in significant wind exposure for users of the bridge, in particular high sided vehicles like HGVs. Measures such as wind shielding parapets would be required to minimise the risk to bridge users and a facility to close the bridge to high sided vehicles in extreme storm events would also be recommended. In this scenario the vehicles would revert to using the existing road network through Newry City.

Table 6.14 – Major Structures Required for Corridor 3

Description/Location	Bridge Type	Total Span (m)	Width (m)	Skew (degrees)
Newry River/Canal – fixed bridge	Underbridge	800	14.8	<5
Flagstaff Road Crossing	Overbridge	50	12	45
Railway Bridge Crossing	Underbridge	20	67	60

At 800m overall length, this bridge would be the longest structure between all alignment options considered. The crossing is square to the river over most of its length; however there would be horizontal curvature at both ends in order to tie-in with the proposed alignment. The longitudinal gradient is relatively modest at 1.5% along the majority of the bridge.

The Flagstaff Road crossing, over the proposed mainline would have a single carriageway width of 12m with a small skew angle of 45^{o}. The total length would be approximately 50m.

The railway bridge width, which is due to the skew angle where the indicative alignment intersects the railway line, will increase the construction cost in contrast to a bridge with no skew. Other structures that will be required are culverts to minor watercourses and retaining walls where cutting or embankment slopes become excessive.

6.9.4.6 Construction Issues

Due to the topography one large cutting (approximately 25m deep) is anticipated along the A2 Warrenpoint Road. The indicative alignment option within Corridor 3 crosses the Newry River/Canal with a minimal skew but requires to cut into the hillside to get back down to the existing level of the A2 Warrenpoint Road. The earthworks would be of a significant height and it may be desirable to steepen side slope angles using geotechnical solutions or conversely to reduce the slopes to blend into the topography.

The construction of the junctions on the A2 Warrenpoint Road and the A1 Newry Bypass will require significant traffic management to alleviate driver stress since it is anticipated that there would be delays during construction. Some delays will be caused by the necessity to reduce vehicle speeds to lower the risks on workforce safety. The intention would be to keep two running lanes open in both directions for the entirety of the construction period. The corridor crosses two local roads which would require traffic management and may also need diversions while any bridges are under construction.

6.9.5 Corridor 4

Corridor 4 has two indicative alignments and they are shown in Figures 5.3.4 & 5.3.5 in Appendix A. The corridor's eastern boundary stretches from approximately 1km south of the Aghnamoira Road junction to a point a further 3km south on the A2 Warrenpoint Road opposite the RoI border. The corridor extends towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor.

The difference between the two alignments is the Newry River/Canal crossing location. The first (Option A) crosses the Newry River/Canal upstream of the Victoria Lock and the second crossing (Option B) is downstream of the Victoria Lock and crosses the Newry River at Rough Island. Option B is at the narrowest point between the B79 Fathom Line and the A2 Warrenpoint Road and provides significant savings in terms of structure costs.

The length of road construction required is approximately 4.9km for Option A and 6.3km for Option B (1.6km of this is upgrade/widening to B79 Fathom Line). Both alignments require a new at-grade roundabout junction connecting to the A2 Warrenpoint Road, a new at-grade roundabout on B79 Fathom Line and connecting into the existing grade separated Ellisholding junction on the A1/N1 Corridor. Providing a roundabout on the B79 Fathom Line would reduce the free flow movement for strategic traffic but provides a link to the existing road network.

6.9.5.1 Junctions and Local Road Network

A2 Warrenpoint Road Junction

This Corridor connects the A2 Warrenpoint Road from a proposed roundabout located between the Aghnamoira Road junction and the A2 Roundabout just north of Warrenpoint. The proposal would site a new roundabout either approximately 1km south of the Aghnamoira Road junction or approximately 3km south of the Aghnamoira Road junction.

There are no major constraints on the A2 Warrenpoint Road within the corridor boundary. There is an airstrip located to the north of the corridor boundary on the western side of the A2 Warrenpoint Road which may cause issues regarding low flying aircraft.

A1/N1 Belfast-Dublin Corridor Junction

Corridor 4 would tie into the A1/N1 Belfast-Dublin Corridor via the existing Ellisholding junction as discussed previously under Corridor 1.

Local Road Network

Corridor 4 crosses: two major roads – B79 Fathom Line and the old A1 Dublin Road; two minor side roads – Flagstaff Road and Barracric Road, and also crosses some minor accommodation and farm access roads. It is envisaged that a number of the minor side roads and accesses could be either stopped up or linked to nearby side road crossings, thus eliminating the need for some structures.

It is expected that there would be some impact on the A2 Warrenpoint Road and B79 Fathom Line as works will be required to accommodate the new roundabouts that are sited on these roads. The Flagstaff Road as shown in the indicative alignment would be carried over the new carriageway on a bridge structure as the new carriageway is in a cutting at this location. Other side roads/accommodation lanes would then be accessed either from B79 Fathom Line or from Flagstaff Road.

At side road crossings, some reconstruction would be expected. The need to provide at-grade accesses to properties on the side roads is likely to prevent significant changes to vertical alignment of these existing roads.

The Flagstaff Road is approximately 3.5m wide where it crosses the proposed carriageway. The road connects to the A2 Dublin Road at its northern end and to the Ferryhill Road in the south, outside the Study Area. As it is expected to carry more traffic than the other minor side roads which cross Corridor 4, significant upgrade works are likely to be required to this road.

6.9.5.2 Topography, Earthworks and Geology

Corridor 4 traverses very thin deposits where bedrock is expected to be at or near to the surface, although it does cross some areas of glacial till, in particular on approach to the Ellisholding junction tie-in. Similar to the other corridors, it also crosses the recent marine deposits on the valley floor (Figure 7.11.2 in Appendix A). On the eastern extents Corridor 4 would traverse the greywackes and shales from the Hawick Group in the vicinity of Warrenpoint Road. The western boundaries of the corridor would traverse granodiorites on the slopes of the Fathom Mountain, passing over dyke intrusions adjacent to the Newry Canal. As the corridor sweeps up the side of the Fathom Mountain it would generally pass over the granodiorites and felsites (Figure 7.11.1 in Appendix A).

Corridor 4 passes over a historical quarry close to the railway line towards the south eastern extent of the Corridor. The Corridor also passes very close to two historical quarries at the south western extents close to Green Island; it is possible that these two locations were one quarry in operation at different times.

The potentially contaminated land site areas covering the corridor options study area are indicated on Figure 7.11.4 in Appendix A. The source locations shown have been identified from a review of the NIEA contaminated land database, historic and current maps. The Corridor 4 option would traverse 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);
- The Belfast –Dublin Railway Line to the west of the corridor and two historical railway lines running either side of the Newry River (Newry and Greenore Railway; Newry to Warrenpoint Railway); and
- Two mineral workings are in close proximity to the corridor's eastern boundary (source nos. 6 & 8).

In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land, may also give rise to potential contaminated site areas.

6.9.5.3 Utilities

Corridor 4 has similar interaction with utility service apparatus to any previous corridor. Table 6.15 shows the number of service crossings within the corridor. Service crossings are likely to be straightforward in this rural setting; however, it will become more difficult to accommodate the services working close to and around live junctions. Since Corridor 4 lies within a more rural context there are no sewerage main line systems being crossed within the corridor. Most dwellings will have individual systems to deal with sewage waste.

Table 6.15 – Number of service crossing for Corridor 4

Existing Services		No. of Service Crossings
Northern Ireland Electricity	MV	3
	11kV	6

Existing Services		No. of Service Crossings
	33kV	1
Northern Ireland Water	Watermains	6
	Sewerage	0
Communications	BT	O/H = 3 U/G = 3
	Virgin Media and Eircom	N/A
	CTIL	N/A
Firmus Gas		1

The impact on utilities is deemed to be relatively minor within this corridor when compared to other road schemes of a similar scale. Given the above information, service diversions should not make up a high proportion of the overall scheme cost. The utility providers would be consulted throughout the design process to ensure that their requirements are satisfied and the most cost effective solutions are provided. The two indicative alignments have the same number of utility crossing.

6.9.5.4 Drainage

Corridor 4 has two main watercourse crossings of the Newry River and Canal. There are a further seven minor watercourse crossings, two of which are the same watercourse; a minor watercourse running through Fathom Lower Wood. The Newry Canal is the outfall point for the minor watercourse continuing from Barracric Road.

Two of the watercourses are located to the west of the Newry Canal at approximately 2.7km and 2.9km respectively south of B79 Fathom Line/B79 Drumalane Road junction. These are minor watercourses running through a wooded area that outfall into the Newry Canal.

The final three watercourses are located to the east of Newry River at 750m, 950m and 1.2km respectively south of Aghnamoira Road junction with A2 Warrenpoint Road. These are minor watercourses running through a wooded area that outfall into the Newry River.

These watercourses would act as the main outfalls for the drainage of the proposed road. It is envisaged that the mainline drainage would follow the existing topography and would flowing generally towards the Newry Canal. Some other minor watercourses running across the proposed corridor and depending on their size may be directed towards a main culvert crossing, including a ditch running parallel to the A2 Warrenpoint Road on the western side within the airstrip which has numerous collection points along its length. Environmental consent and a Drainage Order would be required to allow any diversion of the watercourses.

This corridor crosses existing roads at four locations and links into two existing roads with existing drainage infrastructure. At each of these locations any existing drainage would need to be considered when designing the proposed link.

Records do not show any major flooding of infrastructure or lands within the extents of the corridor (apart from the floodplain storage on the mud flats); however, the vertical alignment of the road at low-lying locations would need to have sufficient elevation to ensure that drainage outfalls can be accommodated above any future flood levels.

6.9.5.5 Structures

Table 6.16 lists the structures that would be required as part of the construction of the indicative route within Corridor 4. There are three main obstacles which require to be bridged; the Newry River/Canal, the Flagstaff Road crossing and the main railway bridge that runs parallel to the A1/N1 Belfast-Dublin Corridor near Ellisholding Junction.

Option A – The indicative alignment provides a roundabout junction with existing roads on either side of the Newry River/Canal, i.e. Fathom Line to the west and the A2 to the east. This results in a perpendicular bridge

crossing the river and canal approximately 600m north of Victoria Lock. The bridge is relatively low, with approximately 6m clearance between canal water level and bridge soffit in the closed position and therefore would require an opening section over the canal. The bridge is located entirely on the river floodplain and therefore poor ground conditions are to be expected.

The bridge would be 415m long including an allowance of 55m for the bascule opening section, based on a clear canal width of 40m. The relatively low level of the structure would result in deep excavations required adjacent to the canal in order to construct the bascule pier. Significant retaining walls would also be required between the canal and the realigned Fathom Line due to the elevation of the proposed roundabout junction.

Option B – This option has some similarities to Corridor 4 Option A in that the indicative alignment provides for a roundabout junction on Fathom Line Road and the A2 on either side of the river, which results in a straight square crossing. However, the proposed crossing is approximately 1km south of Victoria Lock, at a location known as Rough Island; the bridge does not cross the canal.

The proposed crossing location is at a natural local narrowing of the river channel which results in a relatively shorter bridge with an overall length of 200m, including an allowance of 45m for the bascule opening section over the navigable channel. Similar to Option A, the bridge is located entirely on the river floodplain and therefore poor ground conditions are anticipated.

Table 6.16 – Major Structures Required for Corridor 4

Description/Location	Bridge Type	Total Span (m)	Width (m)	Skew (degrees)
Newry River/Canal – fixed bridge (A)	Underbridge	360	14.8	<5
Newry River/Canal – bascule opening section (A)	Underbridge	55	14.8	<5
Newry River – fixed bridge (B)	Underbridge	145	14.8	<5
Newry River – bascule opening section (B)	Underbridge	55	14.8	<5
Flagstaff Road Crossing	Overbridge	50	12	45
Railway Bridge Crossing	Underbridge	20	67	60

The Newry River/Canal crossing for Option A ranks fourth and the Newry River crossing for Option B ranks second in terms of length when compared to the rest of the corridors. Both bridges cross a floodplain area which would increase the cost and complexity of the design.

The Flagstaff Road crossing, over the proposed mainline would have a single carriageway width of 12m with a small skew angle of 45^{o}. The total length would be approximately 50m.

The railway bridge width, which is due to the skew angle where the indicative alignment intersects the railway line, will increase the construction cost in contrast to a bridge with no skew. Other structures that will be required are culverts to minor watercourses and retaining walls where cutting or embankment slopes become excessive.

6.9.5.6 Construction Issues

The cutting and embankment heights (approximately 10m high) that are apparent in the alignment options are not as excessive as those in other corridors; these could be locally steepened to reduce the environmental impact.

The construction of the junctions on the A2 Warrenpoint Road and the A1 Newry Bypass will require significant traffic management to minimise congestion since it is anticipated that there would be delays during construction. Some delays will be caused by the necessity to reduce vehicle speeds to lower the risks on workforce safety. The intention would be to keep two running lanes open in both directions for the entirety of the construction period. The corridor crosses two local roads which would require traffic management and may also need diversions while any bridges are under construction.

6.9.6 Corridor 5

Corridor 5 is shown in Figure 5.3.6 in Appendix A. The corridor heads west from the locality of Greenbank Industrial Estate on the A2 Warrenpoint Road towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor.

The length of road construction required within Corridor 5 is approximately 3.4km, with an at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and connecting into the existing grade separated Ellisholding junction in the west. Also two new at-grade roundabout junctions are proposed; 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.

6.9.6.1 Junctions and Local Road Network

A2 Warrenpoint Road Junction

This Corridor connects to the A2 Warrenpoint Road in the locality of Greenbank Industrial Estate approximately 1.3km from the existing Greenbank Roundabout. The corridor frontage onto the A2 Warrenpoint Road allows for various tying in options to be considered further in the scheme assessment process.

Similar to Corridor 1 some constraints exist at this tie-in location, notably the high density of sports grounds, industrial and retail units within the Greenbank Industrial Estate, of which some would be affected by choosing this corridor.

A further constraint is the numerous services within the Greenbank area and the close proximity to housing on the eastern side of the A2 Warrenpoint Road. It is anticipated that any roundabout proposal on the A2 Warrenpoint Road would provide enough spacing between it and the existing Greenbank Roundabout.

A1/N1 Belfast-Dublin Corridor Junction

Corridor 5 would tie into the A1/N1 Belfast-Dublin Corridor via the existing Ellisholding junction as discussed previously under Corridor 1.

Local Road Network

Corridor 5 crosses: one major road – B79 Fathom Line; one side road – Flagstaff Road, it connects to the old A1 Dublin Road, and some minor accommodation and farm access roads. It is envisaged that a number of the minor side roads and accesses could be either stopped up or linked to nearby side road crossings, thus eliminating the need for some structures. At side road crossings, some reconstruction may be expected. The need to provide at-grade accesses to properties on the side roads is likely to prevent significant changes to vertical alignment of these existing roads.

It is expected that there will be some impact on the A2 Warrenpoint Road, B79 Fathom Line and the old A1 Dublin Road as works will be required to accommodate the new roundabouts and junctions that are sited on these roads. The Flagstaff Road as shown in the indicative alignment would be carried over the new carriageway on a bridge structure as the new carriageway is in a cutting at this location. Other side roads/accommodation lanes will then be accessed either from B79 Fathom Line or from Flagstaff Road.

The Flagstaff Road is approximately 3.5m wide where it crosses the proposed carriageway. The road connects to the A2 Dublin Road at its northern end and to the Ferryhill Road in the south outside the Study Area. It is expected to carry more traffic than the other minor side roads which cross Corridor 5; significant upgrade works are likely to be required to this road.

6.9.6.2 Topography, Earthworks and Geology

At the northern boundary of Corridor 5 at A2 Warrenpoint Road, the corridor may encroach on some raised marine deposits then generally crosses glacial tills and areas where bedrock is expected to be at or near to the surface. Similar to the other Corridors, it also crosses the recent marine deposits on the valley floor (Figure 7.11.2 in Appendix A). Corridor 5 primarily crosses over the greywackes and shales, although it does pass over felsites on the slopes of the Fathom Mountain before traversing granodiorites towards the A1/N1 corridor (Figure 7.11.1 in Appendix A).

The south eastern extent of Corridor 5 passes over a historical quarry close to the railway line. It also passes over the southern extents of the Drumalane Quarry to the north of the corridor. This corridor avoids the known

area of instability at Hillhead Road. However, careful consideration will be required for any potential route options within Corridor 5 along with assessment and investigation to ensure that it is out of any areas of global instability.

The potentially contaminated land site areas covering the corridor options study area are indicated on Figure 7.11.4 in Appendix A. The source locations shown have been identified from a review of the NIEA contaminated land database, historic and current maps. The Corridor 5 option would traverse the following potentially contaminated land sources:

- Factory/engineering works: mechanical engineering and ordnance works (source nos. 23, 26 & 28);
- Waste recycling: landfills & other waste disposal sites (source no. 24);
- Drumalane Quarry (source no. 69);
- Mineral workings and a possible quarry (source nos. 81 & 82);
- The current Belfast –Dublin Railway Line to the west of the corridor and two historical railway lines, either side of the Newry River (Newry and Greenore Railway; Newry to Warrenpoint Railway);
- East of the Newry River, a garage and quarry are located close to the corridor boundary (source nos. 25 & 29); and
- West of the Newry River, an oil storage site and dockyard/dockland site are near the corridor boundary (source nos. 16 & 17).

In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land, may also give rise to potential contaminated site areas.

6.9.6.3 Utilities

Corridor 5 has, with the exception of water infrastructure generally, less interaction with utility service apparatus than any previous corridor. Table 6.17 shows the number of service crossings within the corridor. Service crossings are likely to be straightforward in this rural setting; however, it will become more difficult to accommodate the services working close to and around live junctions.

A large proportion of Corridor 5 lies within a more rural context; however, the corridor goes through the Greenbank Industrial Estate at its western tie-in location and will encounter services that lie within that area. The number of utility service crossings in this area would be similar to both Corridor 1 and 2. Away from Greenbank Industrial Estate, Corridor 5 has similar utility service crossings to that of Corridor 3 and 4.

The impact on utilities is deemed to be relatively minor within the corridor when compared to other road schemes of a similar scale. Given the above information, service diversions should 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 6.17 – Number of service crossing for Corridor 5

Existing Services		No. of Service Crossings	
Northern Ireland Electricity	MV	1	
	11kV	3	
	33kV	1	
Northern Ireland Water	Watermains	6	
	Sewerage	2	
Communications	BT	O/H = 3	U/G = 2
	Virgin Media and Eircom	0	

	CTIL	N/A
Firmus Gas		1

6.9.6.4 Drainage

Corridor 5 has two main watercourse crossings of the Newry River and Canal. There are a further two minor watercourse crossings, a ditch running parallel to the A2 Warrenpoint Road and a minor watercourse running through Fathom Lower Wood from Barracric Road. The Newry Canal is the outfall point for the minor watercourse continuing from Barracric Road.

These watercourses would act as the main outfalls for the drainage of the proposed road. It is envisaged that the mainline drainage would follow the existing topography flowing generally towards the Newry Canal. Some other minor watercourses run across the proposed corridor and depending on their size may be directed towards a main culvert crossing, including a ditch running parallel to the A2 Warrenpoint Road on the western side. Environmental consent and a Drainage Order would be required to allow any diversion of the watercourses.

This corridor crosses existing roads at two locations and links into two existing roads with existing drainage infrastructure. At each of these locations any existing drainage that may be present would need to be considered when designing the proposed link.

Records do not show any flooding of infrastructure or lands within the extents of the corridor (apart from the floodplain storage on the mud flats); however, the vertical alignment of the road at low-lying locations would need to have sufficient elevation to ensure that drainage outfalls can be accommodated above any future flood levels.

6.9.6.5 Structures

Table 6.18 lists the structures that will be required as part of the construction of the indicative route within Corridor 4. There are three main obstacles which are required to be bridged; the Newry River/Canal, the Flagstaff Road crossing and the railway bridge that runs parallel to the A1/N1 Belfast-Dublin Corridor at Ellisholding Junction.

The river and canal bridge in this corridor crosses approximately 950m south of the Corridor 1 alignment and has some similar features. The indicative alignment has a roundabout junction on the A2, traverses the Greenbank Industrial Estate on the eastern side of the river and ties into a further roundabout junction to the west of Fathom Line. As for Corridor 1, this route does not cross the flood plain mud flats, which reduces the need for temporary works and the potential for environmental impact during construction. However as this area is reclaimed flood plain, poor ground conditions are to be expected. The waterway channels are also relatively narrow with the river being 55m wide and the canal being 27m wide, based on square widths.

The provision of a roundabout junction on either side of the river/canal crossing results in a straight alignment crossing square to the river, which minimises bridge length. The clearance between canal water level and bridge soffit is approximately 9m, so this structure would require an opening section over the navigable channel. The longitudinal gradient on the bridge is modest and varies between 2% and 4%.

In addition to the waterways the bridge spans across the existing Fathom Line Road on the western side and also continues for approximately 15m beyond the river bank on the eastern side in order to accommodate a local road which would maintain connectivity within Greenbank Industrial Estate. The resultant overall length of the bridge is 145m, which includes an allowance of 45m for the bascule opening section which is the shortest and hence the cheapest when compared to the other corridors.

It is anticipated that there will only be one column required in the Newry River for this structure; if a long span structure is to be used there may be no requirement for a column in the Newry River.

Table 6.18 – Major Structures Required for Corridor 5

Description/Location	Bridge Type	Total Span (m)	Width (m)	Skew (degrees)
Newry River/Canal – fixed bridge	Underbridge	100	14.8	<5
Newry River/Canal – bascule opening section	Underbridge	45	14.8	<5
Flagstaff Road Crossing	Overbridge	50	12	<5
Railway Bridge Crossing	Underbridge	20	15	0

The Flagstaff Road crossing, over the proposed mainline would have a single carriageway width of 12m with a small skew angle of approximately 5^{o}. The total length would be approximately 50m.

The railway overbridge has a 0^{0} skew angle where it cross over the railway line; reducing the total construction cost in comparison to the other corridors. Other structures that will be required are culverts to minor watercourses and retaining walls where cutting or embankment slopes become excessive.

6.9.6.6 Construction Issues

The cutting and embankment heights (approximately 10m high) that are apparent in the Corridor 5 are not as excessive as those in other corridors; these could be locally steepened to reduce the environmental impact.

The construction of the junctions on the A2 Warrenpoint Road and the A1 Newry Bypass will require significant traffic management to alleviate driver stress since it is anticipated that there would be delays during construction. Some delays will be caused by the necessity to reduce vehicle speeds to lower the risks on workforce safety. The intention would be to keep two running lanes open in both directions for the entirety of the construction period. The corridor crosses two local roads which would require traffic management and may also need diversions while any bridges are under construction.

6.10 Comparative Assessment

6.10.1 Junctions and Local Road Network

In terms of junctions and their interaction with the local road network; Corridor 4 is the best performing. Its junction on the A2 Warrenpoint Road does not affect other existing junctions and is far enough from Newry City that it does not affect either local residential properties or sports grounds, industrial and retail units within the Greenbank Industrial Estate unlike the other corridors which all impact these to varying degrees. Only Corridors 4 and 5 can be readily connected to Fathom Line. The corridors that connect to Ellisholding (Corridor 1, 3, 4 and 5) are all quite similar with respect to severance of the local road network and each provides one overbridge structure to the Flagstaff Road. At the Ellisholding grade-separated junction, the corridors are similar with Corridor 5 marginally performing better with respect to the railway bridge skew.

The worst performing corridors are Corridors 1 and 2. These both have constraints at their respective tie-ins to the A2 Warrenpoint Road; albeit Corridor 1 is marginally worse due to the close proximity to substantial sports grounds, industrial and retail units at Greenbank Industrial Estate. However the tie-in location on the A2 Dublin Road for Corridor 2 is likely to be difficult due to constraints that include: Cloghogue Heights housing development, Cloghogue Pitch and Putt Golf Club, Church of the Sacred Heart, its connecting cemetery, and the Flagstaff Road.

Corridor 3 and Corridor 5 are located between the other three corridors with Corridor 3 being slightly better due to less interaction with the Greenbank Industrial Estate, its junction on the A2 Warrenpoint Road does not significantly affect other existing junctions, fewer roundabouts and opening structures to obstruct free-flow on the proposed road.

6.10.2 Topography, Earthworks and Geology

The most significant known existing geotechnical risk within the Corridor Options study area is the stability of the western extents of Drumalane Quarry and the land adjacent to this. The quarry's footprint is large and there is some evidence of instability due to ground movements to the west of the quarry.

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 have indicated further movement has occurred since the road was closed.

Corridor 1 and Corridor 2 are within the zone of known historical instability along Hillhead Road. This is an area deemed to be of significant geotechnical risk and should be avoided.

Potential contaminated land sources have been identified within each of the proposed route corridors. These source locations will require further investigation in order to assess the likely scale of impact on each particular route. The greatest potential impact from contaminated soils/groundwater is likely to found within Corridor 1 as this route traverses the northern, more populous area of the industrial estate east of the Newry River. The Corridor 4 option is likely to encounter the least significant sources of potential contaminated land. Corridor 5, followed by Corridor 2 and Corridor 3 are also likely to include a number of significant sources which may require remediation/mitigation if chosen as the preferred route.

It is anticipated that Corridor 4 would have the least amount of cut with respect to the other corridors; however, it requires a large amount of fill due to its length traversing along the side of Fathom Mountain. This large imbalance between the cut and fill within this corridor would increase the cost of the earthworks due to the imported fill requirement. That being said, Corridor 4 does not have any excessive cuts or embankments when compared to the other corridors and therefore is ranked in the middle. Corridors 1 and 2 have a better cut and fill balance but are still expected to have excessive cuts and embankments and they are close to the existing Drumalane Quarry which is considered to be a major geotechnical risk. These alignments are ranked as the worst performing with Corridor 1 being slightly worse due to the anticipated cut volume assumed to be in rock and therefore incurring a higher cost in terms of earthworks.

It is not anticipated that Corridor 3 would require any fill to be imported but it does have an excessively large cut at the eastern tie-in location to the A2 which would increase the cost of the earthworks when compared to the other corridors. Corridor 5 would require fill to be imported; however, it is minimal in comparison to Corridor 4. It has a minimal cut as well, leading to one of the lowest cost of earthworks and is the lowest cost of earthworks overall when broken down into cost/km. Corridor 5 is ranked as best performing in terms of earthworks.

6.10.3 Utilities

In terms of utilities, there are a few of the services that are common to all of the corridors; Firmus gas is apparent in all of the corridors at the A2 Warrenpoint Road tie-in and all corridors cross a 33kV NIE line. After this the corridors diverge slightly in terms of the utility crossings with Corridors 1 and 2 the worst performing. Corridor 1 is the worst overall as it crosses more; NIE, NIW and BT networks. Corridor 2 crosses fewer services but it does cross a Virgin broadband cable on the A2 Dublin Road.

Corridor 3, Corridor 4 and Corridor 5 are all quite similar in terms of number of utility crossings. Corridor 5 is marginally the best performing by affecting fewer NIE services. Corridor 3 is ranked second best performing as it has a fewer number of NIE and NIW service crossings. Corridor 4 lies in the middle of all the rankings.

6.10.4 Drainage

All corridors must cross the Newry River and Newry Canal. Corridor 2, Corridor 3 and Corridor 5 similarly impede the least number of minor watercourses ranking them the best performing. Corridor 2 is ranked best; whilst it may affect a similar number of watercourses, a greater length of watercourse is affected on both Corridor 3 and Corridor 5 traversing down the Lower Fathom Wood with Corridor 3 affecting the greatest length.

Corridor 4 Option B is the worst performing as it will impede the greatest number of minor watercourses along the B79 Fathom Line due to the length of proposed carriageway under consideration.

6.10.5 Structures

Corridor 5 is the best performing; it has the shortest overall Newry River/Canal bridge span, the joint shortest Newry Canal bascule opening span and it has the shortest railway bridge span. Corridor 4 Option B is ranked the second best performing due to having the second shortest Newry River/ Canal bridge span and a joint lesser skew angle of 61^0 for the railway bridge structure. Corridor 1 is ranked as the next best with the following shortest overall bridge length and similar railway skew angle to Corridor 4.

Corridor 4 Option A is ranked the fourth best option, closely followed by Corridor 2. The Newry River/Canal bridge for these options are longer than those previously mentioned and require the largest Newry Canal bascule opening section due to their location crossing the Newry Canal and alignment's skew angle.

Corridor 3 is the worst performing option as it has the longest bridge structure at 800m long across the valley; however, it does not have an opening section and is a totally fixed structure which would not impede strategic traffic. The other options all require an additional operational cost estimated to be £26,000 per annum which would not be required for Corridor 3.

6.10.6 Construction Issues

All of the corridors will have some similar issues such as traffic management for working on live carriageways and at the tie-in locations. Corridor 2 is ranked the worst performing as it has the greatest number of construction issues/risks including: large cuttings and embankments, construction of piers in water, construction close to the airstrip, close proximity to the existing Drumalane Quarry and a Newry Canal bridge bascule opening section.

Corridor 3 is ranked the second worst; it has similar issues to Corridor 2 apart from the bascule opening section or a close proximity to the existing Drumalane Quarry. Corridor 1 is the third worst with similar issues to Corridor 2 apart from constructing piers in the water as it is anticipated that the bridge will be spanned between the canal and river banks and it is not in close proximity to the airstrip.

Corridor 4 and Corridor 5 are similar to each other as the best performing with Corridor 5 ranked marginally better as it is anticipated that no piers will be needed to be constructed in the water over the Newry River.

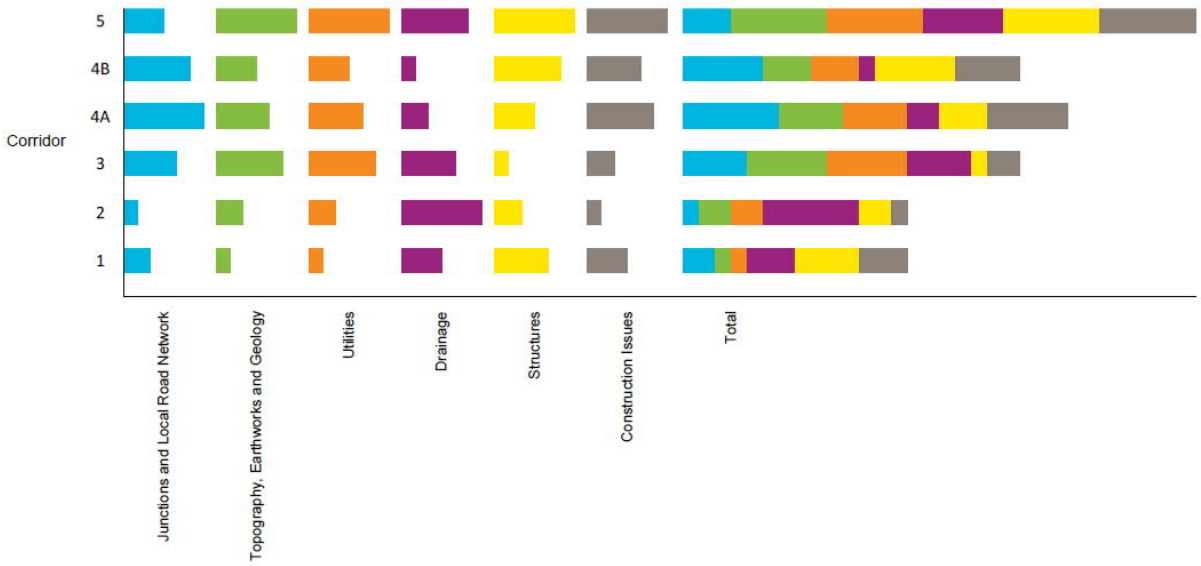
6.10.7 Comparative Assessment Conclusion

shows the ranking of the corridors in context of the engineering assessment. Each corridor was ranked from best to worst performing in each of the categories listed on the left hand side of the graph; first place receives 6 points, reducing by one point per place down to last place receiving one point.

Figure 6.10.1 Comparative Assessment Ranking

Corridor

	1	2	3	4(A)	4(B)	5
Junctions and Local Road Network	2	1	4	6	5	3
Topography, Earthworks and Geology	11	2	5	4	3	6
Utilities	1	2	5	4	3	6
Drainage	3	6	4	2	1	5
Structures	4	2	1	3	5	6
Construction Issues	3	1	2	5	4	6
Total	24	14	21	24	21	32



It is clear that Corridor 5 performs well in the comparative assessment. Corridor 4 Option A is ranked the second best closely followed by Corridor 4 Option B and Corridor 3 in joint third place. The worst performing alignments are Corridors 1 and 2 which are in joint last position. This engineering assessment has been recorded on the Assessment Summary Table at the end of Appendix B.

6.11 Engineering Conclusions

Corridor 5 is the overall best performing corridor in terms of the engineering assessment as the corridor:

- is the most sympathetic in terms of topography, earthworks and geology;
- crosses the least number of utilities;
- has the shortest bridge crossing (consequently the least expensive structure cost); and
- encounters the least number of construction issues/risks.

Corridor 4 performs well in terms of the engineering assessment as the corridor:

- has the least conflict with the local road network;
- cross a medium number of utilities;
- have a medium bridge crossing structural cost; and
- encounters a medium number of construction issues/risks.

Corridor 3 performed well in terms of the engineering assessment as it provides continuous flow to the traffic on this route:

- is sympathetic in terms of topography, earthworks and geology;
- with the exception of Corridor 5 crosses fewer utilities than other corridors;
- has the longest bridge crossing (consequently the most expensive structure cost); and
- encounters the least number of construction issues/risks.

Corridors 1 and 2 are the worst performing corridors in terms of engineering assessment as these corridors:

- are in close proximity to the Drumalane Quarry which is a known geohazard;
- have some of the most expensive bridge elements;
- encounter the greatest number of construction issues/risks;
- have junctions in dense urban locations, including close to Greenbank Roundabout and Cloughogue Roundabout; and
- crosses more services, due to their urban city centre context.

Environmental Assessment

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7. Environmental Assessment

The General Location Plan and Study Area boundary for the scheme are shown on Figure 7.1.1, and the Preliminary Corridors for development of a relief road to the south of the Newry are shown on Figure 5.2.1.

The Preliminary Corridors are subject to a Stage 1 Scheme Assessment, as defined in the DMRB TD 37/93. This Stage 1 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 five Preliminary Corridors, giving a broad 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.

Although mitigation cannot be considered in detail at this stage, a broad indication of potential mitigation measures aimed at preventing, reducing or offsetting adverse environmental effects have also been described. This concludes in the identification and selection of a Preferred Corridor to be developed at Stage 2.

A number of environmental topics are assessed in relation to the scheme, 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 7.1.1 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 7.1.1 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.

7.1 Existing Environmental Conditions

7.1.1 Local Context

The study area is centred 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 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 City 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. The cross border rail link between Northern Ireland and the Republic 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;
- 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.

7.1.2 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.

7.1.3 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).

7.1.4 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.

7.1.5 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).

7.2 Air Quality

7.2.1 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.

7.2.2 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. The procedure for assessing air quality impacts is outlined in DMRB Volume 11, Section 3, Part 1, Chapter 3 (HA 207/07).

For air quality, each assessment level has two components. The first is for local air quality, that is, estimation of pollutant concentrations (i.e. Nitrogen Dioxide, Oxides of Nitrogen, fine particulates (PM_{10})) at specific locations that could change as a result of the scheme. These concentrations are compared with air quality criteria set to protect human health or vegetation, as appropriate. Both construction and operational effects should normally be considered for local air quality. The second component is for the regional impact assessment and examines the change in emissions of a range of pollutants as a result of operation of the scheme, as these pollutants can have impacts on the regional, national and international scale.

The two components may require different assessment levels, of which the process has four discrete levels:

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

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 air quality impacts (local or regional) associated with the five broadly defined corridors under consideration. At this preliminary stage, a Scoping level assessment was deemed 'fit-for-purpose'.

The assessment however should normally be carried out using traffic data for the 'Do-Minimum' (without the scheme) and 'Do-Something' (with the scheme) scenarios, for the assumed opening year and possibly for a further future year. The worst year in the first 15 years from opening needs to be assessed. The base case should also be assessed. However, at time of assessment, very limited traffic information for the scheme (relevant to the air quality assessment) was modelled, though some useful information about traffic is known, including:

- traffic volumes across all corridors would vary with proximity to the City, with the highest volume of traffic using the corridor closest to the City, and the least to the corridor furthest from the City; and
- HDV proportion would be constant, irrespective of the corridor.

Whilst this has ultimately limited the scope, a broad assessment was undertaken, which still enabled informed decision-making from an air quality perspective.

Accordingly, a methodology was adapted from DMRB 11.3.1.3 and tailored to the characteristics of the project at this stage. As much as feasibly possible, it has been carried out to an appropriate level of detail related specifically to the degree of environmental risk associated with each of the broad corridors under consideration. The steps taken therefore included:

- undertaking consultation with key stakeholders, allowing them to register concerns and/or particular requirements during the period of data collection for this assessment;
- identifying which roads are likely to be affected by the scheme. For a road to be affected, this is largely based upon a set of specific traffic-related criteria (as set out below). Utilising available traffic information and professional judgement, the majority of roads that would likely meet any of the following [DMRB11.3.1.3] criteria were identified:
  - road alignment change by 5m or more; or
  - daily traffic flows change by 1,000 AADT or more; or
  - HDV flows change by 200 AADT or more; or
  - daily average speed will change by 10km/hr or more; or
  - peak hour speed will change by 20km/hr or more.
- characterising the existing built environment, paying particular attention to sensitive receptors such as residential housing, schools, hospitals, places of worship, sports centres and shopping areas where people might experience a change in local air quality;
- where relevant, estimating the number of sensitive receptors that may be subject to a change in local air quality. This has been undertaken by providing a 200m offset from the centreline of an indicative alignment of the southern relief road within each of the corridors under consideration. A count of the sensitive receptors was then made within 50m bands up to 200m from each indicative alignment. This has been undertaken by utilising LPS OSNI Pointer data, which is a comprehensive and standardised address database, that holds address information for every property in Northern Ireland;
- identifying any nature conservation sites (designated sites) and their characteristics within 200m of any roads affected by the project. The designated sites that should be considered for this assessment are those for which the designated features are sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the effect of local air quality on vegetation within the following nature conservation sites: SACs (SCIs or cSACs), SPAs, pSPAs, ASSIs and Ramsar sites;
- identifying and reviewing any other relevant local information that may influence the assessment at this stage, including the existence of Air Quality Management Areas (AQMAs), Local Air Quality Monitoring (LAQM) Reports and up-to-date monitoring data;
- identifying any areas where it is likely that air quality will improve or deteriorate as a result of changes to traffic flows and traffic speed, or as a result of reduced congestion or queuing times, due to the scheme. Again, this has been limited to professional judgement in the absence of detailed traffic data.

7.2.3 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 consultation from an air quality perspective.

Table 7.1 Summary of formal consultation responses in relation to Air Quality

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Confederation of Community Groups – Newry & District	22 July 2016 13 Oct 2016* 23 Nov 2016	12 Aug 2016	Concerned regarding traffic volume (particularly from Warrenpoint Port) and its impact upon health of residents including the effect of air pollution, coupled with traffic delays in a number of areas. Concerned at potential impact of scheme on communities close to bridge crossing. Recommended Corridor 3.
East Border Region	22 July 2016 13 Oct 2016* 23 Nov 2016	04 Sept 2016	Support the scheme as it will contribute positively to air quality in Newry by reducing pollutants and improve living conditions for those who work and live in the area.
DAERA – Air and Environmental Quality Unit	22 July 2016 13 Oct 2016	16 Aug 2016 18 Nov 2016	Recommend consultation with NMDDC for local air quality information, as well as impact of the scheme. Provided links to NI air quality information and legislation, and recommended following DMRB assessment procedures. Additional consultation response provided no further comment.
NMDDC – Enterprise, Regeneration & Tourism	22 July 2016 13 Oct 2016* 23 Nov 2016	17 Aug 2016	Stated that the Council has a legal duty to review and assess district air quality. Noted some areas in the City are unable to achieve PM_{10} and NO_2 targets. Main causes are traffic- related and heating systems. Council has developed Action Plan, which included air quality modelling. Response also outlined the benefits of the scheme improving air quality.
Newry & Mourne Enterprise Agency	22 July 2016 13 Oct 2016* 23 Nov 2016	13 Sept 2016	The scheme is vital to relieving traffic congestion and air pollution in Newry and opens the tourism potential of South Down. Does not support Corridor 1 or 2 due to community impacts.
NMDDC – Chief Executive	22 July 2016 13 Oct 2016	16 Nov 2016	In terms of air quality, provided the same response as summarised above for the NMDDC – Enterprise, Regeneration & Tourism.
Warrenpoint, Burren, Rostrevor Chamber of Commerce	22 July 2016 13 Oct 2016	18 Aug 2016 07 Dec 2016	No specific information in first response. In second response, WRB Chamber of Commerce question if the road would alleviate pollution issues in Newry, as they feel the issue is geographical.

**No response received in relation to the additional consultation regarding the developed corridors. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.*

7.2.4 Regulatory & Policy Framework

7.2.4.1 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 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 7.2.

Table 7.2 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

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 7.3.

Table 7.3 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

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

7.2.4.2 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."*

7.2.5 Baseline Environmental Conditions & Constraints

7.2.5.1 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 Plate 7.2.1, 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.

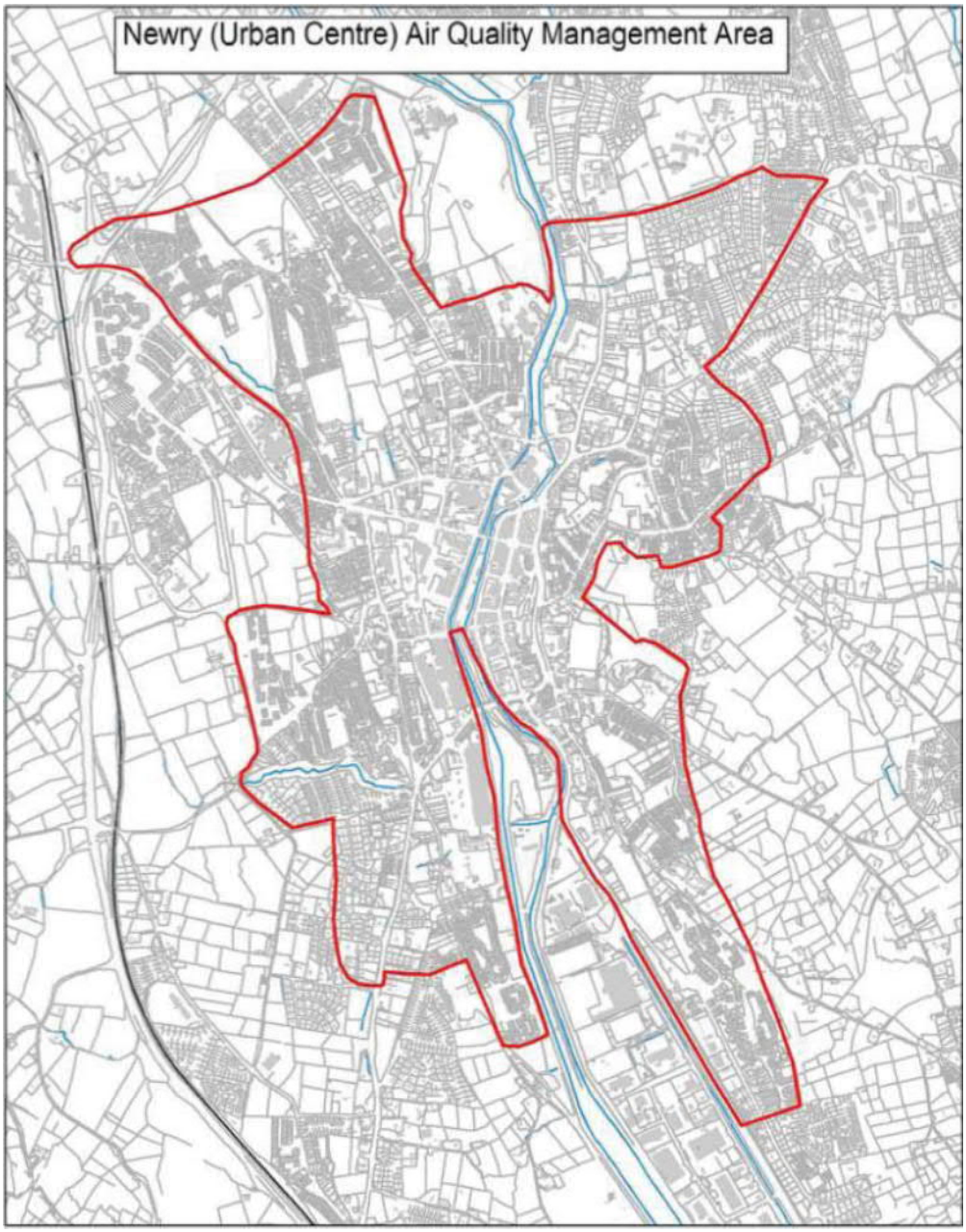

Plate 7.2.1: Newry (Urban Centre) AQMA
Source: http://aqma.defra.gov.uk/images/aqma_maps/Newry.jpg

Newry Canal Street AQMA

The Newry Canal Street AQMA (Plate 7.2.2) 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.

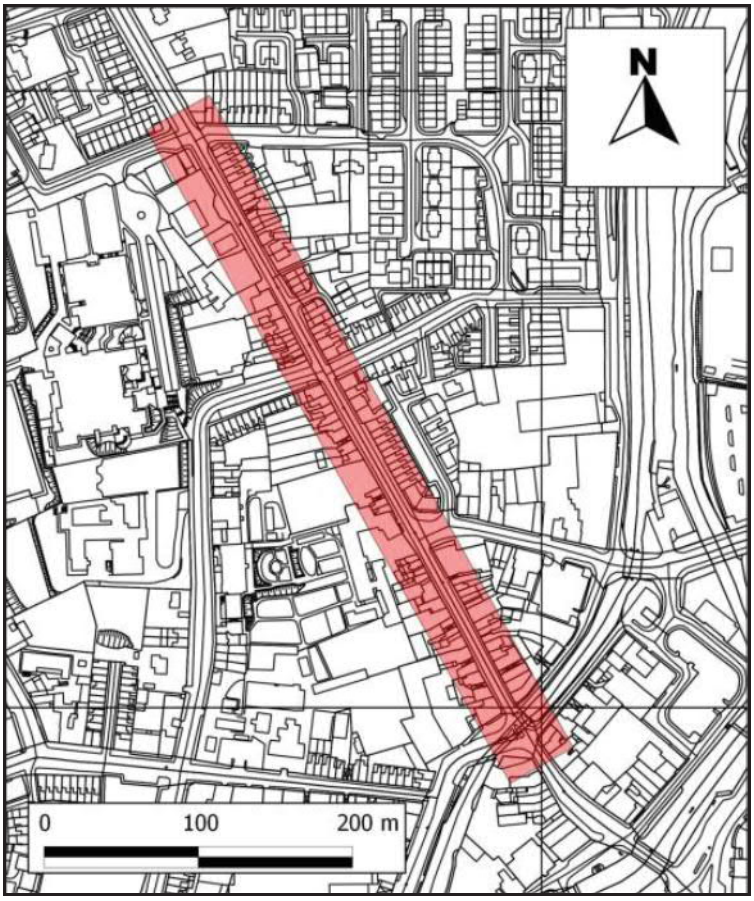

Plate 7.2.2: Canal Street AQMA
Source: http://www.airqualityni.co.uk/assets/documents/dcreports/Newry_and_Mourne_Canal_Street_FA_J1940_D2_130814.pdf

Monitoring

The Council operates three Automatic Air Quality Monitoring Stations (AQMS) in Newry, which monitor NO_2 and PM_{10} levels, at Canal Street, Monaghan Row and Trevor Hill. The Automatic monitoring networks measure 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.

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.

7.2.5.2 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.

7.2.5.3 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 detailed in Figure 2.3.6.

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;
- A1 William Street/Abbey Way;
- A28 Bridge Street/Dublin Bridge; and
- A28 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.

7.2.5.4 Designated Areas

There are three sites designated for either their ecological or earth science interest within the study area. These are:

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

Both Carlingford Lough ASSI and Fathom Upper ASSI have 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. The locations of these sites are shown on Figures 7.4.2 and 7.11.4.

7.2.6 Assessment of Environmental Impacts

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 6-13% (corridor 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.

7.2.6.1 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 (Figures 7.2.1 & 7.2.2), 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 of the southern relief road within each corridor. It has also taken account of the multiple bridge crossing point options (as is the case with Corridor 4). 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 7.4 and must be taken as indicative only at this initial stage.

Table 7.4 Number of properties within 200m of indicative alignment centrelines (not adjusted for potential property loss)

Corridor	Road Centreline – 50m	50-100m	100-150m	150-200m	Total
Corridor 1	58	43	74	87	262
Corridor 2	19	58	110	74	261
Corridor 3	16	10	13	16	55
Corridor 4 (Option A)	9	15	14	7	45
Corridor 4 (Option B)	12	16	14	7	49
Corridor 5	19	13	31	45	108

Corridor 1

There would be approximately 262 receptors within 200m of the indicative alignment within Corridor 1, with approximately 58 of these being within the first 50m.

From east to west, these receptors are located on, or in the vicinity of, the Old Warrenpoint Road, Toragh Park, Chapel Hill, Maple Grove, Cole Court, Flagstaff Court, Greenbank Industrial Estate, Quayside Close, Drumalane Road, Hillhead Road, Cloghogue Heights, Carrif Vale, Flagstaff Road, Brogies 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 receptors are 'high' sensitivity residential properties.

There is one community facility within the first 50m; Newry Showgrounds. Between 50-100m is Pairc Esler, a private equestrian facility on Hillhead Road (Carlingford Horses) and Cloghogue Cemetery. Within 200m are Formula Karting, and Cloghogue Pitch & Putt.

Corridor 2

There would be approximately 261 receptors within 200m of the indicative alignment within Corridor 2, with approximately 19 of these being within the first 50m.

From east to west, these receptors are located on, or in the vicinity of, the A2 Warrenpoint Road, Forest Hills, Fathom Line, Hillhead Road, Cloghogue Heights, Carrif Vale, A28 Dublin Road, Chancellor's Road and Forkhill Road. The vast majority of these receptors are 'high' sensitivity residential properties.

There are a number of community facilities within the first 50m, including the Church of the Sacred Heart and its Cemetery, and Cloghogue Pitch & Putt. There are no other community facilities within 200m of the indicative centreline.

Corridor 3

There would be approximately 55 receptors within 200m of the indicative alignment within Corridor 3, with approximately 16 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, Aghnamoira Road, Forest Hills, Fathom Line, Flagstaff Road, Barracric Road, old Dublin Road and Ellisholding Junction. The vast majority of these receptors are 'high' sensitivity residential properties. There are no community facilities within 200m of the indicative centreline.

Corridor 4 Option A

There would be approximately 45 receptors within 200m of the indicative alignment within Corridor 4 Option A, with approximately 9 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 receptors are 'high' sensitivity residential properties. There are no community facilities within 200m of the indicative centreline.

Corridor 4 Option B

There would be approximately 49 receptors within 200m of the indicative alignment within Corridor 4 Option B, with approximately 12 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 receptors are 'high' sensitivity residential properties. Victoria Lock Amenity Site is the only community facility within 50m of the indicative centreline. There are no other community facilities within 200m of the indicative centreline.

Corridor 5

There would be approximately 108 receptors within 200m of the indicative alignment within Corridor 5, with approximately 19 of these located within the first 50m.

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 receptors are 'high' sensitivity 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 100m. There are no other community facilities within 200m.

Overall

In terms of sensitive receptors, Corridor 4 Option A has the fewest receptors within 200m, and is not in proximity to any community facilities; it would therefore be the preferred corridor from an Air Quality perspective. The next preferred would be Corridor 4 Option B, or Corridor 3, again based on proximity to fewer sensitive residential properties or community facilities than other corridors.

7.2.6.2 Local Air Quality Assessment

In terms of local air quality during normal operation of the scheme, the removal of a proportion of strategic traffic from proximity to the more densely populated parts of the study area would likely result in a benefit to those sensitive receptors, as air quality may improve. It is likely that an alignment within Corridor 1 would attract a higher volume of traffic onto the relief road than any other corridor under consideration, as its proximity to the City Centre would make it a more attractive alternative for traffic originating from Newry (i.e. when accessing the A1) than a corridor located closer to Warrenpoint (i.e. Corridor 4).

Although this aspect will require detailed consideration at a later design stage, it is reasonable to assume that those corridors located closer to the City Centre would have the greatest potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, even though an alignment within these corridors would result in the highest number of sensitive receptors in close proximity than the more rural corridors.

This aspect is important, as the risk of emissions from road traffic leading to exceedances of the relevant Air Quality Standards within any of the corridors under consideration is likely to be low.

7.2.6.3 Local Air Quality Management Areas

Implementation of a southern relief road within any of the corridors would likely have a positive effect on the two declared AQMAs within Newry City Centre. However, until the relevant traffic data is modelled in more detail and the extent of the affected road network determined, it is not known whether this effect would be sufficient to result in the AQMAs being revoked.

Again, it is envisaged at this stage that the corridor which attracts the highest volume of traffic out of the City would likely be preferred from a local air quality perspective. However, this aspect will require detailed consideration at a later design stage, when the roads with significantly changed traffic flows are determined.

7.2.6.4 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/m3 (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 are two designated ecological sites within the study area which have designated features which may be sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the effect of local air quality on vegetation (as shown on Figure 7.4.2) These are:

- Carlingford Lough ASSI (within Corridor 2, Corridor 3 and Corridor 4); and
- Fathom Upper ASSI (within 165m of the indicative centreline through Corridor 4).

An Air Quality assessment on Sensitive Ecosystems has not been undertaken at this stage, however it is evident from above that with regards to impact upon designated sites; Corridor 4 would be least preferred, followed by Corridors 2 and 3. In terms of the likely impact upon sensitive ecosystems, the effect is unlikely to be significant from an air quality perspective. Nevertheless, this will need to be considered at the next design stage in more detail.

7.2.6.5 Regional Air Quality Assessment

Generally, it can be assumed that the removal of a proportion of traffic from the City, which currently leads to congestion, would likely result in a slight beneficial effect from a regional air quality perspective. The removal of some 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. Nevertheless, the absence of detailed traffic data does not facilitate the opportunity to determine a preference between the corridors under consideration at this stage from a Regional air quality perspective.

7.2.7 Mitigation & Enhancement Measures

It is considered unlikely at this stage that any specific mitigation for operational impacts will be required, as implementation of an alignment within any of the corridors under consideration has the potential to lead to improvements in air quality in the Newry urban area by relieving traffic congestion, particularly within the Newry (Urban Centre) and Canal Street AQMAs.

Nevertheless, at this early stage, there are opportunities to minimise the potential for adverse impacts associated with any of the corridors under consideration by considering the following measures:

- Increasing the distance between the road and sensitive locations. Realignment by only a few tens of metres may provide significant benefits;
- Orientation of the road relative to locally prevailing winds. If a route can be chosen so that a sensitive location tends to be upwind of the road, average concentrations at that location will be lower than if the sensitive location tends to be downwind;
- Junctions and intersections should be sited to minimise the impact on air quality at sensitive locations. Slow traffic negotiating intersections generally produces greater amounts of pollution than freely flowing traffic; and

- Placing the road in a cutting or on an embankment can increase the distance between a roadside receptor and the vehicles, thus allowing more time for dispersion and reducing concentrations at the receptor.

7.2.8 Presentation of Key Issues

The key issues associated with the five broad corridors from an air quality perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.5.

- Implementation of any of the corridors is likely to have a beneficial 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;
- 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;
- Corridor 1 would have the highest number of sensitive receptors in close proximity to its indicative alignment, however is likely to provide the greatest benefit to City Centre air quality, as it would attract the most traffic;
- Corridor 4 would have the least number of sensitive receptors in close proximity to its indicative alignment, however is likely to provide the least benefit to City Centre air quality as a lower proportion of City Centre traffic is predicted to use an alignment within this corridor;
- In terms of designated ecological sites, Corridor 4, followed by Corridor 2 and 3 would be least preferred, due to their relative positioning;
- Significantly more properties would experience an improvement in air quality than experience a deterioration, with construction of the scheme in general; and
- On balance, Corridor 5 can be considered the preferred corridor in terms of local and regional air quality, and sensitive receptors. It is likely to attract slightly less traffic than Corridor 1, but would have an impact on fewer sensitive facilities, and fewer properties within 200m (particularly within 50m).

Table 7.5 Air Quality Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment					Assessment
Corridor 1	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Would likely attract the highest volume of traffic onto the relief road. Thus, it is reasonable to assume it would have the greatest potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, even though it would result in the highest number of sensitive receptors in close proximity. Would have no perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centrelines:					Slight Adverse – Slight Beneficial
		Road Centreline – 50m	50-100m	100-150m	150-200m	Total	
		58	43	74	87	262	
Corridor 2	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 2 would likely attract the third highest volume of traffic onto the relief road, thus it is reasonable to assume the potential to improve local air quality conditions within the Newry (Urban Centre) AQMA is lessened and it would also result in the second highest number of sensitive receptors in close proximity. May have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centrelines:					Slight Adverse – Slight Beneficial
		Road Centreline – 50m	50-100m	100-150m	150-200m	Total	
		19	58	110	74	261	
Corridor 3	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 3 would likely attract the fourth highest volume of traffic onto the relief road. Thus, it is reasonable to assume the potential to improve local air quality conditions within the Newry (Urban Centre) AQMA would be lessened, though it would result in the second lowest number of sensitive receptors in close proximity. May have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centrelines:					Slight Adverse – Slight Beneficial
		Road Centreline – 50m	50-100m	100-150m	150-200m	Total	
		16	10	13	16	55	

Corridor	Qualitative Impacts	Quantitative Assessment					Assessment
Corridor 4 Option A	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 4 would likely attract the lowest volume of traffic onto the relief road. Thus, it is reasonable it would have the least potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, though it would result in the lowest number of sensitive receptors in close proximity. Is likely to have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centrelines:					Slight Adverse – Slight Beneficial
		Road Centreline – 50m	50-100m	100-150m	150-200m	Total	
		9	15	14	7	45	
Corridor 4 Option B	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 4 would likely attract the lowest volume of traffic onto the relief road. Thus, it is reasonable it would have the least potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, though it would result in the lowest number of sensitive receptors in close proximity. Is likely to have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centrelines:					Slight Adverse – Slight Beneficial
		Road Centreline – 50m	50-100m	100-150m	150-200m	Total	
		12	16	14	7	49	
Corridor 5	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 5 would likely attract the second highest volume of traffic onto the relief road. Thus, it is reasonable to assume it would have the potential to improve local air quality conditions within the Newry (Urban Centre) AQMA. It would also result in the third highest number of sensitive receptors in close proximity. Would have no perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centrelines:					Slight Adverse – Slight Beneficial
		Road Centreline – 50m	50-100m	100-150m	150-200m	Total	
		19	13	31	45	108	

7.3 Cultural Heritage

7.3.1 Introduction

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

- assess the potential impacts that the corridor options may have on cultural heritage features and to determine whether any further study 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 broadly defined corridors 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*".

7.3.2 Methodology

7.3.2.1 Data Sources

The NSRR scheme has the potential to adversely impact local historic environment sites (Figure 7.3.1). To identify the location of sites within or in the vicinity of the corridor options, a Historic Environment Division digital GIS dataset was downloaded from the Department for Communities' web-page (August 2016):

- World Heritage Sites (no entries within study area);
- Monuments in State Care;
- Scheduled Historic Monuments;
- Listed Buildings;
- Register of Parks, Gardens and Demesnes of Special Historic Interest;
- Archaeological Sites and Monuments in the Sites and Monuments Record of Northern Ireland;
- Areas of Significant Archaeological Interest;
- Battlefield sites;
- Industrial Heritage Record 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 Ordnance Survey Northern Ireland mapping, including historic mapping (Figures 7.3.2 - 7.3.6), recent topographic mapping and aerial photography.

Solid and Drift geology maps, produced by the GSNI, were reviewed (Figures 7.3.7 and 7.3.8).

Information on Conservation Areas was obtained from the Department for Infrastructure's (DfI) Planning Portal.

The Newry Southern Relief Road Feasibility Study Report (Scott Wilson, 2008) chapter on archaeology and cultural heritage was reviewed.

This culminated in the preparation of a gazetteer of heritage assets, (Appendix C).

7.3.2.2 Study Area

The assessment of cultural heritage considers a study area that typically extends 500m from the scheme centre-line. However, sites up to 1km beyond the edge of the corridor boundaries have been taken into consideration in order to consider the potential for impacts upon the setting of heritage assets, and to gain a wider insight into the known range of archaeological remains in the locality. 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.

Although the corridor options are located entirely within Northern Ireland, data on heritage assets immediately across the Irish border, south-east of Corridor 4, was gathered to assess the potential for any setting impacts upon them. Data gathered comprised National Monuments Service records and National Inventory of Architectural Heritage records. No consultation response was received from the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs in the Republic of Ireland.

7.3.2.3 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 7.6 to Table 7.8 below.

Table 7.6 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 7.7 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 7.8 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 7.9 to Table 7.11 below.

Table 7.9 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 corridor 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 in Table 7.10.

Table 7.10 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 7.11 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

7.3.2.4 Assessment of significance of effects: method

The magnitude of impact is judged in accordance with the guidance set out in Table 7.12. Categories with possible dual scores are defined as a single score for clarity, based on professional judgement.

Table 7.12 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 7.13 Description of the Significance of Effects for Cultural Heritage

Score	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

Score	Comment
	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 /

Score	Comment
	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

7.3.2.5 Scope of Assessment

The corridor options have not been subject to a cultural heritage site walkover at this preliminary stage. This will be undertaken during the preparation of the DMRB 'Simple' and 'Detailed' assessments for the scheme.

Figure 7.3.1 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 each broadly defined indicative route alignment within the five corridors on cultural heritage is also given.

7.3.3 Consultation

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 7.14 Summary of formal consultation responses in relation to Cultural Heritage assets

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
EHS – Built Heritage	12 Feb 2008 10 Apr 2008	27 June 2008	Historic Monuments recommended that the following is undertaken: i) an assessment of the potential physical and visual impact of the proposed route on the upstanding archaeological monuments; ii) an assessment of the potential for previously unknown below ground archaeological remains that may be discovered as a result of the proposed scheme; iii) an assessment into the physical and visual impact of the proposed route on protected monuments that are either Scheduled or in State Care, and monuments that are of local importance. EHS indicated that any development within the immediate vicinity of a Scheduled or State Care monument that may affect it or its setting would not be permitted under Planning Policy Statement (PPS) 6, Policy BH1. Monuments that are of a local significance and associated below ground remains are protected under PPS 6, Policy BH2.
The National Trust	12 Feb 2008 10 Apr 2008	22 Apr 2008	Confirmed that no National Trust property would be affected by the proposed scheme. The closest site is Derrymore House and Estate, situated approximately 4km northwest from the nearest corridor (Greenbank), along the A25 Camlough Road towards Bessbrook.
Historic Buildings Council	12 Feb 2008	12 Feb 2008	Historic Buildings Council (HBC) hold no relevant information in relation to the scheme.
Historic Monuments Council	12 Feb 2008	12 Feb 2008	Historic Monuments Council (HMC) hold no relevant information in relation to the scheme.
NIEA - Built Heritage	Jun 2014	19 Jun 2014	AECOM (then URS) submitted a Written Scheme of Investigation (WSI) for archaeological evaluation to NIEA for review / comment and approval. Telephone consultation with Paul Logue on 28th June 2014 raised certain points that needed to be changed in the document, and further clarification was also given by Paul Logue on 2nd July 2014. The document was amended and re-issued. The Archaeological Evaluation was undertaken in late November and early December 2014.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
NIEA – Built Heritage	22 July 2015	22 July 2015	Consultation Meeting with NIEA with regards to an archaeological evaluation on Fathom Mountain and the Newry Canal (a Scheduled Monument). The on-site archaeological investigation and subsequent Evaluation Report was prepared by IAC, in relation to two of the four features on the slopes of Fathom Mountain. A copy of IAC's Evaluation Report had been circulated prior to the meeting. It was generally accepted that the two features investigated were highly likely to be ornamental tree ring features, believed to be of c. 1800 date, rather than late 16th century military sconces. Discussion then turned to the route crossing of the Newry Canal (Scheduled Monument). NIEA highlighted that the canal was a Scheduled Monument and therefore any works that over span the canal or physically impact the canal would require formal Scheduled Monument Consent (SMC) under the Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995. NIEA stated that the key legal constraint issues would be the visual [indirect] impact of the bridge on the setting of the canal and physical [direct] impact of the bridge structure on the canal. It was suggested that SMC be sought in tandem with the development of the Environmental Statement for the preferred route. SMC remained valid for 5 years, subject to no design changes. It was also suggested that an on-site meeting be held to discuss the issues surrounding the Scheduled Monument.
DFC - HED	05 May 2016	05 May 2016	Consultation Meeting – On-site at the Newry Canal Scheduled Monument. Purpose of the meeting was to obtain the view of Historic Environment Division (HED, formerly NIEA) in relation to a potential bridge crossing of the canal (Scheduled Monument) and likelihood of gaining Scheduled Monument Consent (SMC). HED stated that they would have concerns with any bridge design proposal which would have a direct physical impact on the canal, either the banks or the canal bed, and that it may be difficult to grant SMC for this. It was agreed AECOM would provide some more details on the indicative crossing (plan view / elevation / footprint in relation to the canal) and send these to HED, and if content with the concept, would issue some form of written statement of agreement-in-principle, however, HED stated that much more detailed plans would be required for the formal SMC application – which would be developed at the Detailed Assessment Stage.
DAERA - Marine Historic Environment, /Marine and Fisheries Division	6 May 2016	17 May 2016	Provided information on wreck records. No designated wrecks or any wrecks with firm positions in the immediate area. List and map of historic losses for the river and harbour area, largely late 19th/early 20th century partial losses or strandings. Information gleaned from Commons Sessional Papers. Despite past dredging and development of the Harbour and river areas, there is still the potential for unknown archaeological remains to come to light. The possibility of remains being present (vessels, artefacts etc.) cannot be

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
			conclusively discounted. While the impacts of the works will be relatively localised, should any impact occur it is likely to be of a long-term and irreversible nature.
DAERA - Marine Historic Environment, /Marine and Fisheries Division	22 July 2016 13 Oct 2016	19 Aug 2016 18 Nov 2016	Marine Historic Environment previously supplied AECOM with information regarding potential marine heritage assets occurring within the Newry River (below MHWM). Despite past dredging and development of the Harbour and river areas, there is still the potential for unknown archaeological remains to come to light at various points in the river. Although there are no designated sites (Scheduled Monuments, Protected Wrecks) within the river, there remains the possibility of remains being present (vessels, artefacts etc.). While the impacts of the works will be relatively localised, should any impact occur it is likely to be of a long-term and irreversible nature. Therefore, the EIA should address the predicted impacts on the historic environment (inclusive of potential maritime heritage receptors associated with the river) and describe the mitigation proposed to avoid or reduce impacts to a level where they are not significant. Historic environment issues should be taken into consideration from the start of the site selection process and as part of the alternatives considered. Contact details provided for Monuments and Building Record (MBR) and Northern Ireland Sites and Monuments Record. Second response added no further comments to the previous response.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Department for Communities (DfC)- Historic Environment Division	22 July 2016 13 Oct 2016 16 Oct 2016	20 Sep 2016 17 Nov 2016	HED has two areas to comment on regarding the archaeological aspects of this scheme. The first is the mitigation of recorded and unrecorded archaeological sites along the proposed route(s). The recorded potential AD 1600 Gaelic defensive positions, sometimes referred to as sconces, located on the lower slopes of Fathom Mountain have been the subject of archaeological evaluation excavation and survey. This work has been undertaken as per the DEM 156-15 and demonstrated that the features are not Gaelic sconces, but instead likely to be later aesthetic tree planting known as tree rings. With regard to the archaeological mitigation of the chosen route, HED would expect DfI and their consultants to follow the guidance and procedures set out in DEM 156-15. The second area of comment relates to the Newry Canal, an historic monument scheduled for protection under the Historic Monuments and Archaeological Objects (NI) Order 1995. DfI, their consultants and HED have discussed the Scheduled canal and the possibility that the route may cross it. Scheduled Monument Consent is normally required for such an undertaking and HED note that there is no presumption in favour of granting Scheduled Monument Consent. HED is content that DfI and their consultants understand the constraints involved and are content to discuss any proposed designs should the need arise. In the second response, HED reviewed the revised set of Stage 1 corridor options. With regard to the changes proposed to Corridors 1 & 2 and the new Corridor 5, they noted that Corridors 2 and 5 include areas containing listed buildings, and the Senior Area Architect should be contacted for discussion and comment. The comments regarding archaeology and the Scheduled Newry Canal still apply to all corridors and associated extensions.
Newry, Mourne & Down District Council - Planning	22 July 2016 31 Aug 2016 13 Oct 2016	30 Sep 2016 17 Nov 2016	Extract of information on designations from the Banbridge, Newry & Mourne Area Plan 2015 for Newry Southern Relief Road Corridor Options 1 – 4, along with Listed Buildings and protected monuments that fall within the highlighted Corridor Options. Second response identified the Area Plan designations, Listed Buildings and protected monuments within Corridor 5.
Department for Communities - Historic Environment Division Area Conservation Architect	18 Nov 2016	18 Nov 2016	HED's Area Architect noted that there is a number of Listed Buildings in the vicinity of the corridor options and provided a list. Their response noted that a new road development may have significant effect on the Historic Environment and, with reference to The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2012; HED requested that a Listed Building section is included in the Cultural Heritage/ Material Assets Chapter of the Environmental Statement. This should include a Full Visual Impact Assessment which includes the impact on all Listed Buildings which will be intervisible with the proposed road development in order to fully assess the impact on their setting as per Planning Policy Statement 6 BH11 (Development Affecting the Setting of a Listed Building) including a set of existing and proposed block plans, clearly indicating the location of any listed buildings in the locality of the new road proposal. HED's response highlighted that gates, screens, boundary walls and curtilage structures are afforded protection

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
			by the Listing of a Property, even when that property may be some distance back from the road, and that the impact on the setting of Listed Buildings both during the construction of the road and on completion/in-operation should be assessed within the study. HED's response noted Further Guidance on Policy BH 11 (Development affecting the Setting of a Listed Building).

7.3.4 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.

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.

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

7.3.4.1 Archaeological Sites and Monuments

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."*

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).

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).

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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.

7.3.4.2 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.

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).

7.3.4.3 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.

7.3.4.4 Regional and Local Planning Policy

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".*

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."*

Areas of Outstanding Natural Beauty (AONBs)

South-west of Newry, within the study area, 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.

7.3.4.5 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; and
- Chartered Institute for Archaeologists, Code of Conduct and Standards and Guidance for Historic Environment Desk-based Assessment.

7.3.5 Baseline Environmental Conditions & Constraints

7.3.5.1 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 corridors, covering periods from the Neolithic to the 20th century. These comprise one Scheduled historic monument, one State Care monument, 22 archaeological sites, 28 Industrial Heritage Record sites, and one Defence Heritage Site (Figure 7.3.1).

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 scheme corridors.

There are no Areas of Archaeological Potential within the corridor options. The nearest is in Newry City.

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 State Care site 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. This is also a Grade A listed building (HB16/11/019A).

Medium Value Archaeological Assets

No medium value archaeological remains have been identified within the study area.

Low Value Archaeological Assets

Heritage assets recorded in the NI SMR identified as being of low value comprise:

- Prehistoric sites
  - Clonlum South Cairn (ARM029:005), a Neolithic tomb (c.4500 – 2500 BC); and,
  - Cist burials at Boyle's Fort, Newtown (ARM029:038), probably of Bronze Age date (c.2500 – 300 BC).
- Early Christian sites (c.AD400 - 1150):
  - Three raths – at Newtown (ARM029:007), Aghnamoira (DOW051:033), and Greenan (DOW051:028); and;
  - One cashel – Greenan Wood Cashel on the north slope of Greenan Mountain (DOW051:021).
- 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 side of Fathom Mountain, commanding an extensive view over the Newry River below, but there are no visible remains (ARM029:025).
  - Another possible hilltop enclosure site is recorded at Newtown, though its location is not precise (ARM029:039).
  - There is a further undated hilltop enclosure at Aghnamoira, Co. Down (DOW051:062).
- Aerial imagery also shows a number of watercourses, drainage ditches and palaeochannels, particularly in Cloghogue and Drumalane.
- In addition, there is the site of a children's burial ground immediately south of Corridor 4, in Cornamucklagh, County Louth (RMP LH002-001001). This is also reputedly the site of the monastery of Killansnamh which is said to have stood opposite Narrow Water Castle.

Heritage assets recorded in the NI IHR identified as being of local value comprise:

- A series of elements of the scheduled Newry Canal, including the Albert Basin (00172:049:00), a culvert (00172:097:00), a lock (00172:114:00) and a Lock House (00172:115:00) in Lisdrumliska, a spill weir at Cloghoge (00172:096:00) and in Fathom Upper, Victoria Lock (00172:041:00), a quay (00172:093:00), a dock house (00172:042:00) and a pump house (00172:112:00);
- A navigation beacon at Narrow Water (07546:000:00);
- A group of IHR sites are associated with the GNR Main Line from Belfast to the border. These comprise railway bridges at Lisdrumliska (00062:095:00), Carrivemaclone (00062:098:00), two at Cloghoge (00062:099:00, 00062:100:00), and one at Fathom Lower (00062:103:00) and Killeen (00062:104:00);

- Historic mapping indicates the course of the Newry and Greenore Railway west of the Newry Canal, at the foot of Fathom Mountain;
- A further group of IHR sites are associated with the GNR Branch Line from Goraghwood to Warrenpoint: a bridge over the Newry River at Ballynacraig (00478:030:00) and a former train station at Narrow Water (00478:021:00);
- Bridges are recorded across the study area, with examples at Fathom Upper (00607:000:00); and
- Manufacturing sites include a spinning mill at Lisdrumliska / Drumalane (03699:000:00 – see also grade B1 listed Drumalane Mill HB16/29/010), a corn mill site at Narrow Water (03580:000:00), and a Tobacco pipe manufactory at Cloghoge (00601:000:00).

Negligible Value Archaeological Assets

Sites noted on aerial photographs are recorded across the study area, but these are probably not antiquities (Altnaveigh, ARM026:027; Newtown ARM029:027, ARM029:029, ARM029:030, ARM029:031). A further non-antiquity is recorded – the incorrectly designated Danes Cast earthwork in Killeen (ARM029:017).

One modern defence heritage site (648) is recorded in southern Newry, described as a 'prepared demolition site'.

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 gleaned 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.). 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.

A rapid review of Ordnance Survey (OS) historic mapping indicates an area marked 'stones' on 19th century mapping of Cloghoge (CH-10) (Figure 7.3.1), possibly a prehistoric site, a clearance cairn or geological feature. Historic mapping also shows the former Wellington Inn, Cloghoge, north-east of the Ellisholding Junction (CH-11). Further sites may be indicated on historic mapping, which will be reviewed at the next assessment stage.

A rapid review of aerial imagery has identified a number of areas of archaeological potential, based on the form and complexity of field boundaries, the presence of mounds or stands of trees, and cropmarks of palaeochannels and former boundaries (CH-02 to CH-09). A review of readily available aerial imagery will be undertaken at the next assessment stage.

Historic mapping indicates (see Figures 7.3.2 – 7.3.6) that there is a degree of past ground disturbance within the study area due to historic quarrying and gravel pits. Some stone monuments close to the Newry River, such as the Clontygora Court Tomb or King's Ring (ARM029:011), beyond the study area, were pillaged to build the Newry Canal in the 18th century.

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. Solid and drift geology maps with the corridors superimposed are illustrated in Figures 7.3.2 and 7.3.6.

7.3.5.2 Built Heritage

At this stage, a total of 28 built heritage assets and one conservation area have been identified within the study area, dating from the 18th to 20th century.

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), which is also a State Care Monument (DOW051:044).

There are two Grade B+ listed buildings within the study area: the 19th century Convent of Mercy, Home Avenue Newry (HB16/30/014A), and the early 20th century Church of the Sacred Heart, Dublin Road, Newry (HB16/29/017A).

Medium Value Built Heritage Assets

The Newry Conservation Area is located at the northern end of Corridor 1 (Figure 7.3.1). It is assessed as being of medium value as it contains buildings that contribute significantly to its historic character.

There are seven 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);
- Laurel Hill, an early 19th century house, Lisdrumliska (HB16/29/009);
- Ivybrook Lodge, an early 19th century house, Drumalane (HB16/29/007A);
- Drumalane Mill, a mid- to late-19th century flax spinning mill (two-storey building, mill house and chimney), Lisdrumliska (HB16/29/010);
- Chapel at Convent of Mercy, Home Avenue, Newry. Dates to the early 20th century (HB16/30/014B); and
- Gates and walling at the Church of the Sacred Heart, Dublin Road, Newry. These date to the early 20th century (HB16/29/017 C).

There are seven 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 crenellated parapet and the walls are of random rubble and cut stone;
- St. Mary's Chapel, Upper Chapel Street, Newry, a late 18th century chapel (HB16/30/015);
- The Sham Castle, a 19th century folly in the former demesne of Greenwood Park (HB16/10/001);
- 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).

The nearest Areas of Townscape or Village Character (ATC) are located beyond the study area, in Newry City and Warrenpoint. There are no ATCs within the study area. There are two north / west of Corridor 1 in Newry (NY112 Dublin Road & NY113 Drumalane Road); Banbridge/Newry & Mourne Area Plan 2015. Map No. 3/02a; DoENI 2013).

In addition, there are three built heritage sites immediately south of the study area, in County Louth: two 19th century beacons on the Newry River (NIAH 13900202; NIAH 13900201) and a house at Cornamucklagh, built c.1920 (NIAH 13900203).

Low Value Built Heritage Assets

No low value built heritage assets have been identified at this stage.

7.3.5.3 Historic Landscape

The corridor options are 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 7.5 (Landscape & Visual Effects). Heritage aspects of these landscapes are noted below.

West of the river, the routes are located within the eastern extent of the Ring of Gullion AONB. The Mourne AONB extends northwest of Warrenpoint, up the east bank of the Newry River. Impacts upon these areas are considered in Section 7.5, Landscape & Visual Effects. Summarised excerpts regarding heritage aspects of these areas are noted below.

Medium Value Historic Landscapes

Narrow Water Castle demesne, south-east of Corridor 4, 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.

Low Value Historic Landscapes

The Newry Valley contains 11 areas of historic woodland, 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);
- Areas of long-established woodland (planted mixed) (WT906) and long-established woodland (parkland) (WT 904 & WT905) at Narrow Water, with an extensive strip of long-established woodland (planted mixed) along the east bank of the Newry River; and
- A group of now-isolated stands of long-established woodland (semi-natural broadleaved) at Greenan (WT947, WT946 & WT944).

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.

Other

There is a modern cemetery at Cloghoge, off Flagstaff Road (CH-01).

Regional Landscape Character Assessment

According to the Northern Ireland Regional Landscape Character Assessment, the corridor options are 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).

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).

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).

7.3.6 Assessment of Environmental Impacts

7.3.6.1 Potential Impacts during Operation

The operation of the NSRR scheme within any of the five corridors 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 NSRR scheme has the potential to result in impacts on the setting of heritage assets located along the route, including the scheduled Newry 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.

Due to the inherent limited design information available for each corridor 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 presently 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 Canal, a Scheduled historic 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 corridor options discussed below are all considered on the basis that any new bridge structure will over-fly the Scheduled monument and there will be no direct physical impact upon it. This, however, may change through the 'Simple' and 'Detailed' Assessment stages and will 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 corridor is given in Appendix C.

Corridor 1

It is anticipated that Corridor 1 would have a major adverse magnitude of impact upon heritage assets including the scheduled Newry Canal, resulting in a large adverse significance of effect. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental potential and a channel associated with Newry Canal, and the southernmost extent of the Newry Area of Archaeological Potential. It may impact upon the B+ listed Church of the Sacred Heart, Drumalane, and its associated B1 listed gates and walling, and four Industrial Heritage Record railway bridges. Corridor 1 may impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets, the southern extent of Newry Conservation Area and the setting of Cloghoge Cemetery.

Corridor 1 may impact upon four Industrial Heritage Record railway bridges on the GNR Main Line (00062:098:00; 00062:100:00; 00062:102; 00062:103:00). It may also impact upon the site of a former tobacco pipe factory at Cloghoge (00601:000:00).

This corridor may also impact upon areas of complex field patterns, areas of palaeoenvironmental potential, and a channel associated with Newry Canal (CH-02 to CH-07), and the southernmost extent of the Newry Area of Archaeological Potential (Figure 7.3.1).

Corridor 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 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.
- The B+ listed Church of the Sacred Heart, Drumalane (Cloghoge 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 scheme by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line. However, the setting may be adversely affected by potential tree removal and the proximity of an alignment within this corridor to the church;
- B+ listed buildings – Convent of Mercy, Newry (HB16/30/014A);
- B1 listed buildings – Chapel of the Convent of Mercy, Newry (HB16/30/014B); Drumalane Mill flax spinning mill, Lisdrumliska (HB16/29/010);
- B2 listed buildings – St Mary's Chapel, Upper Chapel Street Newry (HB16/30/015);
- One Area of Townscape Character in Newry (NY113 Drumalane Road);
- A series of NI SMR sites of uncertain date identified on aerial photographs at Newtown (ARM029:029; ARM029:030; ARM029:031; ARM029:027), a burial site (ARM029:038) and rath (ARM029:007) and an enclosure (ARM029:039) at Newtown, and a non-antiquity recorded at Killeen (ARM029:017);
- Newry Canal Albert Basin (00172:049:00), a culvert (00172:097:00), a lock (00172:114:00) and lock house (00172:115:00), Lisdrumliska;
- Four Industrial Heritage Record railway bridges on the GNR Main Line (00062:099:00; 00062:095:00; 00062:102:00; 00062:104:00) at Cloghoge, Lisdrumliska, Fathom and Killeen, a GNR mile post at Lisdrumliska (00062:096:00), and the GNR Branch Line railway bridge over the Newry River (00478:030:00); and
- Industrial Heritage Record spinning mills at Lisdrumliska / Drumalane (03699:000:00 = HB16/29/010).

Corridor 1 may impact upon the setting of the southern extent of Newry Conservation Area and the setting of Cloghoge Cemetery (CH-01).

Corridor 2

It is anticipated that Corridor 2 would have a major adverse magnitude of impact upon heritage assets, including the scheduled Newry Canal, resulting in a large adverse significance of effect. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental potential and the possible site of the former Wellington Inn. It may impact upon the B+ listed Church of the Sacred Heart, Drumalane, and its associated B1 listed gates and walling; the B2 listed Sham Castle folly at Greenwood Park; and three Industrial Heritage Record railway bridges. Corridor 2 may impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets, historic woodland in Fathom Lower, and the setting of Cloghoge Cemetery.

Corridor 2 may impact upon three Industrial Heritage Record railway bridges on the GNR Main Line (00062:098:00; 00062:099:00; 00062:100:00).

This corridor may also impact upon areas of palaeoenvironmental potential (CH-08, CH-09) and complex boundaries (CH-04), and two sites on OS 1st edition maps (1829-1835): an area marked 'stones' (CH-10), and the possible site of the former Wellington Inn (CH-11) (Figure 7.3.1).

The corridor may impact upon historic long-established woodland at Greenan (WT944).

Corridor 2 also has the potential to impact upon the setting of a range of heritage assets, including:

- The scheduled Newry Canal (ARM/DOW029:500). 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 site would be affected;
- B1 listed Fathom House, Fathom Lower (HB16/13/005). Although it is not anticipated that the building would be directly physically affected by road construction, the setting of the site would be affected;
- 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, Cloghoge 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 scheme by a farm property on Flagstaff Road, and is already close to the Dublin Road and Belfast/Dublin Railway line. However, the historic setting may be adversely affected by potential tree removal and the proximity of an alignment within this corridor to the church building;
- The B2 listed Sham Castle folly at Greenwood Park on the Old Warrenpoint Road, Greenan (HB16/10/001), and associated non-designated historic buildings including the gate lodge (HB16/10/025), gardener's cottage (HB16/10/030), and main gate screen (HB16/10/024). Although the tie-in with the A2 Warrenpoint Road would be in close proximity (approximately 65m) to The Sham Castle, due to the extensive residential development that has taken place in the vicinity of this listed building and its proximity to the Old Warrenpoint Road and A2 Warrenpoint Road, the historic setting is unlikely to be adversely affected by this corridor;
- B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- Industrial Heritage Record sites including a spill weir (00172:096:00), a quay (00172:094:00) and canal locks (00172:039:00) on the Newry Canal; the site of a tobacco pipe factory (00601:000:00), and a bridge (00062:095:00) and a mile post (00062:096:00) on the GNR Main Line; and
- Three areas of historic woodland in Fathom Lower, comprising ancient woodland (WT896) and long-established woodland (WT940 & WT943).
- Corridor 2 may impact upon the setting of Cloghoge Cemetery (CH-01).

Corridor 3

It is anticipated that Corridor 3 would have a major adverse magnitude of impact upon heritage assets, including the scheduled Newry Canal, resulting in a large adverse significance of effect. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential and the possible site of the former Wellington Inn. It may impact upon the B2 listed Belvedere Tower, an Industrial Heritage Record railway bridge, a quay and a lock house on the Newry Canal, and historic woodland in Fathom Lower. Corridor 3 may impact upon the setting of the Newry Canal, listed buildings including the B1 listed Fathom House and the B2 listed Sham Castle folly, non-designated heritage assets, and historic woodland at Fathom, Greenan and north of Narrow Water.

Corridor 3 may impact upon the B2 listed Belvedere Tower, Fathom Lower (HB16/13/029).

Corridor 3 may also impact upon an Industrial Heritage Record railway bridge on the GNR Main Line (00062:103:00), and a quay (00172:095:00) and a lock house (00172:113:00) on the Newry Canal (Figure 7.3.1).

Corridor 3 may impact upon areas of historic woodland, comprising ancient woodland in Fathom Lower (WT896), long-established woodland at Fathom (WT940), historic long-established woodland at Greenan (WT944; WT946; WT947) and the northern end of an area of long-established woodland at Narrow Water (WT907).

This corridor may impact upon an area of palaeoenvironmental potential by Barracric Road (CH-02), an area of archaeological potential at Brogies Road (CH-03), and the possible site of the former Wellington Inn (CH-11), indicated on OS 1st Edition mapping (Figure 7.3.2).

Corridor 3 also has the potential to impact upon the setting of a range of heritage assets, including:

- The scheduled Newry Canal (ARM/DOW029:500). Although it is not anticipated at this stage that the canal itself will be directly physically affected by the new bridge structure, its setting would be affected;
- B1 listed Fathom House, Fathom Lower (HB16/13/005);
- B2 listed Sham Castle folly, Greenwood Park, Greenan (HB16/10/001), and associated non-designated historic buildings including the gate lodge (HB16/10/025), gardener's cottage (HB16/10/030), and main gate screen (HB16/10/024);
- A series of SMR sites, comprising:
  - A prehistoric burial site in Newtown (ARM029:038);
  - Early Christian raths in Newtown (ARM029:007), Aghnamoira (DOW051:033) and Greenan (DOW051:028), and a Cashel in Greenan Wood (DOW051:021);
  - Three undated enclosures in Newtown (ARM029:039), Fathom Lower (ARM029:025) and Aghnamoira (DOW051:062);
  - A battle site of 1600 in Fathom Lower (ARM029:042);
  - Four tree ring sites in Fathom Lower (ARM029:020; ARM029:021; ARM029:022; ARM029:023), particularly the most northerly ones (ARM029:020 & ARM029:021);
  - Four sites of uncertain date noted on aerial photographs (ARM029:029; ARM029:030; ARM029:031; ARM029:027); and
  - A non-antiquity in Killeen (ARM029:017).
- Industrial Heritage Record sites including two railway bridges on the GNR Main Line at Cloghoge (00062:099:00 & 00062:100:00), Fathom Lower (00062:102:00) and Killeen (00062:104:00); a quay (00172:094:00) and canal locks (00172:039:00) on the Newry Canal; a cluster of four sites associated with the Newry Canal to the south – Victoria Lock (00172:041:00), a pump house (00172:112:00), a dock house (00172:042:00) and a quay (00172:093:00); and the site of a tobacco pipe factory (00601:000:00).

Corridor 4

It is anticipated that Corridor 4 would have a major adverse magnitude of impact upon heritage assets, including the scheduled Newry Canal, resulting in a large adverse significance of effect. It may impact upon the B2 listed Belvedere Tower. Undesignated sites that may be impacted include a battle site and a group of four tree ring sites; two bridges and four sites associated with the Newry Canal in Fathom Upper; and extensive areas of historic woodland at Fathom. The corridor traverses a rural and wooded landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential, and the possible site of the former Wellington Inn. Corridor 4 may impact upon the setting of Narrow Water Castle demesne, the State Care and grade A listed Narrow Water Castle and its associated listed and non-designated buildings; B1 listed Fathom House; and a listed house at Cornamucklagh. It may impact upon the setting of a range of non-designated archaeological sites and Industrial Heritage Record sites, including railway bridges, a quay and canal locks associated with the scheduled Newry Canal and navigation beacons at Narrow Water.

Corridor 4 may impact upon the B2 listed Belvedere Tower, Fathom Lower (HB16/13/029).

Corridor 4 may also impact upon five SMR sites, including the battle site dating to 1600 in Fathom Lower (ARM029:042) and the group of four tree ring sites in Fathom Lower (ARM029:020; ARM029:021; ARM029:022; ARM029:023) (Figure 7.3.1).

Corridor 4 may impact upon six Industrial Heritage Record sites, a bridge in Fathom Upper (00607:000:00), a railway bridge on the GNR Main Line in Fathom Lower (00062:103:00), and a series of sites associated with the Newry Canal in Fathom Upper – Victoria Lock (00172:041:00), a pump house (00172:112:00), a dock house (00172:042:00) and a quay (00172:093:00).

Corridor 4 may impact upon the extensive areas of historic woodland at Fathom, including ancient woodland (WT896) and long-established woodland (WT895, WT943 & WT940).

This corridor may impact upon an area of palaeoenvironmental potential (CH-02), an area of archaeological potential (CH-03), and the possible site of the former Wellington Inn (CH-11), indicated on OS 1st Edition mapping (Figure 7.3.2).

Corridor 4 also has the potential to impact upon the setting of a range of heritage assets, comprising:

- The scheduled Newry Canal (ARM/DOW029:500). The canal is within Corridor 4 for much of its length along Fathom Forest. Although it is not anticipated at this stage that the canal itself will be directly physically affected by the new bridge structure, its setting would be affected;
- The Narrow Water Castle demesne, listed on the Register of Parks, Gardens and Demesnes of Special Historic Interest (D-041), and a group of listed buildings within it, including:
  - The State Care and grade A listed Narrow Water Castle (DOW051:044; HB16/11/019A);
  - B1 listed Former Servant's Accommodation (HB16/11/019B);
  - B2 listed Gardener's House (HB16/11/020), stable yard (HB16/11/021) and entrance screen (HB16/11/018); and
  - Associated non-designated structures include the Steward's House (HB16/11/044), farmyard (HB16/11/045) and ice house (HB16/11/043).
- B1 listed Fathom House (HB16/13/005) and a house at Cornamucklagh (13900203), south-east of the corridor, within the Republic of Ireland;
- A series of SMR sites, comprising:
  - A prehistoric burial site in Newtown (ARM029:038);
  - An Early Christian rath in Newtown (ARM029:007);
  - The site of a former late medieval tower house in Fathom Upper (ARM029:033);
  - Two undated enclosures in Newtown (ARM029:039) and Fathom Lower (ARM029:025);
  - Four sites of uncertain date noted on aerial photographs (ARM029:029; ARM029:030; ARM029:031; ARM029:027);
  - A non-antiquity in Killeen (ARM029:017); and
  - A children's burial ground (LH002-001001) south-east of Corridor 4, within the Republic of Ireland.
- Industrial Heritage Record sites:
  - A tobacco pipe factory at Cloghoge (00601:000:00) and a corn mill site at Narrow Water (03580:000:00);
  - Four railway bridges on the GNR Main Line (00062:099:00; 00062:100:00; 00062:102:00; 00062:104:00) and a former train station on the Goraghwood - Warrenpoint GNR Branch Line (00478:021:00);
  - A quay (00172:094:00) and canal locks (00172:039:00) on the Newry Canal; and
  - A navigation beacon at Narrow Water (07546:000:00). There is a further pair of listed beacons (13900201 & 13900202) south-east of Corridor 4, within the Republic of Ireland.
- Historic long-established woodland at Narrow Water (WT904; WT905; WT906; WT907).

Corridor 5

It is anticipated that Corridor 5 would have a major adverse magnitude of impact upon heritage assets, including the scheduled Newry Canal, resulting in a large adverse significance of effect. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential and the possible site of the former Wellington Inn. It may impact upon the B1 listed Fathom House and the B2 listed Belvedere Tower, as well as Industrial Heritage Record railway bridges, a spill weir on the Newry Canal, and historic woodland in Fathom Lower. Corridor 5 may impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets and historic woodland.

Corridor 5 may impact upon B1 listed Fathom House (HB16/13/005) and B2 listed Belvedere Tower, Fathom Lower (HB16/13/029) (Figure 7.3.1).

Corridor 5 may also impact upon a spill weir on the Newry Canal at Cloghoge (00172:096:00).

Corridor 5 may impact upon four Industrial Heritage Record railway bridges on the GNR Main Line at Cloghoge and Killeen (00062:100:00; 00062:102:00; 00062:103:00; 00062:104:00).

Corridor 5 may also impact upon two areas of historic woodland in Fathom Lower, comprising long-established woodland (WT940 & WT943).

This corridor may impact upon an area of palaeoenvironmental potential (CH-02), a possible site in an area of complex field boundaries (CH-09), and the possible site of the former Wellington Inn (CH-11), indicated on OS 1st Edition mapping (Figure 7.3.2).

Corridor 5 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 site would be affected. The impact on the setting of the canal would probably be reduced, as the area where this corridor would cross is in a more urbanised and industrialised area where the setting of the Newry Canal has already been compromised;
- B1 listed Fathom House (HB16/13/005) and B2 listed Belvedere Tower, Fathom Lower (HB16/13/029);
- A series of NI SMR sites of uncertain date identified on aerial photographs at Newtown (ARM029:029; ARM029:030; ARM029:031; ARM029:027), a burial site (ARM029:038) and rath (ARM029:007) and an enclosure (ARM029:039) at Newtown, and a non-antiquity recorded at Killeen (ARM029:017);
- An undated enclosure or ‘fort’ in Fathom Lower (ARM029:025);
- Four IHR sites on the Newry Canal: two quays (00172:094:00; 00172:095:00), a lock house (00172:113:00) and canal locks (00172:039:00); and
- Ancient woodland in Fathom Lower (WT896).

7.3.6.2 Potential Impacts during Construction

Construction of the NSRR scheme within any of the five corridors 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.

7.3.7 Mitigation & Enhancement Measures

7.3.7.1 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.

7.3.7.2 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 NSRR 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.

7.3.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Cultural Heritage perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.15.

- All corridor options may result in setting impacts upon the Newry Canal, a scheduled historic monument and industrial heritage site.
- It is not anticipated that any listed buildings would be physically impacted. However, Cloghoge Church and its walls and gates are on the north-western fringe of Corridors 1 and 2; Sham Castle folly is on the eastern fringe of Corridor 2; and Fathom House and Belvedere Tower are close to or within Corridors 3, 4 and 5. There is potential for an adverse impact on their setting.
- Industrial heritage record sites include a number of 19th century railway bridges which may be impacted by the five corridors.
- No known archaeological remains will be impacted by Corridors 1, 2, 3 or 5, and remains impacted by Corridor 4 comprise a battle site and four 18th or 19th century tree rings. However, it is important to note that little modern fieldwork has been undertaken in the area (apart from the specific tree ring investigation) and this is likely to indicate lack of investigation, rather than a lack of surviving archaeological remains.
- There is the potential for well-preserved organic, waterlogged and/or palaeoenvironmental remains in the vicinity of watercourses, in marshy areas and in inter-drumlin fen hollows.
- The corridors 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, i.e. include signage to AONBs (all Corridors) and for the scheme to underline the ‘gateway’ aspect of the border crossing (Corridor 4).

This section of the report has identified that there are several heritage assets which could potentially be adversely affected by the NSRR scheme, for example through loss or damage during construction, or through adverse effects upon their setting. An overview of the five corridors follows.

From a cultural heritage perspective, Corridor 1 is not preferred as it brings any new road close to Newry and the Albert Basin and several other listed buildings at Cloghoge.

Corridor 2 is also not preferred as it has the possibility of impacting Fathom House and its setting as well as the listed church at Cloghoge.

Corridors 3 and 4 are preferred, providing that impacts to the setting of Fathom House, Belvedere Tower and Sham Castle can be minimised, and a crossing can be made which limits impacts on historic woodland and upon the setting of Narrow Water Castle; a crossing close to Narrow Water Castle is not preferred.

Corridor 5 is also preferred, providing land take can be reduced and impacts to the setting of Fathom House, Belvedere Tower and associated historic woodland minimised. It would also reduce the impact on the setting of the canal by crossing in a relatively developed area.

The height of the new bridge structure could also have impacts on heritage assets beyond the five corridors assessed, dependent on its siting and design restrictions imposed by the existing topography. Careful design would need to be undertaken 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. Alternatively, an iconic structure

may link in to the existing historic landscape and transport networks in a sympathetic way and potentially form 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 'Simple' and 'Detailed' assessments for cultural heritage, further work will be undertaken, including site walkover inspections, archaeological fieldwork (where feasible and applicable), 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.

Estimated costs for cultural heritage investigation and recording cannot be provided at this stage, as the scheme is not sufficiently defined to enable outline costing.

Table 7.15 Cultural Heritage Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	Would have a Major Adverse magnitude of impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets, the southern extent of Newry Conservation Area and the setting of Cloghogue Cemetery. Corridor is not preferred as it brings any new road close to Newry and the Albert Basin and several other listed buildings at Cloghogue.	May impact upon four Industrial Heritage Record railway bridges on the GNR Main Line and may also impact upon the site of a former tobacco pipe factory at Cloghogue.	Moderate Adverse
		Traverses a rural landscape with complex field patterns, areas of palaeoenvironmental potential and a channel associated with Newry Canal, and the southernmost extent of the Newry Area of Archaeological Potential.	
		May impact upon the B+ listed Church of the Sacred Heart, Drumalane, and its associated B1 listed gates and walling.	
Corridor 2	Would have a Major Adverse magnitude of impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets, historic woodland in Fathom Lower, and the setting of Cloghogue Cemetery. Corridor not preferred as it has the possibility of impacting Fathom House and its setting, as well as the listed church at Cloghogue.	May impact upon the B+ listed Church of the Sacred Heart, Drumalane, and its associated B1 listed gates and walling; and the B2 listed Sham Castle folly at Greenwood Park.	Moderate Adverse
		The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental potential and the possible site of the former Wellington Inn.	
		May impact upon three Industrial Heritage Record railway bridges.	
Corridor 3	Adverse impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings including the B1 listed Fathom House and the B2 listed Sham Castle folly, non-designated heritage assets, and historic woodland at Fathom, Greenan and north of Narrow Water. Corridor is preferred, providing that impacts to the setting of sites can be minimised.	May impact upon the B2 listed Belvedere Tower, an Industrial Heritage Record railway bridge, a quay and a lock house on the Newry Canal, and historic woodland in Fathom Lower.	Slight Adverse
		The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential and the possible site of the former Wellington Inn.	

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 4 Option A	Major Adverse magnitude of impact upon heritage assets, including the Scheduled Newry Canal, May impact upon the setting of Narrow Water Castle demesne, the State Care and Grade A listed Narrow Water Castle and its associated listed and non-designated buildings; B1 listed Fathom House; and a listed house at Cornamucklagh. May impact upon the setting of a range of non-designated archaeological sites and Industrial Heritage Record sites, including railway bridges, a quay and canal locks associated with the Scheduled Newry Canal, and navigation beacons at Narrow Water.	May impact upon the B2 listed Belvedere Tower. Undesignated sites that may be impacted include a battle site and a group of four tree ring sites; two bridges and four sites associated with the Newry Canal in Fathom Upper; and extensive areas of historic woodland at Fathom. The corridor traverses a rural and wooded landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential, and the possible site of the former Wellington Inn.	Moderate Adverse
Corridor 4 Option B	Adverse impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of Narrow Water Castle demesne, the State Care and Grade A listed Narrow Water Castle and its associated listed and non-designated buildings; B1 listed Fathom House; and a listed house at Cornamucklagh. May impact upon the setting of a range of non-designated archaeological sites and Industrial Heritage Record sites, including railway bridges, a quay and canal locks associated with the Scheduled Newry Canal, and navigation beacons at Narrow Water. Corridor is preferred, providing that impacts to the setting of sites can be minimised.	May impact upon the B2 listed Belvedere Tower. Undesignated sites that may be impacted include a battle site and a group of four tree ring sites; two bridges and four sites associated with the Newry Canal in Fathom Upper; and extensive areas of historic woodland at Fathom. The corridor traverses a rural and wooded landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential, and the possible site of the former Wellington Inn.	Moderate Adverse
Corridor 5	Adverse impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets and historic woodland. Corridor is preferred, providing that impacts to the setting of sites can be minimised.	May impact upon the B1 listed Fathom House and the B2 listed Belvedere Tower, as well as Industrial Heritage Record railway bridges, a spill weir on the Newry Canal, and historic woodland in Fathom Lower. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential and the possible site of the former Wellington Inn.	Moderate Adverse

7.4 Ecology and Nature Conservation

7.4.1 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 ecological and nature conservation aspects associated with each of the five broadly defined corridors under consideration; the environmental protection which exists within the area; and the potential impact of the scheme corridors on ecology and nature conservation interests.

7.4.2 Methodology

The principal objective of the Ecological Assessment at this preliminary stage is to identify whether there are any nature conservation constraints associated with the five broadly defined corridors under consideration.

In accordance with the requirements of DMRB 11.3.4.7 (Stages of Ecological Assessment), the steps taken include:

- Consultation with Department of Agriculture, Environment, and Rural Affairs (DAERA) Natural Environment Division (NED), and the Republic of Ireland's Department of Heritage & Local Government (National Parks & Wildlife Service) to obtain details on the location and nature of any designated sites within or close to the corridors;
- Review of the current Banbridge / Newry & Mourne Area Plan 2015 for the study area to obtain details on Sites of Local Nature Conservation Importance (SLNCI); and
- Collation of information on existing surveys of the area, including any Phase 1 Habitat Surveys.

This culminated in the preparation of constraints maps showing areas of potential ecological and nature conservation interest (Figures 7.4.1 & 7.4.2). A statement is also provided, setting out the nature conservation interest of the area including sites regarded as being a constraint. An indication is also given as to what types of surveys may be required.

7.4.3 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. The following table outlines the responses from the consultation in relation to Ecology and Nature Conservation interests.

Table 7.16 Summary of formal consultation responses in relation to Ecology and Nature Conservation

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Birdwatch Ireland	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Council for Nature Conservation and the Countryside (CNCC)	22 July 2016 13 Oct 2016	19 Aug 2016 07 Nov 2016	CNCC has no comment to make on this proposal at this stage but would welcome the opportunity to comment on the EIA. Second response stated there may be impacts on estuary with Corridor 4.
DAERA – Forest Service	22 July 2016 13 Oct 2016	30 Sep 2016 03 Nov 2016	Forest Service's position 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

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
			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. Provided information and maps showing woodland type, ownership, number of block and total acreage for each corridor. Second response updated information to include Corridor 5 and updates to Corridors 1 and 2.
DAERA NIEA – Natural Environment Division (NED)	22 July 2016 13 Oct 2016 26 Jan 2017	19 Aug 2016 24 Nov 2016 26 Jan 2017	Have concerns and potentially some objections with the different corridors. Some encroach on designated sites and all are approx. 10km upstream of Carlingford Lough SPA. NED has fewest concerns with Corridor 1. Concerns re: Corridor 2 include; potential impact on two ASSIs and long-established woodland. NED has serious concerns re: Corridor 3, including potential impacts on Carlingford Lough ASSI, Ring of Gullion AONB and loss of Ancient and Long-established Woodland. Similar concerns re: Corridor 4, potential impacts on Carlingford Lough and Fathom Upper ASSI, impact on two AONBs and loss of Ancient and Long-established Woodland. A HRA is required for this development. Second response updated information to include Corridor 5 and updates to Corridors 1 and 2. Corridor 1 would impact on Cloghogue SLNCI which should be avoided, as mitigation/compensation of rare habitat would be difficult. Corridor 2 could affect Fathom Lower Woods and Grassland SLNCI which cannot be recreated. Corridor 5 also includes Fathom Lower Woods and Grassland SLNCI and would impact on the Ring of Gullion AONB. Meeting held to follow up on the responses from NED (as detailed above) and clarify some of their issues and constraints in the study area, with a particular focus on woodland, landscape and habitats.
Environmental Protection Agency	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Irish Whooper Swan Study Group	25 July 2016 13 Oct 2016	02 Aug 2016 14 Oct 2016	Hold no relevant information, from either a whooper swan or brent goose perspective. No further comments made with second response.
Loughs Agency - Foyle, Carlingford and Irish Lights Commission	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	01 Dec 2016	Meeting held to discuss the scheme and the potential for impacts with each of the broad corridors under consideration. Loughs Agency to respond formally.
NMDDC - Biodiversity Officer	22 July 2016 13 Oct 2016	29 July 2016 21 Oct 2016	Outlined designated sites in the area, including Derryleckagh SAC/ASSI, Greenan ASSI, Greenan Lough ASSI, Carrivemaclone ASSI, Fathom Upper ASSI and Clermont and Anglesey Mountain ASSI. A Phase 1 habitat survey should be carried out, as well as considering the impact on bats, otters and protected/breeding birds.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
			Second response as per first response.
National Parks and Wildlife Service	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Northern Ireland Badger Group	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Northern Ireland Bat Group	22 July 2016 31 Aug 2016 05 Sep 2016 13 Oct 2016 23 Nov 2016	05 Sep 2016	Request for information to be forwarded to Chairperson. No further information received.
Ring of Gullion Landscape Partnership Scheme	22 July 2016 13 Oct 2016* 23 Nov 2016	02 Sep 2016	Outlined range of designated sites in the study area including: Derryleckagh SAC/ASSI, Greenan ASSI, Greenan Lough ASSI, Carlingford Lough ASSI, Carrivemaclone ASSI, Fathom Upper ASSI and Clermont and Anglesey Mountain ASSI.SPA and Ramsar site at Carlingford Lough may also be affected. Extended Phase 1 habitat survey to be carried out as part of application and consideration of impact on options, including bats, otters, red squirrels, pine martins and protected and breeding birds. Additionally within the response, were the quantities of woodland to be affected by each corridor option. 12.3ha and 132.5ha of total Forest Service woodland would be potentially affected by Option 3 and Option 4 respectively, and 0.4ha, 8.2ha, 28.9ha and 16.9ha of non-Forest Service woodland affected by Corridors 1, 2, 3 and 4.
Royal Society for the Protection of Birds (RSPB)	22 July 2016 31 Aug 2016 13 Oct 2016	16 Sep 2016 16 Nov 2016	RSPB's preferred selection is Corridor Option 1 as this avoids any designated sites of nature conservation importance. This route may involve the least impact on biodiversity, subject to further environmental assessment. Corridor options 2, 3 and 4 cross the Carlingford Lough Area of Special Scientific Interest (ASSI) and as such represent an increased potential for impact on the ASSI. 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. Advocate no loss of biodiversity to development. Second response supported consideration of Corridor 5, but Corridor 1 remains RSPB's preferred route.
Ulster Angling Federation	22 July 2016 13 Oct 2016* 23 Nov 2016	15 Aug 2016	Concerned regarding impact of all corridor options on water quality of Newry River, habitat for Atlantic Salmon protected species. Enclosed Pollution Prevention Policy document.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Ulster Wildlife	22 July 2016 31 Aug 2016 13 Oct 2016* 23 Nov 2016	-	No response received
Woodland Trust	22 July 2016 13 Oct 2016	01 Aug 2016 09 Nov 2016	No route should be considered if it affects ancient / long established woodland. Options 1 & 2 have no impact on ancient / long established woodland. Options 3 & 4 seriously impact and threaten Fathom Wood. Second response stated WT were unsure as to impact of revisions on existing woodland. If no negative impacts, they would have no concerns.

**No response received in relation to the additional consultation regarding the developed corridors. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.*

7.4.4 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 (SPAs) 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 (SACs) 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 proposed development 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 NI employs 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.

7.4.4.1 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 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.

7.4.4.2 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 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.

7.4.5 Baseline Environmental Conditions & Constraints

7.4.5.1 Designated Ecological Sites of International/National/Local Importance

With reference to NED – 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 7.4.1).

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. The sites include Derryleckagh SAC, ASSI & proposed Ramsar Site, Carlingford Lough ASSI, Fathom Upper ASSI, Greenan ASSI, and Greenan Lough ASSI (Figure 7.4.1).

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, these sites include Carlingford Shore SAC, Carlingford Mountain SAC & pNHA and Carlingford Lough proposed Natural Heritage Area (pNHA) (Figure 7.4.1). The closest of these is Carlingford Shore SAC, located immediately adjacent to the southern boundary of Corridor 4.

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 339 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 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 four designated Sites of Local Nature Conservation Importance (SLNCI) within the study area. These include Narrow Water Forest, Fathom Lower Woods & Grasslands, Maginnis Villas and Cloghogue SLNCIs (Figure 7.4.2). A fifth 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. The stand is even aged with a minimal cover of mosses mainly on dead wood. The ground flora is exceptionally rich – dominated by bluebell (Hyacinthoides non-scripta), ivy Hedera helix, wood-sorrel Oxalis acetosella, and ramsons Allium ursinum. The site merits it notification due to the diverse ground flora associated with the woodland.

Maginnis Villas SLNCI is a mixture of estate woodland and regenerating scrub, located between the A2 Warrenpoint Road and Greenan Road. The area comprises beech- dominated estate woodland with some examples of very mature trees important for other species such as cavity nesting birds, invertebrates and mammals including bats. Shrub species include holly, birch, and hazel, with occasional ash in the canopy. The regenerating scrub is blackthorn, hawthorn, hazel and birch with a rich field layer of bramble, ferns, bluebells Hyacinthoides non-scripta, pignut Conopodium majus, wood-sorrel Oxalis acetosella, wood anemone Anemone nemorosa with the moss Thuidium tamariscinum covering any exposed rocks. The ground flora is typically associated with long-established woodland and it would appear that the entire area was perhaps extensively wooded in the past.

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 parcels. The scrub is at different stages of development with blackthorn and hawthorn frequent, giving way to ash, hazel and rowan.

The grassland is very rich with both wet and dry areas. Notable species within the cattle-grazed sward include: common twayblade Listera ovata, frog orchid Coeloglossum viride, 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 quality of plants found, such as burnet-saxifrage Pimpinella saxifraga and Devil's-bit scabious Succisa pratensis, make it an important semi-natural area.

7.4.5.2 Non-Designated Ecological Sites

There are a number of non-designated areas, which may be of greater ecological or nature conservation interest within the study area, in particular the isolated strip of land between the Newry River and Newry Canal, and 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. These are extensive hedgerow field boundaries within the study area, particularly on the slopes of Fathom Mountain. These hedgerows are valuable wildlife corridors.

7.4.5.3 Woodland Areas

With reference to the Woodland Trust – 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 7.4.2). The database provides a comprehensive record of information of 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 170 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 1830 and 1600 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.

A baseline on-site survey of the long-established woodland within the study area was carried out in 2016. The woodland parcels as outlined in the Woodland Trust's Woodland Inventory were visited (Figure 7.4.2). Information in the form of Target Notes is presented in Appendix D of this report.

7.4.5.4 Rivers

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.

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.

7.4.6 Assessment of Environmental Impacts

7.4.6.1 Designated Ecological Sites of International/National/Local Importance

Corridor 1

Corridor 1 would not directly affect Carlingford Lough ASSI, as it crosses the river at a more northerly location. An alignment within this corridor would likely cross the Newry River on a single span structure, thus not directly impacting on the river. Nevertheless, there remains the risk of a pollution incident affecting the river, either during construction or during long- term operation/maintenance of the scheme. Corridor 1 does pass through part of Cloghogue SLNCI north of the Ellisholding Junction.

Corridor 2

Corridor 2 would cross Carlingford Lough ASSI (Figure 7.4.1), traversing it in its upper extent, over an approximate distance of 350m. This would involve crossing the Newry River on a bridge structure and due to the river's width, at this point; it is highly likely that there would be several bridge piers in the river, thus directly affecting the mudflats. The northern-most parcel of the Fathom Lower Woods & Grassland SLNCI complex would be within Corridor 2, with its most northern extent potentially being directly affected by an alignment within this corridor. The central parcel of this SLNCI may also be traversed at its extreme eastern edge. Similarly, this route passes through a portion of Cloghogue SLNCI north of the Ellisholding Junction. The most northerly section of Maginnis Villas SLNCI would also be within the eastern fringe of this corridor.

Corridor 3

Corridor 3 would traverse the Carlingford Lough ASSI for an approximate distance of 500m. As with Corridor 4, the degree of impact on the river and designation would depend on the subsequent bridge design. Likely impacts may include sediment accumulation on the upstream side of the piers, scouring as a result of current eddying on the downstream side of the piers, and an overall disruption to sediment movements within the river channel.

Depending on any subsequent road alignment within Corridor 3, there could be direct effects on three SLNCIs. As it climbs the eastern valley side to cross the Newry River at height, Narrow Water Forest SLNCI could be traversed, whilst fragmenting an area of woodland from the main body of the SLNCI to the south. An alignment within Corridor 3 could also directly affect and potentially fragment Maginnis Villas SLNCI, and on the western valley side, Corridor 3 could directly affect the Fathom Lower Woods and Grassland SLNCI complex, however to a much lesser extent than an alignment within Corridor 4. Corridor 3 would traverse both the largest (and southernmost) parcel of the complex and the middle parcel of this SLNCI. This corridor could also cause fragmentation between the different sections of the SLNCI, leaving the largest parcel isolated from the two smaller parcels located closer to Newry.

Corridor 4

Carlingford Shore SAC in the Republic of Ireland would be approximately 2km south-east of Corridor 4. Carlingford Lough SPA in Northern Ireland (at its closest point) would be approximately 10km south-east of this corridor. 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 undertaken to test the likely significance of the scheme on these sites. This assessment would be undertaken at a future stage.

Although there would be a large bridging point area associated with Corridor 4, the potential impact on Carlingford Lough ASSI would be broadly similar, with all alignments within this corridor traversing the site for an approximate distance of 350m, south of Green Island. 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. As this is a preliminary stage, it is not feasible to speculate upon the degree of impact until a more detailed design stage.

Fathom Upper ASSI is located close to Corridor 4, however it is not expected that there would be any direct impact on the site, being several metres west of the corridor on the slopes of Fathom Mountain.

An alignment within Corridor 4 could have a significant impact on several SLNCIs. Narrow Water Forest SLNCI, east of the A2 Warrenpoint Road, would be within Corridor 4, the extent of impact would be largely dependent on the junction arrangement with the A2. Any proposed at-grade junction associated with Corridor 4 would have the least impact, only marginally encroaching into the SLNCI, whereas a grade-separated junction would result in a significant amount of land loss within the SLNCI, potentially fragmenting the site into three parcels of woodland.

An alignment within Corridor 4 could have a major impact on the Fathom Lower Woods and Grassland SLNCI complex, directly affecting the majority of the largest (and most southern) parcel of the complex. Corridor 4 would result in the SLNCI being traversed over a distance of approximately 750m leading to significant habitat loss and habitat fragmentation. The central parcel of this SLNCI complex could also be significantly affected by this corridor and the integrity of the SLNCI complex would be further compromised as the southernmost parcel would be isolated from the two smaller parcels located closer to Newry.

Corridor 5

Corridor 5 would not directly affect Carlingford Lough ASSI, as it crosses the river at a more northerly location. An alignment within this corridor would likely cross the Newry River on a single span structure, thus not directly impacting on the river. Nevertheless, there remains the risk of a pollution incident affecting the river, either during construction or during long-term operation/maintenance of the scheme. The northern-most parcel of the Fathom Lower Woods & Grassland SLNCI complex could be directly affected by Corridor 5. The central parcel of this SLNCI could also be directly impacted by an alignment within this corridor. Additionally, this could fragment this SLNCI by splitting the two northern sections from the large southern section. This corridor would pass within several metres of Cloghogue SLNCI north of the Ellisholding Junction, but would not necessarily directly impact upon it.

7.4.6.2 Non-Designated Ecological Sites

Corridor 1

This corridor largely traverses agricultural land with numerous hedgerows. As priority habitat and important wildlife corridors, hedgerow loss would be detrimental, causing habitat fragmentation for local wildlife. The bridging point for Corridor 1 would directly affect the isolated strip of land between the river and canal with the possible construction of a bridge pier. 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 wildlife. The bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor.

Corridor 1 would not directly affect or be close to any long-established/ancient woodland. Several small patches of non-designated broadleaf and conifer woodland (<0.7ha in total) may be affected. Overall woodland loss would be lowest with Corridor 1, compared with all other corridors under consideration.

Corridor 2

The bridging point for Corridor 2 would also directly affect hedgerow habitat and the isolated strip of land between the river and canal, with potential impacts being broadly similar as those discussed above.

Corridor 2 would potentially affect two areas of long-established woodland. This would include long-established woodland associated with the most northern parcel of Fathom Lower Woods and Grassland SLNCI, and a small section of long-established woodland associated with Maginnis Villas SLNCI. In total approximately 13ha of woodland could potentially be affected by this corridor, including areas of non-designated conifer and broadleaf woodland.

Corridor 3

Corridor 3 would also traverse hedgerow habitat and the isolated strip of land between the river and canal, with potential impacts being broadly similar as those discussed above.

An alignment within Corridor 3 could directly affect long-established woodland associated with Narrow Water Forest SLNCI, which could traverse this woodland for approximately 160m and also result in fragmentation of a small parcel of woodland from the main body of the forest to the south. On the western valley side, Corridor 3 could also directly affect the long-established woodland associated with the central parcel of the Fathom Lower Woods and Grassland SLNCI complex, traversing the woodland over an approximate distance of 50m, and isolating woodland north and south of this corridor. Approximately 7 ha of long-established woodland could be directly affected within this corridor and approximately 41 ha of non-designated broadleaf, conifer and mixed woodland could be affected.

Corridor 4

Corridor 4 would also directly affect hedgerow habitat the isolated strip of land between the river and canal, with potential impacts being broadly similar as those discussed above.

As mentioned previously, from the tie-in with Fathom Line, Corridor 4 would climb the lower slopes of Fathom Mountain, through Fathom Forest with the potential for significant woodland loss and severance between the SLNCI and Fathom Line. A grade-separated junction arrangement at Fathom Line associated with this corridor would result in a greater amount of woodland loss.

As detailed previously, woodland loss would be a significant ecological issue with Corridor 4. Long-established woodland associated with Narrow Water Forest SLNCI could be directly affected, the extent to which is largely dependent on the A2 Warrenpoint Road junction arrangement. From the tie-in with Fathom Line, Corridor 4 would climb the lower slopes of Fathom Mountain, which is largely all classified as long-established woodland. This could result in approximately 700 – 850m of long established woodland being traversed within Corridor 4 on the slopes of Fathom Mountain, regarded as being a highly significant impact. Consultation with the Woodland Trust has indicated that they would be strongly opposed to the loss of long-established or ancient woodland as it now only occupies 0.08% of the total landcover of Northern Ireland.

Forming a small part of the Fathom Lower Woods & Grassland SLNCI complex is an area of 'possibly' ancient woodland, which again would be affected by Corridor 4. Alignment options are likely to significantly affect the woodland and cause fragmentation to the habitat. Also forming part of the Fathom Lower Woods & Grassland SLNCI complex, long-established woodland is located within the central parcel. Corridor 4 could also directly affect this area, potentially significantly encroaching on its westernmost fringe. In essence, the impact on woodland would be much greater with Corridor 4 than with Corridor 3.

Approximately 2ha of possibly ancient woodland and 145 ha of long-established woodland could be directly affected within this corridor. Moreover, approximately 150 ha of non-designated broadleaf, conifer and mixed woodland could be affected.

Corridor 5

Corridor 5 would also directly affect hedgerow habitat and the isolated strip of land between the river and canal, with potential impacts being broadly similar as those discussed above.

Corridor 5 would potentially affect two areas of long-established woodland. This would include long-established woodland associated with the two northern parcels of Fathom Lower Woods and Grassland SLNCI, and a small section of long-established woodland associated with Maginnis Villas SLNCI. In total, approximately 3ha of long-established woodland could potentially be affected by this corridor; additionally approximately 11ha of non-designated conifer, broadleaf and mixed woodland could be affected.

7.4.6.3 Rivers

As the river is tidal at the point where all corridors traverse, it is not monitored for its biological or chemical quality. Nevertheless, this stretch of the Newry River remains an important migratory route for salmon and trout migrating to upstream waters, and as such must be protected from pollution incidents, both during construction and normal operation of the scheme.

7.4.7 Mitigation & Enhancement Measures

7.4.7.1 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 desktop review, as part of the Stage 2 Environmental Assessment. This process should identify all the important sites within the preferred corridor for nature conservation, which might be affected by some or all of the route options, including the presence of protected species, if known. The results of the detailed desktop assessment will need to be verified by a preliminary walkover survey, to ensure that no undocumented sites or features of nature conservation importance are overlooked.

The aim is the preparation of a Phase 1 Habitat mapping survey for the area of interest. It will only be following this review that an estimate of protected wildlife surveys may be given, such as badger, otter, red squirrel and bats for example.

7.4.7.2 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 corridors on Carlingford Shore SAC and Carlingford Lough SPA. An HRA is being undertaken alongside this Stage 1 Assessment and would establish if any specific mitigation measures are necessary to protect these Natura 2000 (SAC and SPA) sites from adverse impacts associated with 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 corridor alignment, but on bridge design (in terms of frequency, diameter and shape 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.

As a minimum requirement and in line with best practice extensive pollution mitigation measures, to prevent contaminated water from road drainage entering the watercourses will 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.

7.4.7.3 Non-designated ecological sites

Hedgerows and Canal banks

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 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. All corridors are likely to significantly affect this habitat and the wildlife it supports.

Where possible, all hedgerow, trees and associated scrub vegetation should be retained. Where hedgerows 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 corridor.

Woodland

Long-established and ancient woodland are an irreplaceable resource of great importance for their wildlife, soils, recreation, cultural value, history and the contribution to landscapes. 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 likely to be affected by Corridors 3 and 4. These conifer plantations should not be undervalued as they typically retain characteristic soils and ground flora, which makes 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.

Corridors 1 and 2 completely or almost completely avoid all areas of long-established and ancient woodland and would cause minimal fragmentation. Corridor 5 may impact on a parcel of long-established woodland, although not as extensive as Corridors 3 and 4. It is therefore recommended (from an ecological perspective) that one of these corridors is selected to ensure minimal adverse effects on the extent and integrity of the ancient woodland habitats.

Should Corridors 3, 4 or 5 be selected as the preferred corridor, it will be necessary to establish the precise loss of long-established or ancient woodland by ground-truthing surveys.

Woodland mitigation

General mitigation measures associated with the loss of habitats, would include extensive replacement habitat, additional compensatory habitat creation, habitat restoration where appropriate, protection of existing vegetation and habitats at the margins of the corridors, and the use of native species for landscape planting.

Where possible, the corridor must be kept as far as possible from ancient woodland, with a buffer area maintained between the ancient woodland and the scheme alignment. As a minimum, this buffer should be at least 15m (if at all feasible) around the affected ancient woodland, but larger buffers should be created where possible.

Woodland compensation

Native woodland planting: ancient woodland habitat is irreplaceable and creating new woodland cannot provide a direct replacement. However, if an area of ancient woodland is lost to the scheme, native woodland habitat creation, at a large scale, could be considered as part of a compensation package.

Favourable management of neighbouring sites: As well as new native woodland planting, restoration of Plantations on Ancient Woodland Sites (PAWS) or securing the appropriate management of an area of unmanaged ancient woodland nearby may be considered as part of a compensation package, provided that the long-term management of the site(s) is secured.

Lost veteran replacement tree planting: It is not possible to replace veteran trees with new planting. However, planting numerous young trees of similar species to the veterans that have been lost will help to compensate for this loss. Replanting should take place as close to the lost trees as possible to maintain habitat connectivity. The

intact veteran tree should be felled and relocated in close proximity to established woodland to provide deadwood habitat and allow for invertebrates and fungi to relocate to surrounding habitat. Deadwood is an important and undervalued feature of woodland habitat.

Ancient woodland translocation: An ancient woodland ecosystem cannot be moved. It has developed over hundreds of years and cannot be moved intact due to soil composition and structure, varied topography, range of micro-habitats, species assemblages, and mycorrhiza fungi associations with tree roots. Whilst the translocation of ancient woodland soil to a new site is sometimes proposed as a compensation measure for the loss of ancient woodland, it is impossible to replicate the same conditions at another site; it will no longer be ancient woodland. However, where an ancient woodland is going to be lost to development, it is possible that translocation of the soils to a new site which is then planted with typical native woodland tree and shrub species, could in some circumstances support the development of an ecosystem which contains some of the plants and fungi of the former ancient woodland. Habitat translocation should only be viewed as a measure of last resort in partial compensation for damage to ancient woodland.

7.4.7.4 Habitat fragmentation

Corridors 3 and 4 have the potential to cause significant habitat fragmentation, which can significantly disrupt natural woodland processes and the natural movement of plants and animals.

The impacts of fragmentation can be minimised through the planting of additional woodland sites, in areas which will facilitate habitat connectivity. It should be noted that this concept should be implemented within all habitat types.

The woodland habitats in question are known to have species which are protected at all times under the Wildlife (Northern Ireland) Order 1985 (as amended). These include badger and possibly red squirrel. Mitigation will therefore be required to provide safe movement of these species through the landscape, therein reducing the impacts associated with habitat fragmentation and increasing connectivity for these species. Underpasses in conjunction with appropriately located mammal fencing would be required as a means of enabling badgers to access traditional foraging areas, similarly provision of aerial crossing points would be required to allow red squirrels to move between woodland areas.

7.4.7.5 Rivers

Should Corridors 3, 4 or 5 be selected, protection of the water intake for Bensons Glen fish hatchery from pollution will be paramount, both during construction and for long-term operation and maintenance of the road.

The tidal reach of the Newry River is a migratory route for salmon and sea trout and must be protected from pollution, either 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.

7.4.7.6 Presentation of Key Issues

The key issues associated with the five broad corridors from an ecology & nature conservation perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.17.

- There are several designated sites of national/international ecological importance within or close to the study area. Corridors 2, 3 and 4 would traverse the Newry River, part of Carlingford Lough ASSI;
- There are several SLNCIs within the study area, of which four may be directly affected by the corridors. Corridor 4 would have the greatest impact on SLNCIs;
- No designated Salmonid or Cyprinid waterbodies would be directly affected by the corridors;
- Corridor 4 would result in by far the greatest impact on long-established woodland and possibly ancient woodland, on the lower slopes of Fathom Mountain; a highly significant impact;
- The key ecological impacts of the scheme at this stage would be those resulting from the loss of habitat through road construction and obstruction of wildlife corridors;

- Significant and extensive mitigation and compensation measures would be required if Corridor 3 or 4 was to be implemented;
- Of all corridors, Corridor 4 would have the greatest impact on ecological habitats, particularly on the lower slopes of Fathom Mountain;
- The preferred corridor from, an ecological perspective, would be Corridor 1 as it would avoid designated sites and both long-established and ancient woodland parcels. Corridor 5 would follow Corridor 1 as the second favourite option and depending on specific alignments, ecological impacts could be minimised. Corridors 3 & 4 would be least preferred due to their potential to impact ecological designated sites and important ecological receptors the greatest.

Table 7.17 Ecology and Nature Conservation Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	No direct impact upon designated ecological sites. Direct impact upon Newry River and Newry Canal minimised. Direct impact upon Cloghogue SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would not directly affect or be close to any long-established/ancient woodland.	N/A (Qualitative Assessment Only)	Moderate Adverse
Corridor 2	Direct impact upon Carlingford Lough ASSI. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI, Maginnis Villas SLNCI and Cloghogue SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland.	N/A (Qualitative Assessment Only)	Moderate Adverse
Corridor 3	Direct impact upon Carlingford Lough ASSI. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI, Maginnis Villas SLNCI and Narrow Water Forest SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland, with some significant losses expected.	N/A (Qualitative Assessment Only)	Moderate Adverse
Corridor 4 Option A	Direct impact upon Carlingford Lough ASSI. Closest proximity to Carlingford Lough SAC/SPA. Fathom Upper ASSI in close proximity. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI and Narrow Water Forest SLNCI. Largely traverses a mix of forestry and agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland and possibly ancient woodland, with	N/A (Qualitative Assessment Only)	Large Adverse

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
	some significant losses expected.		
Corridor 4 Option B	Direct impact upon Carlingford Lough ASSI. Closest proximity to Carlingford Lough SAC/SPA. Fathom Upper ASSI in close proximity. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI and Narrow Water Forest SLNCI. Largely traverses a mix of forestry and agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland and possibly ancient woodland, with some significant losses expected.	N/A (Qualitative Assessment Only)	Large Adverse
Corridor 5	No direct impact upon designated ecological sites. Direct impact upon Newry River and Newry Canal minimised. Direct impact upon Fathom Lower Woods & Grassland SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland.	N/A (Qualitative Assessment Only)	Moderate Adverse

7.5 Landscape & Visual Effects

7.5.1 Introduction

The objective of this section of the report is to undertake sufficient assessment to identify the landscape and visual impact constraints associated with the five broadly defined corridors linking the A2 Warrenpoint Road to the A1 at, or in the vicinity of, Cloghogue or Ellisholding junctions south of Newry.

7.5.2 Methodology

7.5.2.1 Assessment of Effects - Methodology

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 replaces 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*' (2002), Second Edition; hereafter referred to as the GLVIA. These publications form the standard reference for undertaking landscape character and visual assessments in Northern Ireland. 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. A 3rd Edition of the GLVIA was published in 2013. However, the GLVIA 2nd Edition was used in order to achieve consistency with 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)."

The baseline landscape and visual conditions of the study area were assessed through desktop studies, previous knowledge of the site and site surveys.

7.5.2.2 Landscape Effects Assessment - Methodology

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 impact, 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.

7.5.2.3 Landscape Quality

The quality of the landscape has been described and assessed based on the GLVIA, and this is detailed in Table 7.18 below.

Table 7.18 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. Sense of place. Occasional detracting features. Could be improved with appropriate management.	Nationally or Regionally recognised e.g. parts of National Parks, AONBs.
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).

7.5.2.4 Classification of Landscape Sensitivity

The sensitivity of the landscape to change is the degree to which a particular landscape can accommodate changes or new features without unacceptable detrimental effects to its essential characteristics. Criteria used in this assessment to determine sensitivity includes:

- the distinctiveness of character and quality of the existing landscape;
- the vulnerability of the key components determining character;
- the nature of predicted impacts, 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 Table 7.19.

Table 7.19 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).

7.5.2.5 Magnitude of Landscape Impacts

The magnitude of a landscape impact relates to:

- the size, extent or degree of change to landscape character, or individual landscape components;
- whether there is a direct impact resulting in the loss of landscape components, or change beyond the land take associated with the Scheme having an impact on the character of the area; and
- whether the impact is permanent or temporary.

Table 7.20 details the criteria used to define the magnitude of landscape impacts (as defined in IAN 135/10).

Table 7.20 Estimating the Magnitude of Impact on a Landscape Attribute

Magnitude of Impact	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).

7.5.2.6 Significance of Landscape Effects

The significance of effect associated with the Scheme on the landscape can be determined by combining the magnitude of impact with the sensitivity of each particular landscape area to change. This is determined by the use of a matrix, shown in Table 7.21, which balances the value of a feature against the magnitude of impact, taking into account the planned mitigation measures (based on the significance of effect categories defined within IAN 135/10).

Table 7.21 Estimating the Significance of Potential Landscape Effects

Landscape Sensitivity	No Change	Negligible	Minor	Moderate	Major
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
			Magnitude of Impact		

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 7.22.

Table 7.22 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.

Significance Category	Description of Effect
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).

7.5.2.7 Visual Effects Assessment Methodology

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.

7.5.2.8 Visual Receptors and Classification of Visual Sensitivity

The classification of visual sensitivity and the criteria used to define sensitivity to change (as defined in IAN 135/10) is detailed in Table 7.23.

Table 7.23 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).

7.5.2.9 Magnitude of Visual Impacts

Table 7.24 presents the criteria used to define the magnitude of visual impacts (as detailed in IAN 135/10).

Table 7.24 Estimating the Magnitude of Impact on a Visual Attribute

Magnitude of Impact	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).

7.5.2.10 Significance of Visual Effects

The significance of the effect associated with the Scheme on each visual receptor was determined by combining the magnitude of impact with the sensitivity of each visual receptor. The criteria used to derive significance are detailed in Table 7.25.

Table 7.25 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 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 Table 7.26.

Table 7.26 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).

7.5.3 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 consultation in relation to Landscape and Visual Effects.

Table 7.27 Summary of formal consultation responses in relation to Landscape and Visual Effects

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
NMDDC – Local Planning Office / Development Plan Team	22 July 2016 13 Oct 2016	30 Sep 2016 17 Nov 2016	Concerns about impact on Ring of Gullion and Mourne AONBs. Second response gave information based on the Area Plan for Corridor 5, and the extended Corridors 1 and 2.
NIEA - Natural Environment Division	22 July 2016 13 Oct 2016 23 Nov 2016	19 Aug 2016 24 Nov 2016	Concerns about adverse effect on Ring of Gullion and Mourne AONBs and loss of ancient woodland. Second response outlined impacts on AONB with Corridor 5.
Historic Buildings Council	22 July 2016 13 Oct 2016* 23 Nov 2016	22 Aug 2016	Commented on potential impact on the setting of the Newry Canal, and Areas of Townscape Character and Archaeological potential in Newry.
Warrenpoint Harbour Authority	22 July 2016 13 Oct 2016* 23 Nov 2016	16 Aug 2016	Careful consideration to be given to lighting of the bridge in Corridors 3 and 4 with regard to potential impact on port navigation.
Warrenpoint, Burren Rostrevor Chamber of Commerce	22 July 2016 13 Oct 2016 23 Nov 2016	18 Aug 2016 07 Dec 2016	Major concern of the possible detrimental effect on AONB and impact on the tourism economy. Second response reiterated response received to first consultation.
Sustrans	22 July 2016 13 Oct 2016* 23 Nov 2016	10 Aug 2016	The visual impact of a high level bridge will impact on experience of walkers and cyclists.

*No response received in relation to the additional consultation regarding the developed corridors. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.

7.5.4 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.

7.5.4.1 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.

7.5.4.2 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.

7.5.4.3 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.

7.5.4.4 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 impacts associated with the Scheme, 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.

7.5.4.5 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).

7.5.4.6 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.

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."*

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.

7.5.4.7 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.

7.5.4.8 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 will enable 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.

7.5.4.9 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.

7.5.4.10 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.

7.5.5 Baseline Environmental Conditions & Constraints

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 7.5.1). 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’.

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 the 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 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.

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 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.

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 Canal towards Carlingford Lough, in a dramatic, steep-sided valley, approximately 1,000m 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.

The landscape character of the upland area around Fathom Mountain and Cloghogue Mountain is extremely 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.

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.

7.5.6 Assessment of Environmental Impacts

In the absence of more design detail of actual route alignments at this initial stage, it is not possible to fully assess the magnitude of impact on the Landscape or Visual attributes for the study area along each route. A proportionate effort high level assessment of the likely range of potential Landscape and Visual effects has been made for each corridor.

Bridging the River / Canal Valley.

All five of the corridors require a bridge structure to traverse the river valley. Whether it is at low level or high level, any such structure is likely to have a Moderate to Very Large Landscape and Visual effect within this valley. Whether this effect is adverse of beneficiary is a very subjective assessment and would be dependent on the final design of the bridge structure.

There are five indicative crossing points, two of which are within the Greenbank Industrial Estate on the Newry urban fringe, one at approximately 17m high (Corridor 1) and the other (Corridor 5) at a lower level (approximately 9m). To the south-east of the Greenbank Industrial Estate, Corridor 2 would also cross the valley at approximately 9m. The other two corridors cross the river valley further south towards Green Island, one at a high level, and the other at a low level. Corridor 3 is a high level bridge crossing (canal clearance of at least 35m) and Corridor 4 is a low structure (approximately 6m) at a range of possible crossing points over the valley.

Ring of Gullion AONB

All corridors encroach to some extent into the Ring of Gullion AONB on the western slope of the valley and would most likely range from a Moderate/ Large to Very Large Adverse Landscape and Visual effect within the AONB.

Corridor 1

Corridor 1 extends from the Greenbank Roundabout at the northern end of the A2 dual carriageway through the industrial estate, rising-up and bridging over the Newry River and Canal in a south-westerly direction at a relatively high level. The Greenbank Industrial Estate is a poor quality degraded urban landscape of unattractive industrial and commercial properties and sports pitches. A road bridge across the river and the Fathom Line at this location may require a shorter structure as the river is much narrower at this point. This option could have lesser landscape impacts as it would be crossing within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area. Due to the Low landscape sensitivity of the location, the significance of landscape effect is likely to be Neutral to Moderate for this section.

Corridor 1 would also have a potentially significant impact on southern views from the Dublin Road Bridge, the Albert Basin quay and promenade in Newry, through the river valley towards Carlingford Lough and Mountains.

This corridor would cross over the Fathom Line/Drumalane Road at high level, rise-up in cutting between housing and the Drumalane Quarry into the Ring of Gullion AONB with one indicative option alignment continuing either in cutting to join into the Ellisholding junction, or a second indicative option sweeping around the Dublin Road LLPA at existing levels to tie into Cloghogue Junction. This latter option would be a shorter length of new road and thus has the potential to have less impact on the AONB than the former.

The proximity of housing developments (visual receptors) close to this corridor as it climbs the western slope of the valley potentially increases the classification of visual sensitivity in this location, and could increase the significance of visual effect within a potential range of Slight to Large Adverse.

Corridor 2

Corridor 2 extends from a new roundabout on the A2 dual carriageway at the junction with Old Warrenpoint Road and would comprise a high level single carriageway structure over the Newry River and Canal climbing up the hillside over the top of the Fathom Line on the western bank of the river and Ring of Gullion AONB in a north-westerly direction to join the A1 at either the existing Cloghogue Junction, or at a new junction with the Dublin Road and Chancellor's Road. Both indicative options are likely to be on embankment for a significant stretch on the western slope before they move into cutting behind Drumalane Quarry.

This bridge and embankment structure over the river /canal and Fathom Line and beyond would mean that the road would be highly visible from the lower river valley, and its proximity to many properties (visual receptors) on the western bank of the river could give it a high visual sensitivity rating, resulting in a Large to Very Large significance of potential visual effect.

The steep topography within the AONB to the south-west of the Newry Canal adjacent to the existing quarry provides significant landscape constraints to this corridor. There would be a need for significant earthworks, particularly on the western slopes as the indicative alignment passes through this area in both cutting and embankment, impacting significantly on the AONB.

The indicative tie-in with a new roundabout at the Dublin Road/Chancellor's Road junction would have significant detrimental landscape and visual impacts on the designated Dublin Road LLPA in terms of the overall setting of the listed Church of the Sacred Heart (Cloghogue Church) and associated vegetation.

This corridor has the potential to have a significant adverse visual impact to the many adjacent properties located within it.

The estimated significance of potential Landscape and Visual effect could range from Large to Very Large Adverse for this section of the corridor.

Corridor 3

This corridor potentially includes a high level bridge structure approximately 41m above the water level. It would branch off a new roundabout on the A2 just south of Green Island, rise back up the eastern slopes towards the Aghnamoira Road impacting on a Local Landscape Policy Area, before bridging over the A2 Warrenpoint Road, the Newry River estuary, and the Fathom Line into the western slopes of the Ring of Gullion AONB, after which it then sweeps around Fathom Mountain to join into the Ellisholding junction.

The indicative alignment would be in cutting as it rises up the eastern slope towards the Greenan Road behind several properties along the A2 Warrenpoint Road. It would then be at a significantly high level as it crosses the river valley and the Fathom Line, from where the embankment would revert to cutting, as the indicative alignment skirts around the northern slopes of Fathom Mountain to tie into the Ellisholding Junction. The estimated significance of potential Landscape Effect would most likely be Large to Very Large Adverse on both sides of the valley, but in particular the Ring of Gullion AONB.

Such a major high level bridge structure, due to its height and span, would inevitably have a much greater zone of visual influence than the lower level options, and in turn would have a greater impact on surrounding properties, both within the river valley and the surrounding uplands with a likely significance of potential effect range of Large to Very Large. Whether that is considered adverse or beneficial is a subjective assessment and would largely depend on the architectural design of the bridge structure. It could also be argued that a high level

bridge in the open valley would allow the landscape to visually 'flow' underneath it, particularly when viewed from the A2 Warrenpoint Road, the Fathom Line and Victoria Lock Amenity Area.

Corridor 4

Corridor 4 allows for a bridge option located to the south of Green Island, which encroaches into the fringe of the Mourne AONB on the eastern slope of the valley and would have a significant impact on the Ring of Gullion AONB. The indicative alignment would result in significant loss of vegetation to the valley slopes either side of the Newry River estuary, as significant earthworks may be required for alignment options within this corridor.

Corridor 4 indicative alignment options all involve the creation of a new roundabout off the A2 Warrenpoint Road with a bridge over the river at a Low/Medium level to either join the Fathom Line at another junction, or bridge over the Fathom Line at a higher level to tie in with the western slopes of the river valley.

The indicative alignments would then follow the contours as much as possible and skirt around the lower slopes of Fathom Mountain to join into the Ellisholding Junction on the A1. This would involve a significant embankment, altering the profile of the northern and eastern slopes of Fathom Mountain.

The alignments would require major junctions at either end to tie into both the A2 and the Fathom Line. This would require significant earthworks and in turn, significant loss of vegetation to the lower slopes of Fathom Forest, and the woodland area to the south of Green Island. This would result in substantial scarring of the landscape in the short to medium term until such vegetation can be re-established. Due to the high sensitivity of the receiving landscape, the significance of landscape effect is likely to range from Large to Very Large over long lengths within this corridor.

A bridge at an indicative level ranging between 5m and 8m for this corridor above the canal has the potential to divide the river basin and indeed the overall river valley into two parts by creating a strong visual and physical barrier when viewed from the A2. This corridor could have a significant impact on the overall landscape character of the area, and the visual impact along the valley from the A2 Warrenpoint Road, the Fathom Line and from Victoria Lock, and the estimated significance of Landscape and Visual effect would be Large to Very Large in this sensitive landscape setting.

Corridor 5

Corridor 5 extends from a new roundabout on the A2 dual carriageway cutting through the Greenbank Industrial Estate and continues to a new roundabout at the Ellisholding grade-separated junction on the A1. The indicative alignment within this corridor comprises a low-level bridge structure across the Newry River which includes an opening section over the Newry Canal leading to a roundabout adjacent to Fathom Line immediately south of Drumalane Quarry. From here, the corridor links into the de-trunked A1 Dublin Road with a new roundabout junction before continuing to Ellisholding Junction. This corridor includes a direct link between the A2 and Fathom Line.

As with Corridor 1, a road bridge across the river at this location would require a shorter structure as the river is much narrower at this point. This corridor option could have less landscape impacts as it would be crossing within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area. Again, due to the Low landscape sensitivity of the location, the significance of Landscape Effect is likely to range from Neutral to Moderate for this section. Corridor 5 would also have a potentially significant impact on southern views from the Albert Basin quay and promenade in Newry, through the river valley towards Carlingford Lough and Mountains.

As the corridor climbs the western slope of the valley, there is again potential for significant earthworks and thus impact on the Ring of Gullion AONB. This would result in substantial scarring of the landscape in the short to medium term until such vegetation can be re-established. Due to the high sensitivity of the receiving landscape, the significance of Landscape Effect is likely to range from Large to Very Large over long lengths within this corridor.

7.5.7 Mitigation & Enhancement Measures

- At Stage 2, 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 vegetation along the route to retain natural screening of new road;

- Develop opportunity 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 as an important architectural landmark and gateway bridge, signifying the north/south link, creating an attractive feature in the landscape.

7.5.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Landscape & Visual perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.28.

- All five of the corridors require a bridge structure to traverse the river valley and any such structure is likely to have a Moderate to Very Large Landscape and Visual Effect within this valley. Whether this effect is adverse of beneficiary is a very subjective assessment and could be dependent on the final architectural design of the bridge structure.
- The indicative high level bridge crossing associated with Corridor 3 could be highly visible from a greater distance than the lower level options, and in turn would have a greater impact on surrounding properties, both within the river valley and the surrounding upland. This corridor is likely to be less favoured from a visual perspective.
- The bridge options associated with Corridors 4 and 5 have the potential to divide the river basin and indeed the overall river valley into two parts by creating a strong visual and physical barrier when viewed from the A2 and Fathom line.
- Alignments developed within Corridors 1 and 5 could have less landscape impacts as they would be crossing within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area.
- All corridor options encroach to varying degrees into the Ring of Gullion AONB on the western slope of the valley and will most likely range from a Moderate/ Large to Very Large Adverse Landscape and Visual Effect within the AONB.
- Corridor 4 encroaches into the fringe of the Mourne AONB on the eastern slope of the valley where it leaves the A2 Warrenpoint Road.

Table 7.28 Landscape & Visual Effects Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	In terms of the bridge crossing, it may have less of a landscape impact as it would be within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area. However, there may be a potentially significant impact on southern views from the Dublin Road Bridge, the Albert Basin quay and promenade in Newry, through the river valley towards Carlingford Lough and Mountains. This corridor would rise up in cutting into the Ring of Gullion AONB to join into the Ellisholding Junction. The proximity of housing developments (visual receptors) close to this corridor as it climbs the western slope of the valley potentially increases the classification of visual sensitivity in this location.	N/A (Qualitative Assessment Only)	Landscape: Moderate Adverse Visual: Slight Adverse - Large Adverse
Corridor 2	The bridge and embankment structure over the river /canal would make the road highly visible, and it is in proximity to many visual receptors. The steep topography within the AONB provides significant landscape constraints to this corridor. The proposed tie-in with a new roundabout at the A28 Dublin Road would have significant detrimental landscape and visual impacts on the designated Dublin Road LLPA. Potential to have a significant visual impact to the many adjacent receptors along this corridor.	N/A (Qualitative Assessment Only)	Landscape: Moderate Adverse - Large Adverse Visual: Moderate Adverse - Large Adverse
Corridor 3	The high level bridge structure and associated earthworks and infrastructure either side of the valley would have a significant impact upon an LLPA and Ring of Gullion AONB. There would also inevitably be a much greater zone of visual influence, and would be highly visible from a greater distance than the lower level corridors, and in turn would have a greater impact on surrounding receptors. Whether that is assessed as adverse or beneficial is a subjective assessment and would largely depend on the architectural design of the bridge structure.	N/A (Qualitative Assessment Only)	Landscape: Moderate Adverse Visual: Moderate Adverse – Large Adverse
Corridor 4 Option A	Slight encroachment into Mourne AONB, though the corridor would have a significant impact on the Ring of Gullion AONB, resulting in significant loss of vegetation in combination with major earthworks on the western valley side. However, the road would follow contours as much as possible. The bridge crossing would have the potential to divide the river basin and indeed the overall river valley into two parts by creating a strong visual and physical barrier when viewed from the A2. The lack of receptors would minimise visual impacts over this section of the corridor.	N/A (Qualitative Assessment Only)	Landscape: Large Adverse Visual: Moderate Adverse

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 4 Option B	Slight encroachment into Mourne AONB, though the corridor would have a significant impact on the Ring of Gullion AONB, resulting in significant loss of vegetation in combination with major earthworks on the western valley side. However, the road would follow contours as much as possible. The bridge crossing would have the potential to divide the river basin and indeed the overall river valley into two parts by creating a strong visual and physical barrier when viewed from the A2. The lack of receptors would minimise visual impacts over this section of the corridor.	N/A (Qualitative Assessment Only)	Landscape: Large Adverse Visual: Moderate Adverse
Corridor 5	The bridge crossing would require a comparatively shorter and lower structure, thus could have less landscape impacts as it would be within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area. As the corridor climbs the western slope of the valley, there is again potential for significant earthworks and thus impact on the Ring of Gullion AONB. This would result in substantial scarring of the landscape in the short to medium term until vegetation can be re-established.	N/A (Qualitative Assessment Only)	Landscape: Moderate Adverse Visual: Slight to Large Adverse

7.6 Land Use

7.6.1 Introduction

The assessment of landtake for a proposed 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 7.3 (Cultural Heritage). Land of ecological importance (including woodland) is dealt with in Section 7.4 (Ecology & Nature Conservation). In addition, Section 7.5 (Landscape & Visual Effects) considers the contribution of all land affected by the scheme to the landscape or townscape and identifies designated areas, such as AONBs and LLPAs.

The principal objective at this preliminary stage is to undertake sufficient assessment to give an indication as to the potential land type losses and demolition required within the five broadly defined corridors under consideration in order to help identify a preferred corridor.

7.6.2 Methodology

To allow for a broad estimate of the potential demolition of property, a risk schedule has been prepared based on the number of properties that would be located within a 10m offset from the earthworks of an indicative alignment for the southern relief road within each of the corridors. It is these properties that would be at high risk of demolition. A similar exercise was carried out for planning applications within the study area, and a schedule produced for applications which may be directly affected, again based on a 10m offset from the earthworks of an indicative alignment within each respective corridor under consideration.

For the impact of the corridors on development land, the current Banbridge / Newry & Mourne Area Plan 2015 was inspected. For the indicative alignments within each corridor, potential landtake from local planning development designation areas was identified, and a broad assessment of how each corridor might affect these was made.

Normally there are four main areas addressed in the assessment of impacts on agricultural land, including land-take, type of husbandry, severance and major accommodation works. However at this preliminary stage, the main requirement is to identify overall likely losses and potential severance of agricultural land and obtain information on land quality and statutory areas designated for their agricultural importance. In terms of areas used for forestry, overall likely losses and potential severance of woodland areas have been assessed in a similar manner to the assessment of impact on agricultural land.

As required by DMRB 11.3.6.4 (Assessing the Loss of Land Used by the Community), Newry, Mourne and Down District Council (NMDDC) were 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 7.4 (Ecology & Nature Conservation) and Section 7.5 (Landscape & Visual Effects); however, as many woodlands are commonly utilised as recreational and open spaces, the impact of their loss is considered in this section as necessary.

In terms of Waterway Restoration Projects, it is essential to consider any waterways, formerly navigable watercourses, or dry watercourses for which there are currently restoration proposals.

All of the aforementioned information culminated in the preparation of land use constraints drawings (Figures 7.6.1 & 7.6.2) showing the various existing and proposed land uses and classifications, and planning applications.

7.6.3 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. The following table outlines the responses from the consultation in relation to Land Use.

Table 7.29 Summary of formal consultation responses in relation to Land Use

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Forest Service	22 July 2016 13 Oct 2016	30 Sept 2016 03 Nov 2016	Have a duty to promote afforestation and sustainable forestry, and seek to avoid removal of woodland and promote woodland regeneration. Provided information and maps showing woodland type, ownership, number of blocks and total acreage for each corridor. Second response updated information to include Corridor 5 and updates to Corridors 1 and 2.
DfC – Regional Development Office (South Eastern Team)	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
DfC – Regional Development Office (Southern Team)	22 July 2016 13 Oct 2016	04 Aug 2016 18 Oct 2016	Both responses stated that the Southern Team had no relevant comments or information regarding the scheme. South Eastern RDO may be better placed to respond.
DfI – Planning Policy Division	08 Aug 2016 13 Oct 2016 23 Nov 2016	11 Aug 2016 24 Nov 2016	Identified Warrenpoint Harbour as an important gateway in RDS, noting sea ports are of fundamental importance and should be able to cope with volume and variety of traffic and are important for future growth of the economy. Connectivity to air and sea ports is a key infrastructure component. Responded (via telephone) confirming that Planning Policy Division had no further comments to make regarding the second consultation.
DfI – Strategic Planning Division	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Louth County Council (LCC)	22 July 2016 13 Oct 2016* 23 Nov 2016	16 Sep 2016	Environmental Assessment should have regard for the proposed Narrow Water Bridge, which is a strategic objective for LCC. Narrow Water Bridge has potential for economic and tourist potential for Carlingford Lough and Mourne area. Joint north/south venture with backing of Irish Government and Northern Ireland Executive along with Special EU Programmes. Full consents have been obtained on both sides of border for Narrow Water Bridge, including connection to the A2 and link road to R173/B79.
Mourne, Gullion & Lecale Rural Development Partnership	22 July 2016 13 Oct 2016* 23 Nov 2016	09 Sep 2016	Local Action Group supports the potential development of transport links in the area.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Mourne Heritage Trust	05 Sep 2016 13 Oct 2016 23 Nov 2016	29 Nov 2016	No comment to make at this stage.
NMDDC – Chief Executive	22 July 2016 13 Oct 2016	16 Nov 2016	Proposals are in line with Council's desire to see a link road connecting the A1 to the A2 Warrenpoint Road.
NMDDC – Combined Departments	22 July 2016 13 Oct 2016* 23 Nov 2016	17 Aug 2016	Comprehensive response, including Community Planning Baseline Report; District Electoral Area profiles of Crotlieve and Newry; Economic Development, Regeneration and Tourism presentation; Statement on Potential Benefits of Scheme, and a presentation regarding the positive impacts of the Southern Relief Road.
NMDDC – Local Planning Office / Development Plan Team	22 July 2016 13 Oct 2016	30 Sep 2016 17 Nov 2016	Provided information based on Area Plan per corridor. Also provided planning history information re: Bigwood and Drumalane quarries. Second response gave information based on the Area Plan for Corridor 5, and the extended Corridors 1 and 2.
National Trust	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Northern Ireland Agricultural Producers' Association	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Northern Ireland Housing Executive	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Ulster Farmers' Union	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Ulster Wildlife	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Woodland Trust	22 July 2016 29 July 2016 13 Oct 2016	01 Aug 2016 09 Nov 2016	No route should be considered where there would be an impact on ancient / long-established woodland (i.e. Corridors 3 & 4 should not be considered). Second response stated they were unsure as to impact of revisions on existing woodland. If no negative impacts, they would have no concerns.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
		20 Dec 2016	Meeting to discuss impact of proposed corridor options upon Woodland Trust's assets and interests within the study area. The Woodland Trust's mandate is to ensure there is no loss of long-established or ancient woodland and that they were not opposed to progress/development, but would be lobbying 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.

**No response received in relation to the additional consultation regarding the developed corridors. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.*

7.6.4 Regulatory & Policy Framework

7.6.4.1 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 (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.

7.6.4.2 Newry City Centre Masterplan (October 2011)

Newry City Centre Masterplan has been 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 have 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.

7.6.5 Baseline Environmental Conditions & Constraints

7.6.5.1 Existing Development

The origins of Newry date back to the 12th Century, when the Cistercian Abbey was founded to the east of 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 Newry. 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 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 lower portion of 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. The existing A2 Warrenpoint Road dual carriageway separates the industrial area from the residential area.

To the south, the industrial area terminates in the vicinity of 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 Canal, the majority of existing development is large parcels/clusters of residential housing which have developed off the B79 Fathom Line, 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.

7.6.5.2 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 (Figure 7.6.1). This website contains the details of all planning applications from 04 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 01 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.

These include Reserved Matters, Full and Outline applications, which have either been Approved or 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.

7.6.5.3 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 for the city. As indicated on Map no. 3/02a (Newry Settlement Map) of the Area Plan, and shown on Figure 7.6.2, 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) as also shown on Figure 7.6.2.

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.

7.6.5.4 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 Southern Relief Road, 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 although are less pertinent to the scheme, they do include proposals on a River Weir 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.

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.

7.6.5.5 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 B79 Fathom Line on the western valley side.

7.6.5.6 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".*

The consultation with Forest Service identified the woodland type, ownership, number of blocks and total area of woodland (including non-Forest Service land) for the broadly defined corridors under consideration. In terms of the Forest Service woodlands within the study area, these include:

- Narrow Water Wood/Forest; and
- Fathom Forest.

Each of these wooded areas includes broadleaf, conifer, mixed broadleaf, mixed conifer and native woodland (Figure 7.4.2).

7.6.5.7 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 and as shown on Figure 7.6.2, 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 Cloghogue Pitch & Putt, the playing fields at Drumalane Park, Newry Bowling Green, Newry Tennis Club and Victoria Lock amenity and picnic site.

In terms of community woodlands, consultation with Woodland Trust did not identify any community woodland sites which the Trust operate within the study area. However, with reference to the Woodland Trust – 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 (as shown on Figure 7.4.2), though it is not evident whether they serve as valuable areas of recreation and open space.

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.

In terms of use by the community, an area of non-Forest Service Broadleaf woodland at Middlebank is within the footprint of a planning application for development of a shared use greenway. Once developed, this alleged PROW will be part of a valuable community facility. 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.

7.6.5.8 Waterway Restoration Schemes

The Newry Ship Canal was originally completed in 1769, with Victoria Lock (three miles south of Newry) being subsequently completed in April 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 May 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.

7.6.6 Assessment of Environmental Impacts

7.6.6.1 Demolition of Private Property and associated Landtake

Considering the location of the study area within the southern urban fringe of Newry and surrounding hinterland, it is inevitable that there would be cases where properties would be affected in terms of demolition and associated landtake. As noted previously, to allow for a broad estimate of the potential demolition of property, a risk schedule (Table 7.30) has been prepared based on the number of properties that would be located within a 10m offset from the earthworks of an indicative alignment for the southern relief road within each of the corridors. It is these properties that would be at high risk of demolition.

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 horizontal or vertical geometry requirements.

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 the indicative alignments within the corridors 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. At this stage however, only a broad estimate of potential private land loss is given.

Table 7.30 Number of properties at risk of demolition and associated landtake for an indicative alignment within each Corridor

Corridor	Residential	Commercial (including Farms)	Other	TOTAL
Corridor 1	35	7	8	**50**
Corridor 2	10	1	2	**13**
Corridor 3	9	2	1	**12**
Corridor 4 (Option A)	7	2	-	**9**
Corridor 4 (Option B)	9	2	-	**11**
Corridor 5	12	2	1	**15**

Corridor 1

Within a 10m offset from the earthworks of an indicative alignment for the southern relief road within Corridor 1, it is estimated that at least 50 properties would be at risk of demolition and associated landtake. This by far, is the highest of any of the corridors under consideration.

The majority of properties affected are residential, with losses expected within Cole Court, Drumalane Road, Hillhead Road, Dublin Road, Flagstaff Road, Brogies Road and Upper Fathom Road.

The Newry Showgrounds would also be lost in its entirety to this indicative alignment, which would include the stadium (and associated infrastructure), back pitch, and a number of small 3G pitches. The majority of other properties affected are farm or domestic outbuildings (i.e. garages).

In terms of private land loss, the indicative alignment within Corridor 1 would also likely result in a comparatively high number of residential properties being at risk of losing private land. Again, this is reflective of the close proximity of the indicative alignment to the urban fringe of Newry, thus increasing the risk of direct impact. The indicative alignment would also result in private land loss from a number of commercial properties.

Corridor 2

Within a 10m offset from the earthworks of an indicative alignment for the southern relief road within Corridor 2, it is estimated that at least 13 properties would be at risk of demolition and associated landtake. The majority of properties affected are residential, with losses expected on the old Warrenpoint Road, Fathom Line, Hillhead Road and Dublin Road.

In terms of other notable demolitions, this indicative alignment would result in the loss of Cloghogue Pitch & Putt course (including associated infrastructure (i.e. Club House)). The majority of other properties affected are domestic outbuildings (i.e. garages).

In terms of private land loss, the indicative alignment within Corridor 2 would also result in a comparatively high number of residential properties being at risk of losing private land. Again, this is reflective of the close proximity of the indicative alignment to the urban fringe of Newry (particularly in the vicinity of A28 Dublin Road, Hillhead Road and Flagstaff Road), thus increasing the risk of direct impact.

Corridor 3

Within a 10m offset from the earthworks of an indicative alignment for the southern relief road within Corridor 3, it is estimated that at least 12 properties would be at risk of demolition and associated landtake. The majority of properties affected are residential, with losses expected on the Aghnamoira Road, Fathom Line, Barracric Road, Dublin Road, Ellisholding Road and Upper Fathom Road. A number of farm outbuildings would also be affected.

In terms of private land loss, the indicative alignment within Corridor 3 would result in a comparatively low number of residential properties being at risk of losing private land, as its alignment is more rurally located. The majority of private land loss expected with this corridor is at the tie-in with Ellisholding Junction.

Corridor 4

Option A

Within a 10m offset from the earthworks of an indicative alignment for the southern relief road within Corridor 4 (Option A), it is estimated that at least 9 properties would be at risk of demolition and associated landtake. This is the lowest of any of the corridors under consideration. The majority of properties affected are residential, with losses expected on the Barracric Road, Dublin Road, Ellisholding Road and Upper Fathom Road. A number of farm outbuildings would also be affected.

Option B

The properties at risk of demolition with the indicative alignment for Option B, would be the same as Option A, except that it would also potentially affect two additional residential properties on the Fathom Line.

In terms of private land loss, the indicative alignments within Corridor 4 would result in the least amount of private land loss overall. This is a result of its rural location, though losses would be expected in the vicinity of Ellisholding Junction.

Corridor 5

Within a 10m offset from the earthworks of an indicative alignment for the southern relief road within Corridor 5, it is estimated that at least 15 properties would be at risk of demolition and associated landtake. The majority of properties affected are residential, with losses expected on the Fathom Line, Upper Fathom Road, Dublin Road and Ellisholding Road.

In terms of other notable demolitions, this indicative alignment may result in the loss of Gerry Brown Park (Newry Mitchels GFC ground) and/or potentially Newry Building Supplies (depending upon how crucial the land expected to be lost from the business is to its continued operation at this site).

In terms of private land loss, the indicative alignment within Corridor 5 would result in notable potential losses of private land from Kehoe Kars, Gerry Brown Park and Newry Building Supplies, which as detailed above could potentially result in demolitions. Losses are also expected in the vicinity of Ellisholding Junction.

7.6.6.2 Potential Effect on Planning Applications

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. As noted previously, to allow for a broad estimate of the number of planning applications potentially affected, a risk schedule (Table 7.31) has been prepared based on the number of applications that would be located within a 10m offset from the earthworks of an indicative alignment for the southern relief road within each of the corridors. It is these applications that would be at high risk of being lost to the scheme.

As this assessment has been based on indicative alignments, it should be noted that the final number of applications affected will change as the scheme is developed, due to construction of applications, new planning applications, and expiry of existing applications. Not all specific footprints and site layouts of planning applications are currently known, and as such in some cases, an accurate estimate of the impact cannot be given. Some of these applications may be under construction or already built at the time of assessment.

Table 7.31 Number of planning applications affected for an indicative alignment within each Corridor

Corridor	No. of Planning Applications	Full		Outline		Other
		Approved	Pending	Approved	Pending	Listed Building Consent
Corridor 1	7	3	1	3	-	-
Corridor 2	4	1	1	1	-	1
Corridor 3	3	2	-	1	-	-
Corridor 4 (Option A)	4	3	-	1	-	-
Corridor 4 (Option B)	4	2	1	1	-	-
Corridor 5	4	3	-	1	-	-

As shown on Figure 7.6.1, most applications have been submitted in areas where the existing terrain is conducive to development (i.e. in the vicinity of the old Warrenpoint Road, Greenbank Industrial Estate, B79 Fathom Line, Flagstaff Road and the A28 Dublin Road). This is essentially all the locations which are currently developed within the study area, and as such, an indicative alignment within Corridor 1 would affect the highest number of applications. There is little to separate the indicative alignments within the other corridors in terms of impact upon planning applications.

The type of planning applications that are at risk of being directly affected by the indicative alignments within the corridor options typically include:

- Sites for new dwellings;
- Sites for replacement dwellings;
- Improvements to existing dwellings; and
- Provision of a greenway between Victoria Lock and Albert Basin.

7.6.6.3 Potential Loss of Development Land

Corridor 1

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 7.6.2), the indicative alignment within Corridor 1 would be within the settlement development limit of Newry from its tie-in with the A2 dual carriageway through to the Hillhead Road at Drumalane. It would also encroach into the settlement development limit to the east of Cloghogue Heights and at the Flagstaff Road.

Also from the tie-in with the A2, to the eastern bank of the Newry River, the indicative alignment within Corridor 1 would directly affect and sever a major area of existing open space associated with the Newry Showgrounds. The alignment would also border but not encroach into an existing area of economic development immediately to the south, associated with Greenbank Industrial Estate.

At the crossing of the Newry River and Canal, the bridge structure associated with this indicative alignment 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 western bank of the Newry Canal, the bridge structure associated with the indicative alignment would also directly affect two adjoining areas of land zoned for housing (Zoning NY 43 Drumalane Road / Fathom Line, and Zoning NY 59 Drumalane Road East). Although the bridge structure would not technically result in severance of each zoned area, the dominance by this large-scale physical infrastructure feature may have a significant impact upon the development potential of the underlying and adjacent land.

On the approach to Ellisholding, the indicative alignment would pass in close proximity to Cloghogue SLNCI, however is unlikely to result in any direct physical encroachment.

Corridor 2

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 7.6.2), the indicative alignment within Corridor 2 would briefly encroach into the settlement development limit of Newry at its tie-in with the A2 dual carriageway (at Forest Hills) before crossing the broad mudflats associated with the transitional reach of the Newry River. It would then re-enter the settlement development limit in the vicinity of its tie-in with the A28 Dublin Road.

The tie-in with the A2 Warrenpoint Road dual carriageway (roundabout and earthworks) would encroach into Maginnis Villas SLNCI, resulting in the loss of some woodland from this site, however would not result in severance.

At the crossing of the Newry River and Canal, the bridge structure associated with this indicative alignment 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 western valley side, the indicative alignment would encroach into Fathom Lower Woods and Grasslands SLNCI. The SLNCI zonation covers three separate parcels on the western side of the Newry River valley, with this indicative alignment affecting the most northerly of the three. Whilst there would be no severance from the northerly parcel, it would result in the loss of over half of this 26-hectare site.

On the approach to its tie-in with the A28 Dublin Road, the indicative alignment would encroach into and sever Dublin Road LLPA (NY 135), which covers much of Cloghogue Pitch & Putt Course. This would result in significant losses from this zoned area and a significant impact upon its setting and amenity value.

Corridor 3

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 7.6.2), the indicative alignment within Corridor 3 would not encroach into the settlement development limit of Newry.

From its tie-in with the A2 Warrenpoint Road dual carriageway through to the bridging point across the Newry River valley, the indicative alignment would encroach into and sever Warrenpoint Road / Greenan Road LLPA (NY 136) and Maginnis Villas SLNCI. This would result in significant losses from these zoned areas and a significant impact upon their setting and amenity value.

The bridge crossing (where it meets the western valley side) would marginally encroach into the most southerly of the three parcels associated with Fathom Lower Woods & Grasslands SLNCI. On the climb up the western valley side, it would also encroach into the central parcel of this SLNCI, though would not result in any severance.

Corridor 4

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 7.6.2), the indicative alignment within Corridor 4 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 indicative alignment within this corridor would marginally encroach into Narrow Water Forest SLNCI, but would cause no severance.

On the lower slopes of Fathom Mountain, the indicative alignment within this corridor 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 setting and amenity value.

Corridor 5

With reference to the Banbridge / Newry & Mourne Area Plan 2015 (and Figure 7.6.2), the indicative alignment within Corridor 5 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 an existing area of economic development (associated with Newry Building Supplies) and a major area of existing open space (associated with Gerry Brown Park), though would not result in severance.

At the crossing of the Newry River and Canal, the bridge structure associated with this indicative alignment 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, the indicative alignment would marginally encroach into the most northerly of the three parcels associated with Fathom Lower Woods & Grasslands SLNCI, and encroach into and sever the central parcel of this SLNCI.

7.6.6.4 Potential Loss of Agricultural Land

As with any proposed major road scheme, agricultural land will 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. At this stage in the assessment procedure, it is too early to determine how many individual farm units would be severed as a result of the scheme. For any of the corridors, it could reasonably be anticipated that farm units would be impacted, having a subsequent knock-on effect on their overall farm operations. However, this will not become evident until the preferred corridor has been selected and a land registry search has been undertaken.

In terms of land currently in agricultural usage that would be lost to the scheme, there is very little to differentiate between corridors under consideration. A broad estimate of the length of each indicative alignment that would affect land currently in agricultural usage is provided below:

- Corridor 1 – 1.7km;
- Corridor 2 – 1.4km;
- Corridor 3 – 1.8km;
- Corridor 4 – 1.8km; and
- Corridor 5 – 1.9km.

As expected, the corridors located closer to the urban fringe of Newry would minimise the length/amount of agricultural land lost to the scheme, but not by a significant margin. Whilst it would naturally be expected that the more rural corridors would have the greater impact upon agricultural land, the losses are not as high as expected due to the influence of forestry activities within the study area (as discussed below).

7.6.6.5 Potential Loss of Forestry and Non-Forestry Woodland

As noted previously, DAERA – Forest Service provided information and maps showing woodland type, ownership, number of blocks and total acreage for each corridor. Table 7.32 below shows hectares (ha), number of blocks and woodland type for Forest Service managed land affected by each corridor option.

Table 7.32 Forest Service woodland area and number of blocks per corridor options

Corridor Option	Conifer		Broadleaf		Mixed		Total	
	ha	Blocks	ha	Blocks	ha	Blocks	ha	Blocks
Corridor 1	-	-	-	-	-	-	-	-
Corridor 2	-	-	-	-	-	-	-	-
Corridor 3	8.9	1	0.4	1	3	1	12.3	3
Corridor 4	86.7	24	14.3	20	31.5	18	132.5	62
Corridor 5	-	-	-	-	-	-	-	-

Source: DAERA – Forest Service

As evident from Table 7.32, Corridor 4 has the greatest potential to result in losses from Forest Service Woodland, within approximately 132.5ha of woodland falling within the corridor. Corridor 3 has the second highest potential, with the remaining corridor options having no potential for loss.

Table 7.33 below shows hectares (ha), number of blocks and woodland type for Non-Forest Service managed land affected by each corridor option.

Table 7.33 Non-Forest Service woodland area and number of blocks by corridor options

Corridor Option	Conifer		Broadleaf		Mixed		Unknown		Total	
	ha	Blocks	ha	Blocks	ha	Blocks	ha	Blocks	ha	Blocks
Corridor 1	0.2	1	0.35	2	-	-	0.15	1	0.7	4
Corridor 2	0.1	1	6.5	8	2.4	1	4.4	6	13.4	16
Corridor 3	1.2	3	17	12	2	1	8.7	9	28.9	25
Corridor 4	1.7	4	6.7	10	3.7	4	4.8	5	16.9	23
Corridor 5	0.6	2	4.8	7	2.4	1	3.5	5	11.3	15

Source: DAERA – Forest Service

As evident from Table 7.33, Corridor 3 has the greatest potential to result in losses from Non-Forest Service Woodland, with approximately 28.9ha of woodland falling within the corridor. All corridor options have the potential to result in losses, with little difference between Corridors 2, 4 and 5. Corridor 1 however would minimise the risk of loss from such woodland, within only 0.7ha falling within the corridor.

DAERA – Forest Service also provided information regarding Northern Ireland Ancient woodland inventory types present in the study area, which includes:

- Long-established Woodland (planted broadleaf);
- Long-established Woodland (planted conifer); and
- Long-established (Mixed).

Long-established woodland is defined as woodland which has been continuously wooded since the First Edition 6" to the mile OS maps were produced in 1830-44, but which cannot be proven to be ancient. Table 7.34 below shows the breakdown of ancient woodland inventory woodland type in Forest Service forests (as recorded in the NI Ancient Woodland Inventory) by area and number of blocks with Ancient Woodland features for each corridor option.

Table 7.34 Ancient Woodland features on Forest Service land

Corridor Option	Long-established	
	ha	Blocks
Corridor 1	-	-
Corridor 2	-	-
Corridor 3	5.3	2
Corridor 4	144.4	9
Corridor 5	0.6	1

Source: DAERA – Forest Service

As evident from Table 7.34, Corridor 4 has the greatest potential to result in losses of long-established woodland on Forest Service land, with approximately 144.4ha of woodland falling within the corridor. Corridor 3 has the second highest potential, followed by Corridor 5, with the remaining corridor options having no potential for such loss.

7.6.6.6 Potential Loss of Community Land (Recreation and Open Space)

Community Land

With reference to the Area Plan and as shown on Figure 7.6.2, 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).

As noted previously, from the tie-in with the A2, to the eastern bank of the Newry River, the indicative alignment within Corridor 1 would directly affect and sever the major area of existing open space associated with the Newry Showgrounds, resulting in its loss.

Between its tie-in with the A2 dual carriageway and the eastern bank of the Newry River, Corridor 5 would encroach into a major area of existing open space (associated with Gerry Brown Park), though would not result in severance. Whether this area would ultimately be lost to the scheme, should Corridor 5 be preferred, would be established through more detailed design and consultation with affected parties.

Although not designated as a major area of existing open space, it is worth noting again that Corridor 2 would result in the complete loss of the Cloghogue Pitch & Putt Course, which was founded in 1967. This would include the loss of the 18-hole course and clubhouse facilities. The impact of the loss of this facility would be significant.

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 7.4.2). It is not however evident whether they 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, even though it is not open to public access. The consultation with DAERA – Forest Service also provided information on Long-established woodland (as detailed in sub-section 7.6.6.5); however, this was limited to where such features occur on Forest Service land. As shown on Figure 7.4.2 and described below, there are parcels of long-established woodland outwith Forest Service land and potentially affected by the scheme.

Of all the corridors under consideration, the indicative alignment within Corridor 4 would have the greatest impact upon community woodland. Further to the impacts described above under the potential loss of forestry land, it would also affect parcels of long-established and possibly ancient woodland within Fathom Lower Woods & Grasslands SLNCI, resulting in severance of the latter.

The indicative alignment within Corridor 3 would affect parcels of long-established and possibly ancient woodland within Maginnis Villas SLNCI; though would cause no severance.

On the climb up the western valley side, the indicative alignment within Corridor 5 would marginally encroach into two parcels of long-established woodland associated with Fathom Lower Woods & Grasslands SLNCI, severing the latter parcel.

7.6.6.7 Effects on restoration proposals for abandoned waterways

The Newry Ship Canal would be crossed by all Corridors (except Corridor 4 (Option B), which instead would cross the navigational channel of the Newry River). The impact of each corridor 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 has advised that a bridge deck with a canal clearance of at least 35m, such as Corridor 3, 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 17m associated with Corridor 1 and approximately 9m associated with Corridors 2 and 5 would provide enough air draft for the ship canal to remain passable for the majority of vessels using it regularly. Conversely, a bridge deck with canal clearance of approximately 6m associated with Corridor 4 would limit the number and type of vessels on the canal. Nevertheless, should Corridors 1, 2, 4 or 5 be selected as the preferred corridor, a bascule bridge could be incorporated into the design to negate any restriction on passage along the ship canal.

7.6.6.8 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.

7.6.7 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 corridor. 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).

7.6.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Land Use perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.35.

- Corridor 1 has the highest number of potential property demolitions. Conversely, property loss would likely be lowest with Corridor 4, Option A;
- Corridor 1 would affect the highest number of Planning Applications, with seven. Corridor 3 has the least impact in terms of planning applications, with three applications likely to be affected;
- Corridor 4 would affect the least amount of development land, as designated in the Banbridge / Newry & Mourne Area Plan 2015;
- At this early stage, it can be confidently assumed that from an agricultural perspective, Corridor 2 would have the least impact on agricultural land. Corridor 4 would likely have the highest impact on agricultural land, due to its length through a rural area;
- Neither Corridors 3 nor 4 affect any designated Community areas or facilities; however, Corridor 4 may affect publically accessible woodland at Fathom Forest;
- Corridor 4 would have by far the greatest impact on Forest Service woodlands and long-established/ancient woodland;

- Corridor 3 would potentially impact the greatest amount of non-forest service woodland, followed by corridors 4 and 2;
- Corridor 1 is likely to have the most detrimental effect, from a Community perspective impacting on a 'Major Area of Existing Open Space', identified in the Banbridge / Newry & Mourne Area Plan 2015. This includes stadium infrastructure, main pitch and a training pitch at Newry Showgrounds;
- The Newry Ship Canal would be crossed by all Corridors (except Corridor 4, Option B). Corridor 3 would provide sufficient air draft for the Newry Ship Canal to remain passable for all vessels potentially using it, and all other corridors would incorporate a bascule bridge over the canal, to negate any restriction on passage along the ship canal; and
- On balance overall, in light of a range of constraints, Corridor 5 can be considered to have the least impact in terms of integration with the existing land use environment although other corridors may have performed better in individual elements of assessment.

Table 7.35 Land Use Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment				Assessment
Corridor 1	The number of properties at risk of demolition would be the highest of any of the corridors, which includes the loss of Newry Showgrounds. A comparatively high number of properties would also be at risk of losing private land. Would directly affect at least 7 planning applications. Would be partially within the Settlement Development Limit of Newry affecting and severing a major area of existing open space. Would directly affect the Newry Canal/River LLPA. Would directly affect two adjoining areas of land zoned for housing (Zoning NY 43 Drumalane Road / Fathom Line, and Zoning NY 59 Drumalane Road East). Would result in the linear loss of approximately 1.7km of agricultural land.	Number of properties at risk of demolition and associated landtake.				Large Adverse
		Residential	Commercial (including Farms)	Other	TOTAL	
		35	7	8	50	
Corridor 2	13 properties would be at risk of demolition and associated landtake, which includes the loss of Cloghogue Pitch & Putt. A comparatively high number of properties would also be at risk of losing private land. Would directly affect at least 4 planning applications. Would be partially within the Settlement Development Limit of Newry. Would directly affect the Newry Canal/River LLPA and Dublin Road LLPA. Would directly affect Maginnis Villas SLNCI and Fathom Lower Woods and Grasslands SLNCI. Would result in the linear loss of approximately 1.4km of agricultural land.	Number of properties at risk of demolition and associated landtake				Moderate Adverse
		Residential	Commercial (including Farms)	Other	TOTAL	
		10	1	2	13	
Corridor 3	12 properties would be at risk of demolition and associated landtake. A comparatively low number of properties would also be at risk of losing private land. Would directly affect at least 3 planning applications. Would not affect the Settlement Development Limit of Newry. Would directly affect Warrenpoint Road / Greenan Road LLPA, Maginnis Villas SLNCI and Fathom Lower Woods and Grasslands SLNCI, including affecting parcels of long-established and possibly ancient woodland. Would result in the linear loss of approximately 1.8km of agricultural land.	Number of properties at risk of demolition and associated landtake				Moderate Adverse
		Residential	Commercial (including Farms)	Other	TOTAL	
		9	2	1	12	
Corridor 4 Option A	9 properties would be at risk of demolition and associated landtake. Would result in the least number of properties at risk of losing private land. Would directly affect at	Number of properties at risk of demolition and associated landtake				Large Adverse

Corridor	Qualitative Impacts	Quantitative Assessment				Assessment
	least 4 planning applications. Would not affect the Settlement Development Limit of Newry. Would directly affect Narrow Water Forest SLNCI and Fathom Lower Woods & Grasslands SLNCI, including affecting parcels of long-established and possibly ancient woodland. Would result in the linear loss of approximately 1.8km of agricultural land. Of all the corridors under consideration, only Corridor 4 would result in the loss of land from any DAERA – Forest Service plantation woodlands.	Residential	Commercial (including Farms)	Other	TOTAL	
		7	2	0	9	
Corridor 4 Option B	11 properties would be at risk of demolition and associated landtake. Would result in the least number of properties at risk of losing private land. Would directly affect at least 4 planning applications. Would not affect the Settlement Development Limit of Newry. Would directly affect Narrow Water Forest SLNCI and Fathom Lower Woods & Grasslands SLNCI, including affecting parcels of long-established and possibly ancient woodland. Would result in the linear loss of approximately 1.8km of agricultural land. Of all the corridors under consideration, only Corridor 4 would result in the loss of land from any DAERA – Forest Service plantation woodlands.	Number of properties at risk of demolition and associated landtake				Large Adverse
		Residential	Commercial (including Farms)	Other	TOTAL	
		9	2	0	11	
Corridor 5	15 properties would be at risk of demolition and associated landtake, which includes the potential losses of Gerry Brown Park (Newry Mitchels GFC ground) and/or potentially Newry Building Supplies. Kehoe Kars may also be subject to private land loss. Would directly affect at least 4 planning applications. Would be partially within the Settlement Development Limit of Newry affecting an existing area of economic development and a major area of existing open space. Would directly affect the Newry Canal/River LLPA and Fathom Lower Woods & Grasslands SLNCI (including the loss of long-established woodland). Would result in the linear loss of approximately 1.9km of agricultural land.	Number of properties at risk of demolition and associated landtake				Moderate Adverse
		Residential	Commercial (including Farms)	Other	TOTAL	
		12	2	1	15	

7.7 Noise and Vibration

7.7.1 Introduction

Traffic noise is a general term used to define the noise from traffic using the road network. A traffic stream is made up of a variety of vehicle types which have their own individual noise sources. Close to a road, individual vehicles can be distinguished in the traffic stream, but further from the road, the influence of individual vehicles is less noticeable as the noise from traffic becomes a continuous drone.

The sources of noise from traffic can be separated into two components. The first is generated by the engine, exhaust and transmission systems of vehicles, and is the dominant source when traffic is not freely flowing or in a low gear, particularly from heavy vehicles which contribute a significant proportion of low frequency noise. Engine and exhaust noise levels are closely related to engine speed, and transmission noise depends more on the relationship between road speed and engine speed than on 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 (especially in wet weather). Tyre noise levels depend on the tyre characteristics and the road surface roughness, but always increase with vehicle speed in this speed range.

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 main factors which influence a basic traffic noise level are traffic flow, speed, composition (percentage Heavy Duty Vehicles (HDVs)), road gradient and road surface characteristics. At a distant reception point, the noise level is attenuated by a number of additional factors, including the distance from the noise source, the nature of the intervening ground surface, and the presence of obstructions.

A road project has the potential to cause both increases and decreases in traffic noise on an existing road by altering the traffic composition. In the case of a new road, for example this southern relief road, a completely new noise source can be created. The objective at this preliminary stage is therefore to undertake sufficient assessment to provide an appreciation of the likely noise and vibration consequences from traffic associated with the five broad corridors under consideration in order to identify a preferred corridor from a noise and vibration perspective. Furthermore, any corridor that could involve significant disruption due to the proximity to population centres, or the possible need for tunnelling, bridgeworks or other intrusive construction processes, should be identified.

7.7.2 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. The DMRB noise and vibration assessment procedure was revised in November 2011.

The procedure for assessing noise and vibration impacts is outlined in DMRB Volume 11, Section 3, Part 7, HD 213/11 (Noise and Vibration) Chapter 3. 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 three discrete levels of assessment; Scoping, Simple and Detailed.

The assessment approach has been designed to be proportionate, consequently the level of assessment will depend upon the potential for impacts to occur, and this will in turn depend upon the scale of the proposed road project, the site and local circumstances, and the location of sensitive receptors. This approach can be equally applied to all road projects, including new construction, improvement and maintenance.

This assessment approach however does not identify a specific methodology for undertaking a Stage 1 assessment of the advantages/disadvantages and constraints associated with the broadly defined improvement strategies. Accordingly, a methodology has been adapted from this and other relevant guidance, tailored to the characteristics of the project at this stage. It has been carried out to an appropriate level of detail, related specifically to the degree of environmental risk associated with each of the broad corridors under consideration. The steps taken include:

- undertaking consultation with key stakeholders, allowing them to register concerns and/or particular requirements during the period of data collection for this assessment;
- defining and characterising the study area, including:

  - identifying the start and end points of the physical works associated with each of the broadly defined corridors;
  - identifying the existing routes that are being bypassed or improved, and any broadly defined road corridors, between the start and end points; and
  - defining an appropriate study area from the broadly defined road corridors identified above.
- identifying any sensitive receptors within the study area, which include residential properties; community facilities (i.e. schools, hospitals, places of worship, public outdoor areas and sports facilities); public rights of way including footpaths, bridleways and byways; and designated sites, including: national parks, AONBs, SPAs, SACs, ASSIs and State Care/Scheduled Archaeological Monuments. If no sensitive receptors are identified, then further assessment would not normally be necessary. Based upon professional judgement, residential properties are generally ranked as 'high' sensitivity to noise and vibration impacts. Community facilities, public rights of way and designated sites are generally ranked as 'medium' sensitivity. Other land uses, such as industrial and commercial uses, are generally ranked as 'low' sensitivity;
- where relevant, estimating the number of sensitive receptors that would be subject to a new noise source. This has been undertaken by providing a 300-metre offset from the centreline of an indicative alignment of the southern relief road within each of the corridor. A count of the sensitive receptors was then made within 50-metre bands for the first 100 metres from the centreline, and within the next two 100-metre bands thereafter;
- identifying any other relevant local information, including information on the existing noise environment that would aid in the assessment of noise and vibration impacts and ultimately contribute to the selection of a preferred corridor.

As noted previously, the main factors influencing the noise level close to a road comprising freely flowing traffic is the traffic volume, speed and composition (% heavy vehicles), the road gradient and surface characteristics. In relation to the scheme:

- traffic volumes across all corridors would vary with proximity to the City, with the highest proportion of traffic transferring to the corridor closest to the City, and the least to the corridor option furthest from the City; and
- HDV proportion would be constant, irrespective of the corridor.

The requirement to determine whether a particular corridor would result in the exceedance of the threshold used for traffic noise assessment during the day (which is a permanent change in magnitude of 1 dB $L_{A10,18h}$ in the short-term (i.e. on opening) or a 3 dB $L_{A10,18h}$ change in the long-term (typically 15 years after project opening) is not critical to the assessment at this stage. The same is applicable to night-time noise assessments. It is fair to conclude that irrespective of which corridor is preferred, a 'Detailed' assessment would be required as the scheme design progresses, since all options involve introducing a new road into an environment where sensitive receptors are present, thus exceedances of the threshold would likely be experienced.

Consequently, what is more valuable to the assessment process, is the estimation of the number of receptors (i.e. residential) that would be in close proximity to an indicative alignment within the corridor options under consideration and thus potentially exposed to a new noise and vibration source, or a change to noise or vibration levels from an existing road source.

Considering the environment that would be affected by any of the corridors, particularly in terms of topography between the A2 Warrenpoint Road and A1 Dublin Road, road gradient is an important aspect worth considering in the assessment at this stage. There would be sections of road within each corridor that would be subject to a maximum 6% gradient in the vertical alignment (anything greater than this would require a departure from standard). This has obvious implications for increased noise from HDVs, as a result of lower gear selection along the steeper sections of road. Furthermore, the topography within the study area would require bridgeworks and a variation between extensive cuttings and embankments with each corridor, which can have either adverse or beneficial impacts from a noise perspective.

This information has allowed for a qualitative and semi-quantitative assessment of the broad corridors to be made from a traffic and road gradient perspective; however, any surface treatments (i.e. road surface finish, texture depth) have not been considered in the assessment.

There is no requirement to undertake monitoring of ambient noise levels within the study area at this stage.

7.7.3 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. The following table outlines the responses from the consultation from a noise and vibration perspective.

Table 7.36 Summary of formal consultation responses in relation to Noise and Vibration

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – Air and Environmental Quality Unit	22 July 2016 13 Oct 2016	16 Aug 2016 18 Nov 2016	Noise sensitive receptors and current ambient noise levels must be identified from a noise survey using L_{max}, L_{A10}, L_{A90} measurements. Increase in noise during construction must be considered using BS5228: Part 1: 2009 and BS4142:2014. District councils have power to control hours and methods of work. Noise maps for Northern Ireland are available on the Department's website: www.daera-ni.gov.uk. The second response stated that no further comments to the original response were applicable,
NMDDC – Enterprise, Regeneration & Tourism	22 July 2016 13 Oct 2016* 23 Nov 2016	17 Aug 2016	Traffic noise has potential to have a negative impact on residential amenity. A noise impact assessment and consideration of mitigation measures at the design stage should address this. Impact caused by noise should be minimised during construction.
NMDDC – Chief Executive	22 July 2016 13 Oct 2016	16 Nov 2016	Council support the scheme in principle. Noted that traffic noise has potential to have a negative impact on residential amenity, and recommend that a noise impact assessment and consideration of mitigation measures are undertaken.

**No response received in relation to the additional consultation regarding the developed corridor options. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.*

7.7.4 Regulatory & Policy Framework

In line with the requirements of the codified EIA Directive 2011/92/EU (as amended by Directive 2014/52/EU), reasonable alternatives must be studied by the Department for Infrastructure (DfI), which are relevant to the project and its specific characteristics, and an indication of the main reasons for selecting a chosen option, including a comparison of the environmental effects, in this case noise and vibration. This legislation provides the basis for the assessment process in the selection of a preferred corridor.

In addition, there are several pieces of legislation that provide the means to re-dress the adverse impacts of traffic noise and vibration resulting from the construction and use of new and improved roads on both land and people. These include:

- The Land Acquisition and Compensation (Northern Ireland) Order 1973;
- The Noise Insulation Regulations (Northern Ireland) 1995; and
- The Environmental Noise Regulations (Northern Ireland) 2006.

Generally, consideration of these statutory instruments does little to assist in the selection of a corridor at this stage. However, an awareness of the Environmental Noise Regulations (Northern Ireland) 2006 is important, as it implements the EU Environmental Noise Directive (END) (Directive 2002/49/EC) which relates to the assessment and management of environmental noise.

The aim of the END is to avoid, prevent or reduce on a prioritised basis, the harmful effects (including annoyance) due to exposure to environmental noise. It focuses on the impact of such noise on individuals, complementing existing EU legislation, which sets standards for noise emissions from specific sources.

On this basis, the selection of a corridor which at best attempts to avoid, prevent or reduce the harmful effects of noise would demonstrate conformance with the requirements of this Directive and its transposing legislation.

There are three main actions that the END requires of Member States; these are to:

- determine the noise exposure of the population through noise mapping;
- make information on environmental noise and its effects available to the public; and
- establish Action Plans based on the mapping results.

The END requires that noise mapping and action planning be completed every five years. From a roads perspective, the END requires that Action Plans be designed to manage noise issues and effects at places near Major Roads and at places near All Roads within Agglomerations, which includes:

- All Major Roads with more than 3 million vehicle passages per year; and
- All Agglomerations with more than 100,000 inhabitants.

7.7.4.1 Roads - Environmental Noise Directive Round Two - Noise Action Plan 2013 to 2018

This Final Roads Noise Action Plan describes how DfI, with the Department of Agriculture, Environment and Rural Affairs (DAERA), proposes to deliver their obligations under the END.

As noted within Section 3.2 (Current Environmental Noise Management) of this Action Plan, wherever possible, the environmental assessment of road schemes should aim to avoid or minimise adverse noise effects through taking a sustainable approach to scheme design by ensuring each scheme performs to an acceptable level across all of the Transport objectives. At an early stage in the design process, measures can be considered including:

- realigning the route away from residential areas or other sensitive areas;
- keeping the route low within the natural topography to exploit any natural screening;
- providing environmental barriers, such as earth mounding or acoustic fencing;
- using low noise surfacing to reduce noise at source.

The Roads Noise Action Plan has also identified Candidate Noise Management Areas (CNMAs), which are areas where it is most likely that the highest population exposures occur from a noise perspective within Northern Ireland.

Within these areas, a wide range of direct and indirect noise mitigation measures are available, which have been reviewed in detail with consideration of timescale of implementation, funding availability, and powers available to DfI. As a result, the CNMAs have been grouped on the following basis:

- potential mitigation to be implemented by DfI within the next five years (2013 to 2018), subject to the necessary funding being made available;
- potential mitigation to be considered by DfI within the following five years (2019 to 2024), subject to the necessary funding being made available; and
- potential mitigation outside the control of DfI.

7.7.4.2 Noise Policy Statement for Northern Ireland – September 2014

DAERA has the policy responsibility to manage environmental noise and recognises that effective noise management requires a coordinated and long-term approach that encompasses many aspects of modern society. Successfully managing noise can result in significant environmental and well-being benefits. In line with the DAERA's policy responsibilities, the following aims of the Noise Policy Statement for Northern Ireland (NPSNI) have been developed:

- Avoid or mitigate significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on heath and quality of life; and

- Where possible, contribute to the improvement of health and quality of life.

The NPSNI is relevant to most forms of noise, except workplace (occupational) noise and applies to environmental noise from transportation sources.

7.7.5 Baseline Environmental Conditions & Constraints

To characterise the existing environmental conditions within the study area from a noise perspective, reference has been made to the DAERA Noise Maps, which illustrate the modelling results for Major Roads likely to exceed the threshold as set out in the Environmental Noise Regulations (Northern Ireland) 2006. These Major Roads are trunk roads, motorways and classified roads with more than 3 million vehicle passages per year, and within the study area they include the:

- A1 Belfast/Dublin Dual Carriageway;
- A2 Warrenpoint Road Dual Carriageway;
- A2 Warrenpoint Road/Kilmorey Street (north of Greenbank Roundabout);
- A2 William Street/Abbey Way;
- A28 Bridge Street/Dublin Bridge;
- A28 Dublin Road; and
- B113 Forkhill Road.

The 2011 dB L_{day} noise levels (which is the annual average 12-hour daytime noise level between 07:00 and 19:00) for the modelled road network within the study area are illustrated on Plate 7.7.1.

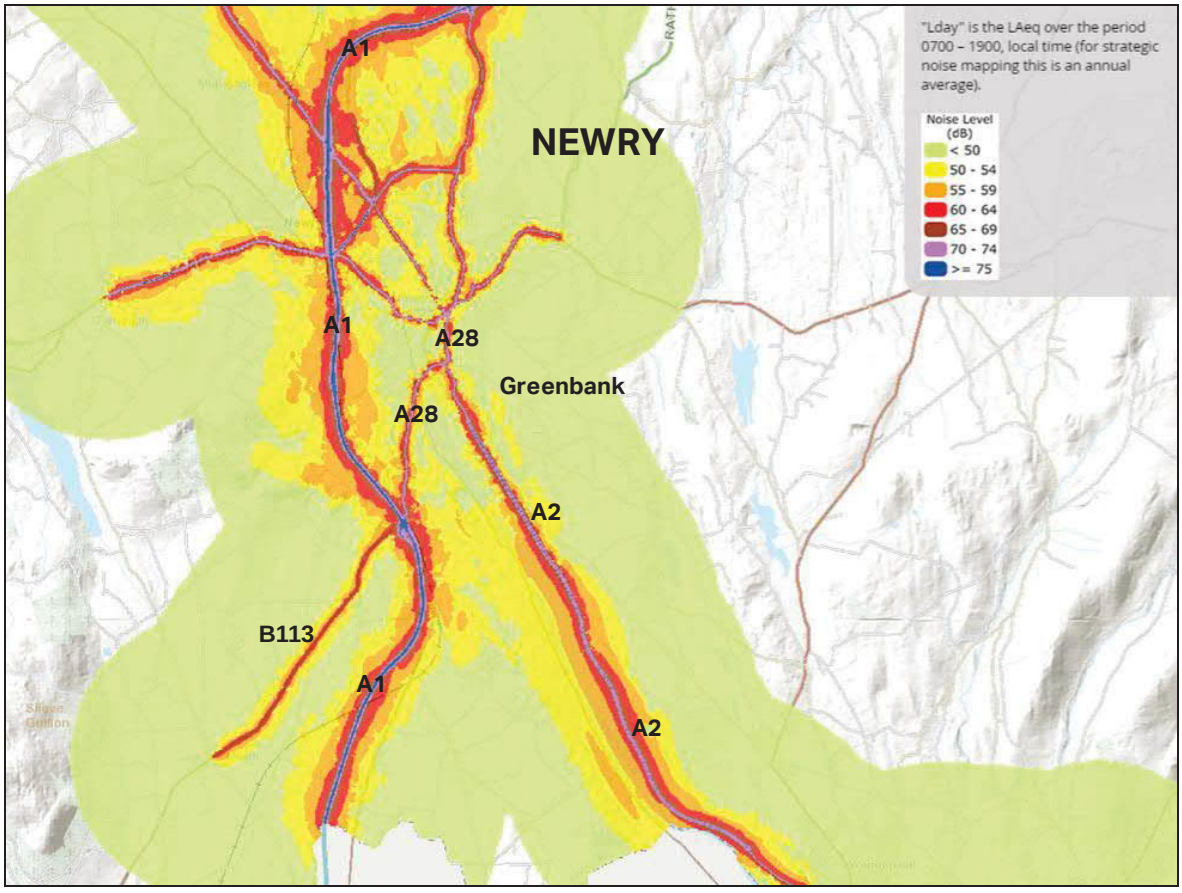

Plate 7.7.1: Modelled road network based on 2011 dB L_{day} noise levels (annual average 12-hr daytime noise level between 07:00 and 19:00).
Source: DAERA Noise Maps http://doeni.maps.arcgis.com/

From a review of the modelled network, it is evident that noise levels are much higher in close proximity to the road (as expected), and reduce with increasing distance from the source. It is reasonable to conclude that based on this data, a receptor in close proximity to the carriageway edge could be exposed to noise levels in excess of

70 dB as a result of existing strategic and local traffic movements. There is also a notable difference between the urban and rural elements of the study corridor, with the A1 and A2 (south of Greenbank) having a much wider sphere of influence on basic traffic noise level, than within the city. These two distinct areas would obviously be affected differently by the two different components of traffic noise, and within the city, by other notable sources of noise (i.e. commercial and industrial activities).

It is also evident that the differences between the natural and built environment within the study may have an influence on the existing noise environment; with the steeps sides of the Newry River valley seemingly forming a natural containment to the noise source, thus increasing the footprint along the valley floor where noise levels from traffic are higher. The broad mudflats in this area would also provide little natural attenuation. Within the City, the sphere of influence from traffic noise is much narrower, where it is likely that existing buildings provide a degree of acoustic attenuation and a street canyoning effect, thus reducing the exposure to basic traffic noise beyond the road corridor.

The existing route from the A2 Warrenpoint Road (through Newry) to the A1 at Cloghogue passes through a built-up urban area, and as expected, the number of properties (including sensitive receptors) within 300m of the existing route is high, especially within 50m of the roadside, where noise levels attributable to vehicular activity are greatest.

With reference to the 'Roads - Environmental Noise Directive Round Two - Noise Action Plan 2013 to 2018' (Amey 2013), there are no CNMAs designated within the study area, or in the Newry area in general.

7.7.6 Assessment of Environmental Impacts

The environmental effects (from a noise 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 noise levels;
- sensitive receptors along the existing route between the A2 Warrenpoint Road and the A28 Dublin Road at Cloghogue, which passes along the southern fringe of Newry City Centre, may experience very slightly reduced noise levels 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 noise levels, 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 region of 6-13% (corridor dependent) in the year of scheme Opening may be experienced on parts of the existing route. Nevertheless, as Newry acts as a local hub, it is inevitable that traffic will continue to be attracted to the City Centre which may continue to contribute to congestion, especially at peak times. Therefore, whilst the noise environment within the City will improve, the beneficial change is unlikely to be significant.

Overall, the introduction of a new Southern Relief Road route, across an area currently devoid of strategic traffic movements would likely result in an increase in noise levels above the threshold for traffic noise assessment in the vicinity of any of the Corridors under consideration. This would affect sensitive receptors, such as residential properties, as outlined above. The perceived or actual change in noise level is likely to be higher for those receptors closer to the more rural Corridor 3 and Corridor 4 (where background levels are likely to be lower). However, conversely, the number of receptors that would be exposed to this change would be lower than with the more urban Corridor 1 and Corridor 2 (as considered further below).

7.7.6.1 Sensitive Receptors

As noted previously, the existing route between the A2 and A1 along the southern fringe of Newry City Centre has a comparatively high number of sensitive receptors within 300 metres of the road, especially within the first 50 metres, where noise levels would be greatest.

In consideration of the potential to expose sensitive receptors to an exceedance of the threshold used for a traffic noise assessment, the number of high to low sensitivity receptors in close proximity to each corridor option has been estimated. This has been undertaken by providing a 300-metre offset from the centreline of an indicative alignment of the southern relief road within each corridor option.

It has also taken account of the multiple bridge crossing points (as is the case with Corridor 4). A count of the receptors was then made within 50-metre bands for the first 100 metres from the centreline and within the next

two 100-metre bands thereafter. The receptor counts have been summarised in Table 7.37 and must be taken as indicative only.

Table 7.37 Number of sensitive receptors within 300 metres of the centreline (not adjusted for potential property loss)

Corridor	Road Centreline – 50m	50-100m	100-200m	200-300m	Total
Corridor 1	58	43	161	282	544
Corridor 2	19	58	184	163	424
Corridor 3	16	10	29	78	133
Corridor 4 (Option A)	9	15	21	38	83
Corridor 4 (Option B)	12	16	21	32	81
Corridor 5	19	13	76	123	231

Corridor 1

There would be approximately 544 receptors within 300m of the indicative alignment within Corridor 1, with 58 of these being within the first 50m (the area where exposure to noise would be highest).

From east to west, these receptors are located on, or in the vicinity of, the old Warrenpoint Road, Toragh Park, Chapel Hill, Maple Grove, Cole Court, Flagstaff Court, Greenbank Industrial Estate, Quayside Close, Drumalane Road, Hillhead Road, Cloghogue Heights, Flagstaff Road, Brogies 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 receptors are high sensitivity residential properties.

As shown on Figure 7.8.1, there is one community facility within the first 50m; Newry Showgrounds. Between 50-100m is Pairc Esler, a private equestrian facility (Carlingford Horses) on Hillhead Road and Cloghogue Cemetery. Within 200m are Formula Karting, and Cloghogue Pitch & Putt. Within 300m is St Mary's Cemetery, and towards Cloghogue, a small area of the grounds of the Church of the Sacred Heart also falls within 300m.

Corridor 2

There would be approximately 424 receptors within 300m of the indicative alignment within Corridor 2, with 19 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, Forest Hills, Fathom Line, Hillhead Road, Cloghogue Heights, Kilvaragh, A28 Dublin Road and Chancellor's Road. The vast majority of these receptors are high sensitivity residential properties.

There are a number of community facilities within the first 50m (as shown on Figure 7.8.1), including the Church of the Sacred Heart and its Cemetery, and Cloghogue Pitch & Putt. There are no other known community facilities within 300m of the centreline.

Corridor 3

There would be approximately 133 receptors within 300m of the indicative alignment within Corridor 3, with 16 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, Aghnamoira Road, Forest Hills, Fathom Line, Flagstaff Road, Barracric Road, old Dublin Road and Ellisholding Junction. The

vast majority of these receptors are high sensitivity residential properties. There are no known community facilities within 300m of the centreline.

Corridor 4

Option A

There would be approximately 83 receptors within 300m of the indicative alignment within Corridor 4 tie-in Option A, with 9 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 receptors are high sensitivity residential properties. There are no known community facilities within 300m of the centreline.

Option B

There would be approximately 81 receptors within 300m of the indicative alignment within Corridor 4 tie-in Option B, with 12 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 receptors are high sensitivity residential properties. Victoria Lock Amenity Site is the only known community facility within 50m of the indicative centreline. There are no other known community facilities within 300m of the indicative centreline.

Corridor 5

There would be approximately 231 receptors within 300m of the indicative alignment within Corridor 5, with 19 of these located within the first 50m.

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 are a number of low sensitivity receptors located within Greenbank Industrial Estate, however the vast majority of receptors are high sensitivity residential properties.

There would be only one community facility within the first 50m of the centreline; Newry Mitchel's GAA ground at Gerry Brown Park, Greenbank Industrial Estate. The Funhouse children's play centre on Rampart Road is within 100m. There are no other known community facilities within 300m. These facilities are shown on Figure 7.8.1.

7.7.6.2 Other Sensitive Receptors

As noted previously, sensitive receptors also include public rights of way including footpaths, bridleways and byways; and designated sites, including: national parks, AONBs, SPAs, SACs, ASSIs and State Care/Scheduled Archaeological Monuments all of which are considered to be of medium to high sensitivity from a noise and vibration perspective.

Public Rights of Way

There are a number of Public Rights of Way (PROWs), and alleged PROWs within the study area, as shown on Figure 7.8.1. Three of these could be affected to some extent, depending upon corridor selection.

In terms of impacts, each of the five corridors would cross the alleged PROW along the Middlebank and thus result in a perceptible change to its noise environment. In terms of impacts at the Rampart alleged PROW, it would be within Corridors 1 and 5 only. In the case of the alleged PROW on a short laneway between Hillhead Road and Flagstaff Road, it would be within Corridors 1 and 2 only, though Corridor 5 would be located in close proximity to it.

With reference to Figure 7.8.1, the Ring of Gullion Way (part of the Ulster Way) would be partially within Corridors 1, 3, 4 and 5 adjacent to the Belfast/Dublin Railway line, and at the Dublin Road near the Ellisholding Junction. Corridor 2 would traverse it in the vicinity of its tie-in with the A28 Dublin Road. Considering the ambient noise environment in the area where it would be affected, there would be very little to differentiate in terms of impact between the corridors.

Designated Sites (National Parks, AONBs, SPAs, SACs, ASSIs)

There are three sites designated for either their ecological or earth science interest within the study area. These are:

- Carlingford Lough ASSI (directly traversed by the indicative alignments within Corridor 2, Corridor 3 and Corridor 4);
- Fathom Upper ASSI (within 165m of the indicative alignment through Corridor 4); and
- Carrivemaclone ASSI (within 110m of the indicative alignment through Corridor 2).

In terms of noise impacts, the magnitude of change experienced in Carlingford Lough ASSI with any of the corridor options is unlikely to be significant, as the DAERA modelled noise levels across the broad mudflats of the Newry River is already relatively high due to the limited attenuation of noise from the A2 and containment effects of the valley.

Fathom Upper ASSI however would experience an increase in its noise environment due to its location on the upper slopes of Fathom Mountain with Corridor 4, resulting in a perceptible change in the noise environment. The locations of these two sites are shown on Figure 7.4.2.

The noise impact upon Carrivemaclone ASSI (as shown on Figure 7.11.5) with Corridor 2 would be imperceptible as the site is located in immediate proximity to the A1 dual carriageway, which would remain the dominant source of traffic noise in this area post scheme implementation.

There are also two AONBs within the study area, as shown on Figure 7.5.1. These are:

- Ring of Gullion (directly affected by all corridor options to varying extents); and
- Mourne (directly affected by Corridor 4 only).

In terms of the direct impact upon the Ring of Gullion AONB and potential for change to its noise environment, Corridor 1, located closest to Newry would have the least impact, passing through the AONB for approximately 60% of its length. Corridor 2, Corridor 3 and Corridor 5 would have similar encroachment impacts, with approximately 80% of their length passing through the AONB.

Corridor 4 would pass through the Ring of Gullion AONB for the majority of its length. Where this corridor does not fall with this AONB, it falls within the Mourne AONB.

State Care/Scheduled Archaeological Monuments

In terms of State Care sites, the late medieval Narrow Water Castle (DOW051:044) is located on the south-eastern fringe of the study area. This is also a Grade A listed building (HB16/11/019A). Although Corridor 4 is in close proximity to it, it would not result in a perceptible change in the noise environment, as it would have no impact upon traffic movements in the vicinity of it or result in a change in distance from the predominant source of noise on the existing A2.

Within the study area, is the Newry Canal Scheduled Archaeological Monument and industrial heritage site. This feature would be crossed by each corridor, thus resulting in a perceptible change to its noise environment.

7.7.6.3 Road Gradient

As noted previously, in the case of this particular scheme, road gradient is an important aspect worth considering in the noise and vibration assessment, as there would be sections of road within each corridor subject to a maximum 6% gradient in the vertical alignment, as listed below:

- Corridor 1 : 1.7km at 6% gradient;
- Corridor 2: 1.1km at 6% gradient;
- Corridor 3: 1.3km at 6% gradient;
- Corridor 4:
  - Option A at 0.4km at 6% gradient;
  - Option B at 0.33km at 6% gradient; and
- Corridor 5: 1.4km at 6% gradient.

This has obvious implications for increased noise from HDVs, as a result of lower gear selection along the steeper sections of road travelling from the A2 Warrenpoint Road towards the A1 Dublin Road. The longer the length of road at this gradient: the higher the potential there is for adverse impacts upon the noise environment.

7.7.6.4 Earthworks

As noted previously, the variation in extensive cuttings and embankments with each corridor can have either adverse or beneficial impacts from a noise perspective.

At this early stage in the scheme assessment, no specific details of the construction works for any option are available. As bridge construction is required for each corridor, vibration effects may occur during works, such as impact piling. There is also the potential for noise effects at the closest receptors to the works, particularly if night-time works are required at any stage.

An increase in HDV and construction-related traffic would be expected during construction.

7.7.7 Mitigation & Enhancement Measures

With implementation of a southern relief road, properties along the existing route through Newry would experience slightly reduced noise levels due to removal of some of the through traffic. This in itself is a form of mitigation; however, there would be increased noise levels in the surrounding rural environment in proximity to the new road.

At a later stage in the assessment process, mitigation measures should be considered in areas where properties are likely to qualify under the Noise Insulation Regulations, and where significant increases in traffic noise levels, due to the operation of the scheme are predicted. If deemed necessary, through further detailed assessment, typical mitigating measures to reduce noise impacts at these adjacent properties may include low noise road surfacing for example.

7.7.8 Presentation of Key Issues

The key issues associated with the five broad corridors from Noise & Vibration perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.38.

- Properties adjacent to the relief road may experience increased noise levels, with any corridors under consideration.
- Properties along the existing route from the A2 Warrenpoint Road (through Newry) to the A1 at Cloghogue may experience slightly reduced noise levels with the removal of some of the through traffic.
- Properties adjacent to roads intersecting with the relief road may experience some minor changes in noise levels, depending on side-road realignment and traffic redistribution.
- In terms of sensitive receptors, Corridor 1 is likely to have the most receptors, both within 50m (the zone where noise levels would be greatest) and within 300m. These are primarily highly sensitive residential receptors. This is closely followed by Corridor 2.
- In terms of sensitive receptors, Corridor 4 is likely to have the least receptors.
- In terms of other sensitive receptors, Corridors 1, 2 and 5 would have the greatest effect upon the noise environment of PROWs within the study area. Corridor 4 would have the greatest effect upon designated sites. The impact upon State Care/Scheduled monuments would be similar with all corridors under consideration.
- In terms of road gradient, Corridor 1 would have the steepest gradient (6%), over the longest distance, followed by Corridor 5, then 3. The longer the length of road at this gradient: the higher the potential there is for adverse impacts upon the noise environment.
- All corridors will require a significant degree of earthworks (cutting and embankments) and bridge works. On this basis, the corridors located closest to the more populous part of Newry (i.e. Corridors 1 and 2) would be least preferred.
- Overall, the corridors located closer to the more populous part of Newry (i.e. Corridors 1 and 5) would be least preferred, whereas the corridors further away (i.e. Corridors 4, 2 and 3) would be preferable from a noise and vibration perspective. In this regard, Corridor 5 would be favoured as it would strike a balance between receptor exposure and traffic attraction to the southern relief road and off the city road network.

Table 7.38 Noise and Vibration Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment					Assessment
Corridor 1	Likely to have the most receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would have the greatest effect upon the noise environment of PROWs. Would have the steepest gradient (6%), over the longest distance. The longer the length of road at this gradient; the higher the potential there is for adverse noise impacts. Would require a significant degree of earthworks (cutting and embankments) and bridge works, thus its proximity to the more populous part of Newry would be least preferred.	Number of receptors within 300m of indicative alignment centrelines:					Neutral – Large Adverse
		Road Centreline – 50m	50-100m	100-200m	200-300m	Total	
		58	43	161	282	544	
Corridor 2	Would have the second highest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would have the greatest effect upon the noise environment of PROWs. Would require a significant degree of earthworks (cutting and embankments) and bridge works, thus its proximity to the more populous part of Newry would be least preferred.	Number of receptors within 300m of indicative alignment centrelines:					Slight Adverse – Large Adverse
		Road Centreline – 50m	50-100m	100-200m	200-300m	Total	
		19	58	184	163	424	
Corridor 3	Would have the second lowest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred.	Number of receptors within 300m of indicative alignment centrelines:					Slight to Moderate Adverse
		Road Centreline – 50m	50-100m	100-200m	200-300m	Total	
		16	10	29	78	133	
Corridor 4	Would have the lowest number of receptors, both within 50m, (the zone	Number of receptors within 300m of indicative alignment					Slight -

Corridor	Qualitative Impacts	Quantitative Assessment					Assessment
Option A	where noise levels would be greatest), and within 300m. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred. Would have the greatest effect upon designated ecological sites.	centrelines:					Moderate Adverse
		Road Centreline – 50m	50-100m	100-200m	200-300m	Total	
		9	15	21	38	83	
Corridor 4 Option B	Would have the lowest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred. Would have the greatest effect upon designated ecological sites.	Number of receptors within 300m of indicative alignment centrelines:					Slight - Moderate Adverse
		Road Centreline – 50m	50-100m	100-200m	200-300m	Total	
		12	16	21	32	81	
Corridor 5	Would have the third highest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would have the greatest effect upon the noise environment of PROWs. In terms of road gradient, steepest gradient (6%), over the second longest distance. The longer the length of road at this gradient; the higher the potential there is for adverse noise impacts. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred.	Number of receptors within 300m of indicative alignment centrelines:					Slight - Moderate Adverse
		Road Centreline – 50m	50-100m	100-200m	200-300m	Total	
		19	13	76	123	231	

7.8 Pedestrians, Cyclists, Equestrians & Community Effects

7.8.1 Introduction

This section considers the impact of the road scheme 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 scheme 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.

7.8.2 Methodology

The objective at this stage is to undertake sufficient assessment to provide an appreciation of the likely effects on pedestrians, cyclists and equestrians, and for people's ability to move around their local community and to identify the relevant constraints associated with the five broadly defined corridors 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 of existing and proposed routes, rights of way and important community facilities used by pedestrians and others which may be affected by the broadly defined corridors, with particular attention being paid to routes used by pedestrians and others for visiting important community facilities; and
- a broad assessment of whether pedestrians' and others' journeys would be lengthened or reduced by the various corridors, whether the amenity value of such journeys would increase or diminish, and whether some people would be deterred from making journeys which they currently make. Also, an assessment of whether their exposure to risk is likely to be made worse has been undertaken. It is not necessary to calculate increased journey times at this stage.

7.8.3 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 consultation in relation to Pedestrians, Cyclists, Equestrians, and Community effects

Table 7.39 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	22 July 2016 13 Oct 2016 23 Nov 2016	12 Aug 2016 07 Dec 2016	Concerned regarding volume of traffic (particularly from Warrenpoint Port) and its impact on health of residents in Newry. Amount of traffic should be reduced to help bottlenecks at Greenbank Roundabout. Concerned at potential impact of scheme on communities close to bridge. Recommend Corridor 3. Second response reiterated previous response. Feel that Corridors 1, 2 and 5 would have most impact on communities and would not benefit traffic congestion. Continue to feel that Corridor 3 would be the preferred corridor from their point of view.
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs	07 Sept 2016 08 Sept 2016 13 Oct 2016* 23 Nov 2016	09 Sept 2016	Holding letter response only.
DfC – Regional Development Office (Southern Team)	22 July 2016 13 Oct 2016	04 Aug 2016 18 Oct 2016	Both responses stated that the Southern Team had no relevant comments or information, and that the South Eastern RDO may be better placed to respond.
DfC – Regional Development Office (South Eastern Team)	29 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received.
DfI – Cycling Unit	22 July 2016 13 Oct 2016 23 Nov 2016	18 Aug 2016 29 Nov 2016	Project should incorporate opportunities to enable walking or cycling from one side of the road to the other and not create a barrier. There are plans and proposals for greenway schemes either side of the Newry River, which will be published shortly. Scheme provides opportunity to facilitate walking and cycling in attractive area and would benefit recreation, leisure and tourism. Scheme should incorporate a 3m segregated shared walking/cycling track. No corridor preference at this stage. Second response added no further comments, but stressed the importance of a walking/cycling link being provided on the selected corridor. Strategic Plan for Greenways (Exercise – Explore – Enjoy) has recently been published. Scheme should not act as a barrier to active travel.
DfI – Sustainable Transport Branch	29 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Down Gaelic Athletic Association (GAA)	29 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Education Authority – Southern Region	29 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	13 Sep 2016 09 Dec 2016	The Education Authority (EA) has estate interests in the study area but cannot assess the impact to their services at this early stage. Second response reiterated the first response. EA wish to be kept informed for subsequent stages of assessment.
Newry & District Anglers Association	22 July 2016 13 Oct 2016 23 Nov 2016	25 July 2016 24 Nov 2016	No concerns raised regarding angling/community usage. Concerned regarding potential pollution in the Omeath Road area, near Bensons Glen Fish Hatchery. Second response reiterated concerns re: water supply being affected to fish hatchery at Lower Fathom, Omeath Road.
Newry & Mourne Co-operative and Enterprise Agency	22 July 2016 13 Oct 2016* 23 Nov 2016	14 Sept 2016	NSRR would open up tourism potential in area. Do not feel Corridors 1 & 2 would gain public support due to impact on graveyard at Cloghogue and would cause undue controversy.
Newry City Athletic Football Club (AFC)	09 Sept 2016 13 Oct 2016 23 Nov 2016	-	No response received
Newry Coarse Fish Angling Club	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Newry Mitchels Gaelic Athletic Club (GAC)	09 Sept 2016 13 Oct 2016 23 Nov 2016	-	No response received
Newry Shamrocks GAC	09 Sept 2016 13 Oct 2016 23 Nov 2016	-	No response received
NI Greenways	29 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Mourne Heritage Trust	05 Sep 2016 13 Oct 2016 23 Nov 2016	29 Nov 2016	No comment to make at this stage.
PSNI -Traffic Management Unit	22 July 2016 31 Aug 2016 13 Oct 2016	04 Nov 2016	PSNI favour Corridors 2 and 3, due to equal priority to freight traffic from industrial estates, and local/tourist traffic wishing to bypass Newry. Minimal impact upon GAA grounds which attract large crowds, and cause parking issues.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Ring of Gullion Landscape Partnership	22 July 2016 13 Oct 2016* 23 Nov 2016	02 Sept 2016	Named a number of ongoing access projects: Middlebank Greenway; Victoria Locks to Flagstaff through Fathom Woods; Victoria Locks to Omeath Greenway; Ring of Gullion Way.
Southern Health & Social Care Trust	29 July 2016 31 Aug 2016 13 Oct 2016	07 Nov 2016	No specific comments.
Sustrans	22 July 2016 13 Oct 2016* 23 Nov 2016	10 Aug 2016	Ensure continuity with Newry / Carlingford / Dundalk cycle route. Concerned regarding the visual impact of bridge structure, and potential negative impacts on walkers and cyclists. Project offers opportunity to better connect into wider cycle network.
Tourism NI	29 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Translink – Infrastructure Division	22 July 2016 13 Oct 2016* 23 Nov 2016	09 Sept 2016	Reiterated response from Translink – Technical Support.
Translink – Service Delivery	22 July 2016 13 Oct 2016* 23 Nov 2016	26 July 2016	Corridors further from City Centre would be preferred to allow quicker access from buses to/from Newry. Translink would prefer Corridor 4.
Translink – Technical Support	22 July 2016 13 Oct 2016	08 Aug 2016 09 Nov 2016	Early engagement required to mitigate potential impacts to rail services. Impact on some bus services including Dublin Goldline Express and Bus Eireann Newry – Dundalk services. Second response indicated no further comments.
Ulster Angling Federation	22 July 2016 13 Oct 2016* 23 Nov 2016	15 Aug 2016	Represent sixty angling clubs in NI. No concerns raised regarding angling /community usage. Concerned regarding impact of all corridors on water quality of Newry River, habitat for Atlantic Salmon protected species. Enclosed pollution prevention policy document.

**No response received in relation to the additional consultation regarding the developed corridors. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.*

7.8.4 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.

7.8.4.1 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. It 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.

7.8.4.2 Planning Policy Statements

PPS 3: Access, Movement and Parking (February 2005)

This 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.

7.8.4.3 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 and 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.

7.8.4.4 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 and 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 area that would be affected by the Newry Southern Relief Road Scheme.

7.8.5 Baseline Environmental Conditions & Constraints

7.8.5.1 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.

7.8.5.2 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 corridor options study area), as shown on Figure 7.8.1. Those of particular note include:

- Our Mother of Mercy Nursing & Residential Home;
- Orana Family Support Centre;
- Newry Tennis Club;
- St Mary's High School;
- St Mary's Church & Cemetery;
- Conradh na Gaeilge (Irish Language Centre);
- Newry Bowling Club;
- Pairc Elser (home of Down GAA and Newry Shamrocks GAC);
- Newry Showgrounds (home of Newry City AFC);
- Formula Karting;
- 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;
- Newry Golf Inn & Driving Range;
- Rascals Soft Play Centre;
- Puzzles Childcare;
- Flagstaff Amenity Area; and
- Victoria Lock Amenity Site

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.

7.8.5.3 Public Transport Network

Public transport in and around Newry is facilitated by both rail and bus services.

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.

Newry Railway Station is located outwith the corridor 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 7.8.1. 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.

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, Carrivemaclone, Drumgullion, Bessbrook and Newry Railway Station;

- Local Ulsterbus Services with connections to Rathfriland, Kilkeel, Warrenpoint, Armagh, Bessbrook, Crossmaglen, Forkhill, Newtownhamilton, Portadown, Banbridge, Five Mile Hill and Acton Village;
- Local Bus Eireann Services with connections to Dundalk and Carlingford; and
- Inter-Urban/Cross-Border Services (Goldliner and Bus Eireann) with connections to Belfast (via Banbridge, Dromore and Sprucefield), 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:

- A28 Dublin Road;
- A2 Warrenpoint Road;
- B79 Fathom Line; and
- Old Warrenpoint Road.

In terms of school bus services, 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.

7.8.5.4 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 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 eastern 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, beginning in the centre of Newry (as shown on Figure 7.8.1). 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 7.8.1, there are at least three alleged PROWs located within the study area and one assured 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 assured 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 the Middlebank, which is a thin strip of land between the Newry Canal and Newry River. It is not easily accessible or extensively utilised by the general public at present; however, a planning application has been submitted (LA/2015/0319/F) along the alignment of this PROW for upgrade and improvement to the existing pathway, permission for which was granted in February 2016.This would provide improved access along the Middlebank and Albert Basin in Newry, from Dublin Road Bridge to Victoria Lock, with new pedestrian crossings at the existing weir and Victoria Lock gates. Once completed, the path will consist of approximately 5.4km of high quality off-road cycle and walking greenway. It will link with various tourist attractions including the Ring of Gullion Way and the Great Eastern Greenway, which is a new 10km walking/cycling route linking Carlingford and Omeath.

The third 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.

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.

7.8.5.5 Cycling Facilities

National Cycle Network (NCN) Route 99 is located within the study area (as shown on Figure 7.8.1), 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, planning permission was granted in February 2016 for upgrading and improvement of the existing pathway and improved access along the Middlebank and Albert Basin in Newry. In terms of cyclist provision, this scheme includes a shared use high quality off-road cycle and walking greenway of approx. 5.4km. It is envisaged that it 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, where the proposed new shared use greenway will end. 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 expressed a desire to ensure the continuity of the Newry / Carlingford / Dundalk cycle route, which follows the canal alignment. Sustrans is also proposing improving the existing cycling provision on the A2 to create a traffic-free, shared-use facility that could tie in to the existing segregated footway/cycleway route at River Street. Sustrans requested that this potential route be taken into account during the road scheme design. DfI - Cycling Unit also indicated during the consultation process that there are plans and proposals for greenway schemes either side of the Newry River, which will be published in the near future.

7.8.5.6 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 25 Hillhead Road (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.

7.8.5.7 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 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 Bensons Glen, adjacent to Fathom Line. The Association also controls the angling rights to 15 miles of river from Newry to just north of Rathfriland.

7.8.6 Assessment of Environmental Impacts

7.8.6.1 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 corridor 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.

Corridor 1

Corridor 1 runs south-west from the vicinity of Greenbank Roundabout on the A2 Warrenpoint Road towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor. The length of road construction required within Corridor 1 would be approximately 2.95km, with a possible at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and connecting into the existing grade-separated Ellisholding Junction in the west, providing free flow movement for strategic traffic. Ellisholding Junction would require upgrading of the various side roads surrounding the junction to accommodate the new tie-in; with two new south-facing slip roads constructed to make Ellisholding a full movement grade-separated junction (i.e. current layout provides a northbound on-slip merge towards Belfast and a southbound off-slip diverge towards Dundalk).

In terms of the local road network, aside from the tie-ins, Corridor 1 traverses two main roads (B79 Drumalane Road and old A1 Dublin Road) and four minor roads (Ballynacraig Way, Fathom Line, Hillhead Road and Flagstaff Road). It also crosses some minor accommodation and agricultural access lanes. It is envisaged that a number of minor side roads and accesses may be stopped-up or linked to nearby side road crossings to maintain continued access and/or through movements, though some re-construction may be expected.

It is anticipated that on the western side of the Newry Canal, Fathom Line and B79 Drumalane Road would not be affected as through routes by Corridor 1, as the Newry River/Canal crossing structure would pass overhead and would require minimal work to accommodate these roads. The Flagstaff Road would have to be carried over the new carriageway on a bridge structure as the new carriageway would be in cutting where this road is traversed. Other side roads/accommodation lanes would then be accessed either from B79 Drumalane Road/Fathom Line or Flagstaff Road. Due to the very close proximity of Ballynacraig Way to the tie-in with the A2 Warrenpoint Road, it is likely to require localised realignment to maintain at minimum, continued through movements.

Corridor 2

Corridor 2 runs north-west from the vicinity of A2 Warrenpoint Road/Old Warrenpoint Road junction towards the A28 Dublin Road. The length of road construction required within Corridor 2 would be approximately 2.55km, with a possible new at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and a new at-grade roundabout on the A28 Dublin Road heading towards Cloghogue Roundabout junction in the west, providing free-flow movement for strategic traffic.

Corridor 2 would likely tie into the A28 Dublin Road at a new roundabout to the north-east of Cloghogue Roundabout. It is not anticipated that a new junction is required to connect onto the A1/N1 Belfast-Dublin Corridor. The arrangement would involve tying into the A28 Dublin Road at its junction with Chancellors Road on the north-eastern side of the existing height-restricted railway bridge. Various local roads would require modification and upgrading surrounding the proposed junction to bring them up to standard. After travelling through the new roundabout on the A28 Dublin Road, traffic would continue on to the A1/N1 Belfast-Dublin Corridor via Cloghogue Roundabout junction.

In terms of the local road network, it may be possible to connect the Old Warrenpoint Road into the at-grade roundabout to improve connectivity and road safety by closing the existing dual carriageway gap junction, thus ceasing cross-carriageway manoeuvres. However, certain constraints may determine that tying this road into the proposed roundabout is impracticable and infeasible; therefore the junction may have to be stopped-up, which would have a notable adverse impact in terms of local vehicle movements between the residential areas south of Newry and Warrenpoint.

Aside from the tie-ins, Corridor 2 traverses one main road (B79 Fathom Line) and one minor road (Hillhead Road). It also crosses some minor accommodation and agricultural access lanes. It is envisaged that a number of minor side roads and accesses may be stopped-up or linked to nearby side road crossings to maintain continued access and through movements, though some re-construction may be expected.

It is anticipated that on the western side of the Newry Canal, the B79 Fathom Line would not be affected as a through route as the Newry River/Canal crossing structure would pass overhead and would require minimal work to accommodate this road.

The Hillhead Road would be severed, however it can currently only be accessed at its northern and southern extremities any way, as it is stopped-up to through movements due to ground instability associated with Drumalane Quarry. Other side roads/accommodation lanes would be accessed from the B79 Fathom Line, Flagstaff Road and the unaffected sections of Hillhead Road.

Corridor 3

Corridor 3 runs west from the vicinity of Aghnamoira Road on the A2 Warrenpoint Road towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor. The length of road construction required within Corridor 3 would be approximately 3.3km, with a possible at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and tying into the existing grade-separated Ellisholding Junction in the west (as described under Corridor 1), providing free-flow movement for strategic traffic.

In terms of the local road network, it may be possible to connect the Aghnamoira Road into the at-grade roundabout to improve connectivity and road safety by closing the existing gap junction on the dual carriageway, thus ceasing cross-carriageway manoeuvres. However, certain constraints may determine that tying this road into the proposed roundabout is impracticable and infeasible; therefore the junction may have to be stopped-up, which would have an adverse impact on local vehicle movements.

Aside from the tie-ins, Corridor 3 traverses three main roads (A2 Warrenpoint Road, B79 Fathom Line and the old A1 Dublin Road) and two minor side roads (Flagstaff Road and Barracric Road), and it also crosses some minor accommodation and agricultural access lanes. It is envisaged that a number of the minor side roads and accesses may be stopped-up or connected to nearby side road crossings, thus eliminating some structures. At side road crossings, some re-construction should be expected.

It is anticipated that on the either side of the Newry River/Canal, the A2 Warrenpoint Road and B79 Fathom Line would not be affected as through routes, as the Newry River/Canal crossing structure would pass overhead and would require minimal work to accommodate these roads. The Flagstaff Road would be carried over on a bridge structure as the new carriageway would be in cutting at the crossing point. 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.

Corridor 4

Corridor 4 (Option A) crosses the Newry River/Canal upstream of Victoria Lock and Corridor 4 (Option B) crosses the Newry River downstream of Victoria Lock at Rough Island. From this point, the corridor extends west towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor. The length of road construction required within Corridor 4 is approximately 3.75km for Option A and 5.3km for Option B. Option B would also require additional upgrading/widening of the B79 Fathom Line. Both alignments possibly require a new at-grade roundabout junction connecting to the A2 Warrenpoint Road, a new at-grade roundabout on B79 Fathom Line and connection into the existing grade-separated Ellisholding Junction on the A1/N1 Corridor. Providing a roundabout on the B79 Fathom Line would reduce the free-flow movement for strategic traffic, but provides an important link to the existing road network, which is of significant benefit to local vehicle movements. There is however little to differentiate between the two crossing points and respective at-grade tie-ins with the A2 Warrenpoint Road and B79 Fathom Line from a local vehicle movements perspective.

In terms of the local road network, aside from the tie-ins, Corridor 4 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 a number of the 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.

Corridor 5

Corridor 5 runs west from the vicinity of Greenbank Industrial Estate on the A2 Warrenpoint Road towards Ellisholding Junction on the A1/N1 Belfast-Dublin Corridor. The length of road construction required within Corridor 5 is approximately 2.6km, with a possible at-grade roundabout junction connecting to the A2 Warrenpoint Road in the east, and connecting into the existing grade-separated Ellisholding Junction in the west. Also, two new at-grade roundabout junctions 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.

In terms of local vehicle movements, the connection to the A2 Warrenpoint Road in the vicinity of Newry Building Supplies/Gerry Brown Park would allow for various tie-in options to be considered in the design process, though would require localised realignment of Ballynacraig Way to maintain at minimum continued through movements.

Aside from the tie-ins, the corridor crosses one main road (B79 Fathom Line) and one side road (Flagstaff Road), and connects to the old A1 Dublin Road. It also crosses some minor accommodation and agricultural access lanes. It is envisaged that a number of 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. It is expected that 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 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.

7.8.6.2 Community Facilities

The change in local vehicle movements described above largely addresses the issue of access, which is of relevance when considering the accessibility to community facilities throughout the study area. It is evident that from any of the corridor 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 Corridor 4 and Corridor 5 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's 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 7.8.1). 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 corridors 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.

Corridor 1

In terms of direct impacts, the indicative alignment within Corridor 1 would result in the complete loss of the Newry Showgrounds, which was opened in 1923 and is the current home of Newry City AFC. This would include the loss of the main stadium (including stands, turnstiles, floodlights, club rooms, changing rooms, etc.), training pitches and three synthetic mini-football pitches which are actively utilised by the local community. The impact of the loss of this facility would be significant.

The indicative alignment within the corridor would also be in close proximity to a number of community facilities such as Formula Karting and Pairc Esler, the latter of which is a GAA stadium and home of Down GAA and Newry Shamrocks GAC. By providing a new strategic connection between the A2 and A1, the corridor is likely to be of benefit to these facilities in terms of improved access (by avoiding the city centre). This is particularly relevant for Pairc Esler, which as noted in the consultation from PSNI -Traffic Management Unit, attracts large crowds, and causes parking issues. An alignment with this corridor would provide relief to the city centre by providing an alternative route, though its close proximity to the ground may still result in congestion issues, particularly for those travellers not attending matches (and would require further consideration).

The corridor crosses the Newry River and Ship Canal on its approach to B79 Fathom Line, the latter of which is frequently used by the community as a boating, angling and rowing facility. The bridge structure would provide a clearance of approximately 16.8m above the canal, thus would not limit or restrict the vast majority of boating, or rowing activities that take place. 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 entails a section of deck rotating vertically about a pivot mechanism, providing unrestricted clearance above the navigable channel when required.

The importance of the canal as a Scheduled Archaeological Monument would require that the bridge is clear-span with supports/abutments set back from the bank edge. This would therefore result in minimal direct impact upon any angling activities on this section of the canal.

Heading south-west towards the A1, the indicative alignment within the Corridor would sweep through open countryside and pass approximately 100m to the east of Cloghogue Pitch & Putt and the cemetery associated with the Church of the Sacred Heart. As the alignment would be in cutting at this point, impacts upon amenity would be minimal.

No other known community facilities would be directly or indirectly affected through to Ellisholding Junction.

Corridor 2

To the immediate east of the tie-in with the A2 Warrenpoint Road, Corridor 2 traverses a former grassed air strip which in the past has been utilised by microlight aircraft. It is understood that this was an informal and unlicensed landing strip and is no longer in use as such. On this basis, whilst Corridor 2 would not result in the loss of this facility, it would preclude the possibility of re-establishing it at this location.

Corridor 2 crosses the Newry River and Ship Canal on its approach to the B79 Fathom Line, providing approximately 9.1m 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 is also the requirement to provide a possible bascule section of bridge over the canal, providing 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 indicative alignment within Corridor 2 would pass within 20m of the cemetery associated with the Church of the Sacred Heart on embankment. This would obviously have significant amenity impacts upon the graveyard.

In terms of direct impacts, the indicative alignment within Corridor 2 would result in the complete loss of the Cloghogue Pitch & Putt, which was founded in 1967. This would include the loss of the 18-hole course and clubhouse facilities. The impact of the loss of this facility would be significant.

The indicative alignment within Corridor 2 would also pass within 40m of the Church of the Sacred Heart. Whilst the alignment would be within cutting, it is envisaged that amenity impacts would still be experienced.

No other known community facilities would be directly or indirectly affected through to the A28 Dublin Road.

Corridor 3

Corridor 3 would have similar impacts upon the former airstrip and Newry Ship Canal as described under Corridor 2, however it would not require a bascule section of bridge as it would be a high level crossing with a clearance of approximately 38.5m. On this basis, from a community usage of the canal perspective, it would be slightly preferred, as the crossing would be entirely unrestrictive in terms of boating, rowing or angling activities.

No other known community facilities would be directly or indirectly affected through to Ellisholding Junction.

Corridor 4

Corridor 4 (Option A) traverses the Newry Ship Canal by way of a low-level bridge crossing, with a clearance of approximately 5.9m. 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.

Corridor 4 (Option B) only traverses the transitional reach of the Newry River, as the low-level bridge crossing (with a clearance of approximately 7.5m) 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.

Corridor 4 (Option B) would however require partial realignment and upgrading of the B79 Fathom Line to improve the standard of the road. Whilst this would not have a direct impact upon Victoria Lock Amenity Site, it would be in very close proximity to it, thus having a detrimental impact upon amenity.

No other known community facilities would be directly or indirectly affected through to Ellisholding Junction.

Corridor 5

In terms of direct impacts, the indicative alignment within Corridor 5 would result in encroachment into 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. The preliminary design at this stage would indicate that the facility could be retained at this location, however when further consideration is given to, for example, maintaining access along Ballynacraig Way, there would be a risk that additional land from this facility may be required, putting at risk its current community usage. The impact of the loss of this facility would be significant, unless it can be accommodated or mitigated (i.e. at a viable alternative site).

Corridor 5 crosses the Newry River and Ship Canal on its approach to the B79 Fathom Line, providing approximately 9.3m 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 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.

No other known community facilities would be directly or indirectly affected through to Ellisholding Junction.

7.8.6.3 Public Transport Network.

Public Rail Services

Of all the corridor options under consideration, only Corridor 2 would not have a direct impact upon the Belfast – Dublin Railway line.

The remaining corridor options would require a new bridge crossing of the railway line just to the north of Ellisholding Junction, with Corridor 5 crossing on a straight alignment and the other corridors crossing on a skewed alignment. From a rail services perspective, it is unlikely that any of the corridor options would impinge on the usage of the line to any significant degree, with impacts being entirely limited to the construction phase (i.e. possible speed restrictions through the works area). At an advanced stage in the design, consultation will continue with Translink to mitigate any potential impacts.

Public Bus Services

As detailed in Sub-Section 7.8.5.3, 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 corridor 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; maybe even resulting in marginally shorter journey times for a number of services.

Consultation with Translink however indicated that from their perspective, Corridor 4 would be their preferred corridor, as they envisage it would allow traffic to divert to the southern relief road at the furthest point from the city centre, minimising the disruption to public transport services. Translink felt that this would result in a benefit overall to the community.

7.8.6.4 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 enhanced by the redistribution of a proportion of city through-traffic to any of the corridor options under consideration. In terms of traffic attraction, it is envisaged that a higher proportion of traffic would be redistributed to those corridor options which are located closer to the city (i.e. Corridors 1, 2 and 5), thus providing greater benefits to NMUs within the city centre than those corridor options located furthest from the city (i.e. Corridors 3 and 4).

Corridor 1

Corridor 1 traverses two alleged PROWs. The first is the Greenbank Trail, located on the Rampart adjacent to the Newry River on its eastern bank and the second is on Middlebank, on the thin strip of land between the Newry Canal and Newry River (which will soon be upgraded). Since Corridor 1 passes over these alleged PROWs at height as part of the bridge crossing of the river and canal, it would not directly affect them as walking through routes, however would have a localised detrimental impact upon amenity.

Corridor 1 traverses the Ring of Gullion Way at several locations, including on the Flagstaff Road, Brogies Road and on the old Dublin Road. It is envisaged that the walking route would be maintained as a through route for ramblers, however would be subject to significant modification in terms of visual presence of road structures (including bridges) and localised realignment. This would result in a significant change in the amenity on this rural section of the walking route.

Corridor 2

Corridor 2 traverses the alleged Middlebank PROW, however since it would pass over at height as part of the bridge crossing of the river and canal, it would not directly affect it as a walking through route, however would have a localised detrimental impact upon amenity.

Corridor 2 also traverses the alleged PROW which is on a short laneway between Hillhead Road and Flagstaff Road, south of Drumalane Quarry. However, as this road has been closed to through movements due to instability issues associated with the quarry, severance of the lane is unlikely to be an issue from a NMU or

amenity perspective. Severance of the lane may actually be of benefit, as it is evident that the general public have been ignoring the road closure notice, which has resulted in anti-social behaviour within the area.

Corridor 2 also affects the Ring of Gullion Waymarked Way at the tie-in with the A28 Dublin Road, however the impact of this is unlikely to be significant.

Corridor 3

Corridor 3 traverses the alleged Middlebank PROW, however since it would pass over at height as part of the bridge crossing of the river and canal, it would not directly affect it as a walking through route, however would have a localised detrimental impact upon amenity.

Corridor 3 traverses the Ring of Gullion Way on the old Dublin Road, at the tie-in with Ellisholding Junction. It is envisaged that the walking route would be maintained as a through route for ramblers and it is unlikely that the corridor would require a significant change to the existing road layout to accommodate these movements.

Corridor 4

Corridor 4 (Option A) affects the alleged Middlebank PROW, and whilst the low-level bridge crossing would not have a direct impact as a walking through route, it would have more of a localised detrimental impact upon amenity than the higher level crossings.

Whilst Corridor 4 (Option B) does not affect the alleged Middlebank PROW, it has the greatest potential to adversely affect the future development proposals to link the former Dundalk, Greenore and Newry Railway (i.e. the Great Eastern Greenway) with the Newry Canal (at Victoria Lock). This may be much more detrimental than the impacts that are expected with any of the other corridor options under consideration, other than the impacts on the established Ring of Gullion Waymarked Way with Corridor 1.

Corridor 4 (Option B) also affects a number of the paths which zig-zag through Fathom Forest at the foot of Fathom Mountain.

Corridor 4 traverses the Ring of Gullion Way on the old Dublin Road, at the tie-in with Ellisholding Junction. It is envisaged that the walking route would be maintained as a through route for ramblers and it is unlikely that the corridor would require a significant change to the existing road layout to accommodate these movements.

Corridor 5

Corridor 5 traverses two alleged PROWs. The first is the Greenbank Trail, located on the Rampart adjacent to the Newry River on its eastern bank and the second is on Middlebank, on the thin strip of land between the Newry Canal and Newry River (which will soon be upgraded). Since Corridor 5 passes over these alleged PROWs at height as part of the bridge crossing of the river and canal, it would not directly affect them as walking through routes, however would have a localised detrimental impact upon amenity.

Corridor 5 traverses the Ring of Gullion Way on the old Dublin Road, at the tie-in with Ellisholding Junction. It is envisaged that the walking route would be maintained as a through route for ramblers and it is unlikely that the corridor would require a significant change to the existing road layout to accommodate these movements.

7.8.6.5 Cycling Facilities

None of the corridor options under consideration would have a direct impact upon NCN Route 99, as it does not extend any further south than William Street.

In terms of local cycling routes, all corridor 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 corridor options at this stage. As noted in the consultation response received from DfI – 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 real risk of creating an obstacle that discourages active travel in the local area.

In terms of impact upon cyclists that utilise the Greenbank Trail (on the Rampart), Corridors 1 and 5 would be preferred as their tie-in with the A2 would not directly affect movements along this route between Newry and Warrenpoint. These corridor 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.

Consultation with DfI-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 Newry/Carlingford/Dundalk cycle route, which would follow the canal alignment.

As noted previously, planning permission was granted in February 2016 for upgrade and improvement to the existing pathway and improved access along the Middlebank and Albert Basin in Newry. In terms of cyclist provision, this scheme includes a shared-use high quality off-road cycle and walking greenway of approximately 5.4km. All corridors (except Corridor 4 (Option B)) would affect this proposed cycleway by crossing over it, and whilst there would be impacts in terms of changes to amenity, the cycleway would be unaffected as a through route.

Whilst Corridor 4 (Option B) would not affect the high quality off-road cycle and walking greenway proposed on the Middlebank, it has the greatest potential to adversely affect the future development proposals to link the former Dundalk, Greenore and Newry Railway (i.e. the Great Eastern Greenway) with the Newry Canal (at Victoria Lock). This may be much more detrimental than the impacts expected with any of the other corridor options under consideration from a cycling perspective.

7.8.6.6 Equestrian Facilities

No equestrian facilities which are known to be open to the public would be directly affected by any of the corridor options under consideration.

7.8.6.7 Angling Facilities

Each of the corridors (except Corridor 4 Option B) 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 any corridor. At this stage, it is envisaged that there would be no direct impact to any existing angling facilities within the study area.

7.8.7 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;
- crossing facilities, such as footbridges, pedestrian underpasses, central reservations and crossing sites for equestrians;
- 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);
- 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 the fullest consideration as the design proceeds.

7.8.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Pedestrians, Cyclists, Equestrians & Community perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.40.

- Any of the corridor 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.

- Any of the corridor 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 corridor options, the vast majority of roads affected would be maintained to facilitate through movements or subject to localised realignment.
- Corridor 4 and Corridor 5 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's perspective, effectively opening-up a new connection between Newry, South County Down and North County Louth.
- There is the risk that local access to the A2 Warrenpoint Road would be lost from the Old Warrenpoint Road with Corridor 2. Whilst this would be a notable safety improvement, it would be detrimental to connectivity between the extensive residential areas to the south of Newry and Warrenpoint. There is a similar issue on the Aghnamoira Road with Corridor 3.
- In terms of direct impacts upon community facilities, Corridor 1 would result in the complete loss of Newry Showgrounds, home of Newry City AFC. Corridor 2 would result in the complete loss of Cloghogue Pitch & Putt and would have significant impacts upon the amenity of the graveyard associated with the Church of the Sacred Heart. Corridor 4 (Option B) would have an adverse impact upon the amenity of Victoria Lock. With further design refinement, Corridor 5 may result in the loss of Gerry Brown Park.
- With all corridor options, the Newry Ship Canal would remain accessible to all boating (including tall ships), rowing and angling activities that takes place on it.
- In the long-term, there would be no impact upon public rail services with any of the corridor options. Public Bus Services are likely to benefit with implementation of any of the corridor options.
- Corridor 1 would have a significant impact upon the Ring of Gullion Way. Whilst it is envisaged it could be maintained as a walking route, it would be subject to significant modification in terms of visual presence of road structures (including bridges) and localised realignment.
- Corridor 4 (Option B) has the greatest potential to adversely affect the future development proposals to link the former Dundalk, Greenore and Newry Railway (i.e. the Great Eastern Greenway) with the Newry Canal (at Victoria Lock) and would also affect a number of the paths which zig-zag through Fathom Forest at the foot of Fathom Mountain.
- All corridor options would result in severance of the existing segregated cycle lane (Mourne Coastal Route).
- No equestrian facilities which are known to be open to the public would be directly affected by any of the corridor options under consideration.
- Each of the corridors (except Corridor 4 Option B) 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. However, it is envisaged that there would be no direct impact to any existing angling facilities within the study area.
- On balance therefore, Corridor 5 would be preferred from a pedestrian, cyclist, equestrian and community perspective, whereas Corridor 1 and 2 would be least preferred.

Table 7.40 Pedestrians, Cyclists, Equestrians & Community Effects Assessment Summary

Corridor	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	Pedestrians, Cyclists & Equestrians	Would potentially have the greatest impact upon pedestrian facilities, crossing three alleged PROWs, (at Middlebank, Newry Embankment, and Hillhead Road), and crossing the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected, however may indirectly affect a private facility (Carlingford Horses) on the Hillhead Road. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)	Moderate Adverse – Slight Beneficial
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
Corridor 2	Pedestrians, Cyclists & Equestrians	Would potentially affect two alleged PROWs, (at Middlebank, and Hillhead Road), and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals.	N/A (Qualitative Assessment Only)	Slight Adverse – Slight Beneficial

Corridor	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.		
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
Corridor 3	Pedestrians, Cyclists & Equestrians	Would potentially affect one alleged PROW (at Middlebank) and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)	Slight Adverse – Slight Beneficial
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the congested areas. Not only may this	N/A (Qualitative Assessment Only)	Slight Beneficial

Corridor	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		lead to improved access to community facilities throughout the wider urban area, but also partially reduce the degree of community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.		
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
Corridor 4 Option A	Pedestrians, Cyclists & Equestrians	Would potentially affect two alleged PROWs, (at Middlebank, and Hillhead Road), and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)	Slight Adverse – Slight Beneficial
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial

Corridor	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 4 Option B	Pedestrians, Cyclists & Equestrians	Would potentially affect two alleged PROWs, (at Middlebank, and Hillhead Road), and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)	Slight Adverse – Slight Beneficial
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
Corridor 5	Pedestrians, Cyclists & Equestrians	Would potentially affect one alleged PROW (at Middlebank) and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)	Slight Adverse – Slight Beneficial

Corridor	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial

7.9 Vehicle Travellers

7.9.1 Introduction

This section of the report addresses the impact of the scheme 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 corridor options under consideration.

7.9.2 Methodology

The objective at this preliminary stage is to undertake a broad assessment of the variation in views from the road, landscape character and quality, and the variation in driver stress that would be experienced due to likely causes of frustration, fear of potential accidents, and uncertainty associated with each corridor under consideration.

At this preliminary stage, the assessment of views from the road would not normally be a significant factor in the decision making process, however considering the landscape sensitivities of the study area, a broad assessment for each of the corridors in relation to landscape character and quality has been undertaken.

Driver stress is defined for the purposes of an environmental 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. Given the preliminary stage of this project and the broadly defined corridors under consideration, a curtailed assessment is considered appropriate.

Driver stress is caused by a number of factors - discomfort, annoyance, frustration or fear, culminating in physical and emotional tension that detracts from the value and safety of a journey. 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.

7.9.3 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 consultation in relation to Vehicle Travellers.

Table 7.41 Summary of formal consultation responses in relation to Vehicle Travellers

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
Freight Transport Association	22 July 2016 13 Oct 2016	17 Aug 2016	FTA does not favour Corridor 1 as the tie-in at Greenbank is already congested. Also noted that Corridor 4 makes redundant a significant length of the A2 for freight traffic. Provided additional rankings based on cost and tie-in locations.
PSNI - Road Safety Unit	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received.
PSNI - Traffic Management Unit	22 July 2016 31 Aug 2016 13 Oct 2016	04 Nov 2016	PSNI prefer Corridors 2 and 3, due to equal priority to freight traffic from industrial estates, and local/tourist traffic wishing to bypass Newry. Easy access to Warrenpoint docks, particularly for abnormal loads. Minimal impact upon GAA grounds which attract large crowds, and cause parking issues.

7.9.4 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).

7.9.5 Baseline Environmental Conditions & Constraints

7.9.5.1 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 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.

7.9.5.2 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 'High' as a result of the heavily trafficked and congested single carriageway A28 Dublin Road, with traffic regularly backing-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 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.

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. However, stress levels associated with this corridor would also be deemed particularly 'High', 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.

7.9.6 Assessment of Environmental Impacts

7.9.6.1 Views from the Road

Corridor 1

Corridor 1 cuts through the existing industrial estate so views would be initially quite enclosed as it branches off from its tie-in to the A2 Warrenpoint Road, through this area of poor townscape value, before rising-up to cross over the Newry River, Canal and Fathom Line. Travelling in a south-westerly direction having crossed over the river and canal, the main view would be towards the Drumalane Quarry, and down the Newry River valley. The corridor then goes into cutting, so views would be restricted within the road corridor with long views towards Fathom Mountain and Cloghogue Mountain.

Travelling in a north-easterly direction, there would be views up the valley towards the Albert Basin quay edge and promenade, and beyond to the Dublin Bridge on William Street.

Corridor 2

When travelling from east to west across the river basin, views would be directed towards the degraded landscape that is Greenbank Industrial Estate. The area at the rampart has a feeling of derelict wasteland, on the urban fringes of Newry City. The bridge would be sited fairly close to the rampart, so views into the industrial area would be prominent when travelling from east to west.

A road within this corridor would then climb-up the western valley slopes on embankment, offering views down into the industrial estate and towards the hillside scarring that is Drumalane Quarry. The corridor then goes into cutting, which means that views would be restricted within the road corridor, except for the long view towards the Bernish and Camlough Mountain. Corridor 2, on its approach to the A28 Dublin Road tie-in, would have short views due to being in cutting, but may glimpse the prominent Church of the Sacred Heart to the west.

When travelling in an east/south-easterly direction, this corridor would offer stunning panoramic views down the river valley towards the Cooley Mountains/Carlingford Lough. There would also be an impressive long view

towards the woodlands at Greenan/Narrow Water with the Mourne Mountains in the distance when travelling from west to east.

Corridor 3

This corridor is located north of Green Island, and as it would cross the Newry River Valley at a high level, it would offer stunning panoramic views down the river valley towards the Cooley Mountains. This setting is further removed from the urban fringes of Newry City and views back up the river valley towards Greenbank Industrial Estate would be largely distant.

There would be a direct view towards Fathom Mountain and the Ring of Gullion AONB when travelling from east to west across the river channel. As a road within this corridor would then climb the western slopes of the river valley, the view north for the vehicle traveller would be towards Newry City and beyond, with the poor quality landscape of Greenbank Industrial Estate in the middle distance. The view to the south would again be of the slopes of Fathom Mountain, and the associated woodland.

When travelling west to east across the river channel, there would be a direct view towards the wooded slopes at Greenan/Narrow Water and into the Mourne AONB.

Corridor 4

The low level bridge associated with Corridor 4 would afford views both up and down the river corridor between both the Ring of Gullion and Mourne AONBs. There would be minimal difference between Corridor 4 (Option A) and Corridor 4 (Option B) in terms of overall views. 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.

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.

Corridor 5

When travelling from east to west across the river basin, 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.

7.9.6.2 Driver Stress Levels

A Southern Relief Road, which links the A2 Warrenpoint Road to the A1 Belfast to Dublin Road, 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 corridors located closer to the City, such as Corridors 1, 2 and 5, are predicted to remove more traffic from Newry urban area than Corridors 3 and 4, due to their proximity to the main road network and residential areas. 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. It is therefore anticipated that driver stress levels would be assessed as ‘Low’ for the new southern relief road and for the main connecting roads, irrespective of the corridor option. 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’.

Driver stress levels within the city would likely remain to be ‘High’ 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.

7.9.7 Mitigation & Enhancement Measures

In terms of views from the road, typical mitigation for a scheme 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.

As the scheme 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 likely 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.

7.9.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Vehicle Travellers perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.42.

- New and interesting views from the southern relief road would be opened-up by any of the Corridors under consideration. However, Corridor 3, due to its elevation may afford the most dramatic views of the surrounding landscape.
- Currently, driver stress levels through the affected part of Newry are considered to be ‘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 likely be highest with Corridors 1, 5 and 2.
- Any of the corridors should improve road safety, with a reduction in strategic traffic/pedestrian conflict. There would also be a reduction in vehicular/pedestrian conflict in the centre of Newry, due to the removal of a proportion of strategic traffic.
- In terms of preference, Corridors 3 and 1 would be preferred from a view from the road perspective, due to the elevated aspect that each crossing would provide. From a driver stress perspective, Corridors 1 and 5 would be preferred as they are likely to attract the highest volume of traffic to them, and in turn reduce the volume of traffic on the city road network.

Table 7.42 Vehicle Travellers Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views: Moderate – Large Beneficial Driver Stress: Slight – Moderate Beneficial
Corridor 2	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views: Moderate Beneficial Driver Stress: Moderate Beneficial
Corridor 3	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views: Large Beneficial Driver Stress: Moderate Beneficial
Corridor 4 Option A	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views: Moderate Beneficial Driver Stress: Moderate Beneficial
Corridor 4 Option B	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views: Moderate Beneficial Driver Stress: Moderate Beneficial
Corridor 5	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views: Moderate Beneficial Driver Stress: Moderate Beneficial

7.10 Road Drainage & the Water Environment

7.10.1 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 a road within any of the corridors must consider the potential for non-conformance with the EU Water Framework Directive (WFD) [Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy] objectives as implemented in Northern Ireland by The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 and 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 corridor 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.

7.10.2 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 five broadly defined corridors under consideration.

At this preliminary 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 1 assessment of the advantages/disadvantages and constraints associated with the broadly

defined corridors. 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 of the broad corridors under consideration.

The assessment requires an appreciation of the proposed works and some knowledge of the landscape, hydrogeology and drainage pattern and process in which the broad corridors 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).

7.10.3 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 7.43 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 – CM Operational Management Branch – Fisheries Inspectorate	22 July 2016 31 Aug 2016 13 Oct 2016	18 Nov 16	No issues with proposal but drew attention to the Fisheries Act (NI) 1966, which makes it an offence to cause pollution which would have a deleterious effect on fish stocks. All works to be carried out in line with Pollution Prevention Guideline (PPG) 5.
DAERA – Marine and Fisheries Division	22 July 2016 13 Oct 2016	19 Aug 2016 18 Nov 2016	Inland, the Flurry River supports fish populations and is within study area watershed, and is sensitive to water quality and siltation. Corridors 3 & 4 are within Newry Canal, with a hydrological link between them and marine designated waterbodies: Carlingford Lough ASSI, mMCZ, SPA, Ramsar and East Coast Marine pSPA. Proposal falls within the scope of Regulation 8 (Annex II projects) of the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). It's DAERA's opinion that, due to the scale, location, environmental sensitivities, and potential implications which may arise as a result of the proposed works, the applicant should request a formal Scoping opinion. The second consultation response indicated that the division had no further comments to make in relation to the revised corridors.

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA – NIEA Water Management Unit	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016*	20 Sep 2016	High level comment at this stage. Provided waterbody 2015 status and 2021 objectives for all waterbodies within a 10km radius of scheme. The Water Framework Directive (WFD) requires protection of waterbodies from deterioration. Plans were published in December 2015 for period 2016-2021. The proposal should not cause any deterioration in status to any water bodies in the surrounding area. The proposal should not prevent any water bodies in the surrounding area, from achieving objectives. Area supports important habitats and wildlife, including European sites. Proximal to the scheme are Derryleckagh SAC and Carlingford Lough Shellfish Waters.
DAERA – NIEA Natural Environment Division (NED)	22 July 2016 13 Oct 2016 23 Nov 2016*	19 Aug 2016 24 Nov 2016	All options are approximately 10km upstream of Carlingford Lough SPA, and Options 2, 3 & 4 are within or near Carlingford Lough ASSI. NED has serious concerns due to potential impacts on these areas in terms of the Water Environment.
DAERA – NIEA Waste Management (Land and Groundwater Team)	22 July 2016 13 Oct 2016 23 Nov 2016*	12 Aug 2016	Former activities at site/surrounding area may cause contamination of groundwater. Attached maps and table of potential contamination in area. Comprehensive risk assessment should be completed to identify unacceptable risks to water environment, and remediation strategy agreed where appropriate.
DfI – Rivers Agency	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Environmental Protection Agency	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Inland Fisheries Ireland	24 Nov 2016	16 Dec 2016	Noted that whilst the corridors would not be located within their jurisdiction, the watercourses in the vicinity of the Ellisholding junction are located within the Flurry River Catchment and that it is important that the proposal does not impact negatively upon it.
Loughs Agency – Foyle, Carlingford and Irish Lights Commission	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016 01 Dec 2016	01 Dec 2016 20 Dec 2016	Meeting held to discuss the scheme and the potential for impacts with each of the broad corridors under consideration. Raised general concerns regarding the increased potential for runoff (and associated contaminants), stormwater discharges, uses of SuDS, culverting, drainage design, working methods during construction and associated environmental management practices (i.e. timing of works).
Newry & District Anglers Association	22 July 2016 13 Oct 2016 23 Nov 2016	27 July 2016 24 Nov 2016	Concerned regarding risk of pollution of water supply into Bensons Glen Fish Hatchery, as well as water runoff from any structure in the area. Second response reiterated concerns re: water supply

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
			being affected to fish hatchery at Lower Fathom, Omeath Road.
Newry Coarse Fish Angling Club	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No response received
Newry Maritime Association	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016*	11 Sep 2016	Outlined a potential alternative option to those being considered, involving a high bridge linking to a tunnel.
Warrenpoint Harbour Authority (WHA)	22 July 2016 13 Oct 2016 23 Nov 2016*	15 Aug 2016	WHA has advocated for 10 years+ for the construction of a NSRR. Included comprehensive list of considerations including: impact on 'Slieve Ban' vessel which maintains channel markers and leading marks; lighting of bridge impacting on navigation lights; obstruction of line of sight; alterations of river flow and subsequent displacement of sediment; release of potential contaminants from sediment; air draught over navigable waters; impact on birds/water based species; weather conditions and global warming.
Ulster Angling Federation	22 July 2016 13 Oct 2016 23 Nov 2016*	15 Aug 2016	Concerned as to effect on water quality of Newry River and impact on Atlantic Salmon (protected under Article 14 of Habitats Directive). Scheme should not include in river works and works close to river should be carried out in a manner to not impact on Salmon. Enclosed policy on pollution prevention.

**No response received in relation to the additional consultation regarding the developed corridors. It is assumed that the response received to the original consultation is equally applicable to the secondary consultation.*

7.10.4 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:

a) 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;

b) any public sewer or public sewage treatment works;

c) 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

d) any drain or road drain –

i. constructed and laid by the Department for Regional Development under Article 45(1) of the Roads (Northern Ireland) Order 1993; or

ii. 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 7.44 Legislation and Planning Policy

Legislation or Policy	Relevance to the Scheme
The Water Framework Directive (WFD) [Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy] implemented in Northern Ireland by The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003.	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

Legislation or Policy	Relevance to the Scheme
	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 the implementation of the EU Floods Directive in Northern Ireland and the 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 will be used to guide development decisions within the Banbridge / Newry and Mourne Area over the Plan period. The DfI - Rivers Agency 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.

7.10.5 Baseline Environmental Conditions & Constraints

7.10.5.1 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 around 5740 km^2. It includes all of County Armagh, large parts of counties Antrim, Londonderry, Down and Tyrone, and a small area 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 (as discussed in Section 7.6.4). 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 7.45 and shown on Figure 7.10.1.

Table 7.45 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	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	Minor watercourse flowing	Newry Canal

Name	Location	Description and comments	Outfall Location
	2.9km south of B79 Fathom Line/ Drumalane Road priority junction	through a wooded area (Fathom Forest)	
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

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 7.10.2, 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 as 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.

7.10.5.2 Floodplain

With reference to the DfI Rivers Agency 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 Plate 7.10.1 and Figure 7.10.1). 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 Plate 7.10.2).

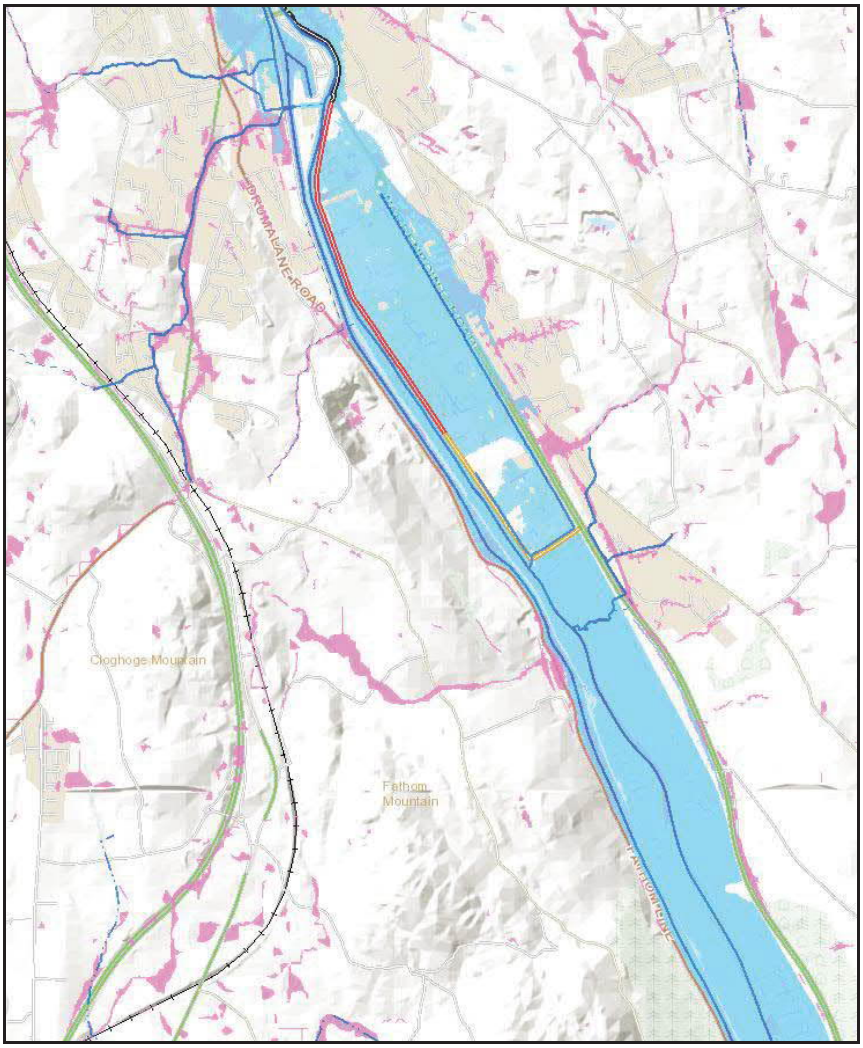

Plate 7.10.1: Q_{100} River and Surfaces Water Floodplain (accounting for Climate Change 2030)
Source: http://riversagency.maps.arcgis.com/

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).

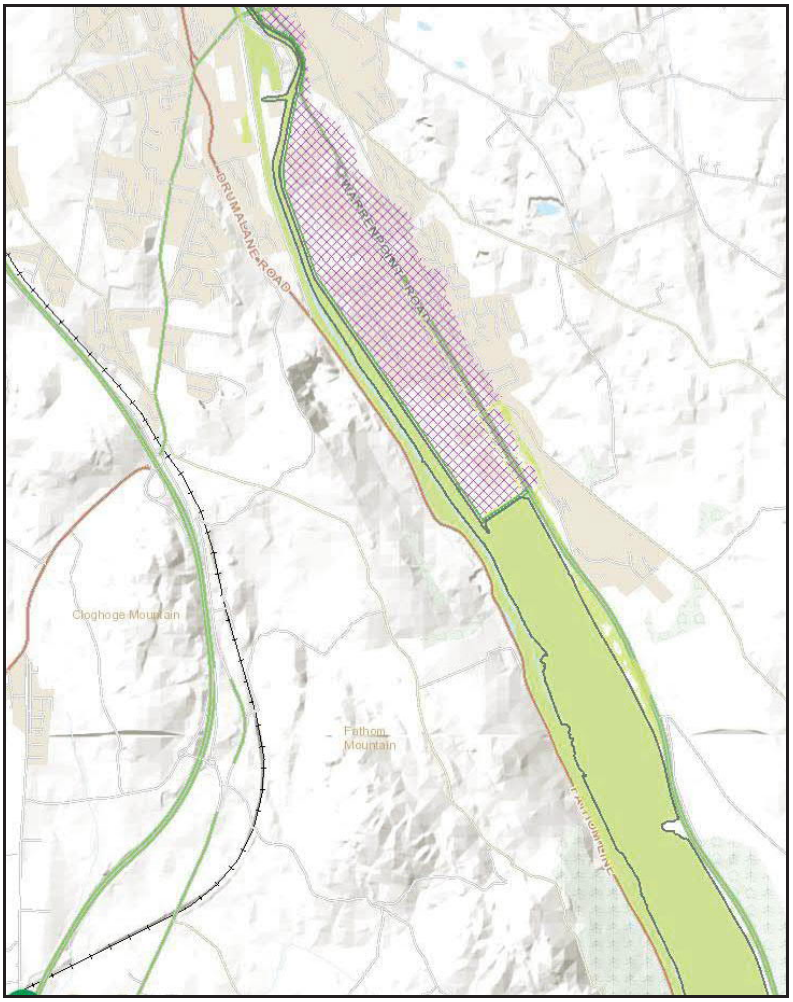

Plate 7.10.2: Q_{200} Sea Floodplain (accounting for Climate Change 2030) – including areas benefitting from flood defences (hatched areas)
Source: http://riversagency.maps.arcgis.com/

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 Agency 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 Agency 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 Agency 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.

7.10.5.3 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.

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.

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 7.10.3, 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.

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.

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.

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 at 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.

7.10.5.4 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 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.

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 7.10.4, 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.

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 7.10.5, 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.

7.10.6 Assessment of Environmental Impacts

7.10.6.1 Surface Waters and Floodplain

Corridor 1

At the tie-in with the A2 Warrenpoint Road, any alignment within Corridor 1 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 scheme would be designed with respect to flood protection requirements, an alignment within this corridor would be located within the Q_{100} floodplain through to its crossing of the Newry River. The vertical alignment of a road at this location 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 an alignment within this corridor. The design will 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, any alignment developed within this corridor would then cross the Newry River and Canal in quick succession, with a fixed bridge over the former and a bascule opening bridge over the latter via a skewed structure. The bridge structure would also cross over the Omeath Road Drain Extension (which is a minor tributary of the Newry Canal) before its landing point on the western valley side.

As the corridor climbs up the western valley, it would run parallel to a minor tributary of the Newry Canal (which flows immediately parallel to the Hillhead Road) for approximately 500m, before crossing over this watercourse to the east of Cloghogue Church Graveyard.

On the approach to Ellisholding junction, Corridor 1 would cross the very upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Plate 7.10.1, this watercourse does have localised surface water flooding issues in its upper reach (as a result of a localised depression), however this is unlikely to be problematic in the area that Corridor 1 would cross.

Corridor 2

The tie-in of an alignment within Corridor 2 with the A2 Warrenpoint Road Dual Carriageway would immediately traverse a minor tributary of the Newry River. This watercourse flows directly towards the A2 from the east (from Forest Hills), before passing under and flowing parallel to this road in a southerly direction, and ultimately outfalling to the Newry estuary near Aghnamoira Road.

As mentioned previously, although the scheme would be designed with respect to flood protection requirements, an alignment within this corridor would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. 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, any alignment developed within this corridor would cross the estuarine section of the Newry River/Estuary 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 a road 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 skewed fixed structure. The canal would be crossed immediately adjacent to the river crossing via a skewed bascule opening bridge structure.

The bridge structure would also cross over the Benson's Glen Stream (which is a minor tributary of the Newry Canal) just before its landing point on the western valley side. It is envisaged that the abutment associated with the bridge would not have a direct hydromorphological impact upon this watercourse; however its very close proximity to the natural channel cannot rule out the possibility of direct impacts at this stage. This would also result in a direct impact upon Benson's Glen fish hatchery. Associated with the Newry & District Anglers Association, this hatchery was made fully operational in 2007 with the minor watercourse providing freshwater for the hatching tanks which support Salmon, Sea Trout and Brown Trout.

On the approach towards the A28 Dublin Road, an alignment within Corridor 2 would cross over a minor tributary of the Newry Canal (which flows immediately parallel to the Hillhead Road) to the east of Cloghogue Church Graveyard.

At the tie-in with the A28 Dublin Road, Corridor 2 would affect a culverted section of the Drumalane Stream Extension, which largely flows parallel to the A28 Dublin Road towards the canal siphon (Quays Shopping Centre).

Corridor 3

An alignment within Corridor 3 would cross a minor tributary of the Newry River (which runs parallel to the A2 Warrenpoint Road dual carriageway), the estuarine reach of the Newry River (mud flats) and the Canal all in succession via a high level fixed bridge structure.

Although the scheme would be designed with respect to flood protection requirements, an alignment within this corridor would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. 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).

On the climb up the western valley side, an alignment within Corridor 3 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. sediment release) to its operation during the works.

On the approach to Ellisholding junction, an alignment within Corridor 3 would cross the upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Plate 7.10.1, 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 will obviously require further consideration as part of any subsequent flood risk assessment.

Corridor 4

Both options associated with Corridor 4 would affect a number of minor tributaries of the Newry River/Estuary at their tie-ins with the A2 Warrenpoint Road Dual Carriageway. This network of minor watercourses flow 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, an alignment within this corridor would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. 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, an alignment within this corridor 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 road 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

with Option A, and a straight bascule opening bridge structure with Option B. Only Option A requires a crossing of the canal immediately adjacent to the river crossing via a straight bascule opening bridge structure.

On the western valley side, any alignment developed within Corridor 4 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 waterbody's.

On the climb up the western valley side, an alignment within Corridor 4 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. sediment release) to its operation during the works.

On the approach to Ellisholding junction, Corridor 4 would also cross the upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Plate 7.10.1, 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 will obviously require further consideration as part of any subsequent flood risk assessment.

Corridor 5

At the tie-in with the A2 Warrenpoint Road, an alignment within Corridor 5 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 scheme would be designed with respect to flood protection requirements, an alignment within this corridor would be located within the Q_{100} floodplain through to its crossing of the Newry River. The vertical alignment of a road at this location 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 corridor. The design will 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, an alignment within this corridor would then cross the Newry River and Canal in quick succession, with a fixed bridge over the former and a bascule opening bridge over the latter via a straight structure.

As the Corridor climbs up the western valley, it would cross the middle reach 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. sediment release) to its operation during the works.

On the approach to Ellisholding junction, an alignment within Corridor 5 would cross the very upper reach of Benson's Glen Stream to the east of the Belfast/Dublin railway line. As shown on Plate 7.10.1, this watercourse does have localised surface water flooding issues in its upper reach (as a result of a localised depression), however this is unlikely to be problematic in the area that Corridor 5 would cross.

7.10.6.2 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 early stage, an assessment of the probability of a serious spillage incident occurring in receiving surface waters has not been carried out, due to an assessment broad corridors at this stage rather than specific alignments, as well as limited traffic information and link lengths within the corridors. It can be assumed that as each corridor contains a watercourse, there is likely to be a risk to the watercourse, prior to mitigation measures being implemented. A spillage risk assessment should be carried out at the next stage, once a preferred corridor has been selected, and route options developed within it.

7.10.6.3 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 impacts, Corridor 4 would have the greatest potential to affect the shellfishery, as it is located closest to it and any alignment developed within it would require physical works within the estuary. This would present the greatest risk during construction due to the potential for establishment of preferential pathways. To a lesser extent, the same risks apply to Corridors 2 and 3. Corridors 1 and 5 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 Canal by alignments within any of the corridors would be outwith with the wetted area, so there is little to differentiate between the corridors in terms of fisheries impacts within this cyprinid waterbody.

The fisheries habitat of the minor watercourses within the corridors 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. In terms of potential impact, Corridor 2 has the greatest potential to result in the direct loss of the hatchery or result in the most proximal hydromorphological changes. The skewed crossings of possible alignments within Corridors 3, 4 and 5 have the potential to result in upstream hydromorphological changes, which present a significant risk of sediment release during construction.

7.10.6.4 Areas designated for the protection of habitats or species

As detailed in Sub-Section 7.10.5 and illustrated on Figure 7.4.1 Carlingford Lough ASSI has the potential to be directly or indirectly affected by any alignments developed within the corridors under consideration. The predicted impact as a result of each corridor is discussed below.

Corridor 1

Corridor 1 would not directly affect Carlingford Lough ASSI, as it crosses the river at a more northerly location. It is likely that an alignment developed within this corridor would cross the Newry River on a single span structure, thus not directly impacting on the river. Nevertheless, there remains the risk of a pollution incident affecting the river, either during construction or long-term operation of the relief road.

Corridor 2

Corridor 2 would cross the ASSI in its upper extent, for an approximate distance of 350m. An alignment within this corridor would cross the Newry River on a bridge structure and due to the river's width, it is highly likely that there would be several bridge piers in the river, thus directly affecting the mudflats and potentially aquatic habitat quality.

Corridor 3

Corridor 3 would traverse the ASSI for an approximate distance of 520m. The degree of impact on the river and its designation would depend on the bridge design. However, at this preliminary stage it is envisaged that an alignment developed within Corridor 3 would have much fewer but much larger diameter piers in the river. Likely impacts may include sediment accumulation on the upstream side of the piers, potential scouring as a result of current eddying on the downstream side of the piers, and an overall disruption to sediment movements within the river channel.

Corridor 4

Corridor 4 Option A would traverse Carlingford Lough ASSI for an approximate distance of 360m, south of Green Island. The indicative crossing for Corridor 4 Option B 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.

Corridor 5

Corridor 5 would not directly affect Carlingford Lough ASSI, as it crosses the river at a more northerly location. It is likely that an alignment within this corridor would cross the Newry River on a single span structure, thus not directly impacting on the river. Nevertheless, as the Corridor 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.

7.10.6.5 Construction

As mentioned previously, there are a number of watercourses within the study area. The Newry River itself would be traversed by Corridors 1 and 5, with the estuarine section being traversed by the three other corridors (Corridors 2, 3 and 4). Other minor watercourses in the study area may also be affected. All of the corridors also pass over the Newry 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.

7.10.7 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 (in terms of 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 Corridor 3 or 4 be taken forward, a more detailed assessment of likely impacts on sediment movements would be required, which may include some degree of sediment modelling.

Should Corridors 3, 4 or 5 be taken forward, protection of the water intake for Benson's Glen fish hatchery from pollution will be paramount during construction. Corridor 2 may impact directly on the fish hatchery itself, and mitigation of this impact would require ongoing consultations with Newry & District Anglers Association.

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 either during construction or 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.

7.10.7.1 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.

7.10.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Road Drainage & the Water Environment perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.46.

- 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 Corridors 2, 3 and 4. The degree of impact will depend on the frequency, diameter and shape of the associated bridge piers.
- Although floodplains would be traversed by all corridors, the main issue in terms of functionality of the road in relation to floodplain impacts would be associated with Corridors 1 or 5, though these would be benefit from existing flood defences.
- The Benson's Glen Fish Hatchery would be directly affected by Corridor 2.
- The feeder stream to Benson's Glen fish hatchery would be traversed by Corridors 3, 4 and 5. Protection of this water intake from pollution would be paramount should any of these options be taken forward.
- Corridor 1 is the least likely to impact on Carlingford Lough ASSI, or it's designated Shellfish Water.
- Overall and on balance, Corridor 1 and to a lesser extent Corridor 5 would have the least potential for adverse impact on the water environment due to the reduced potential for direct interference with waterbody's.

Table 7.46 Road Drainage & the Water Environment Assessment

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	Would not directly affect any designated or known shellfishery beds, nor would it directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would minimise the potential for establishment of preferential pathways and sediment release. Would be located within the Q100 floodplain which may affect the functionality of the road during an extreme flood event.	N/A (Qualitative Assessment Only)	Slight Adverse
Corridor 2	Would not directly affect any designated or known shellfishery beds; however it would directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release. Would not be located within the Q100 river and surface water floodplain associated with the Newry River or the Q200 Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The Bensons Glen Fish Hatchery may be directly affected.	N/A (Qualitative Assessment Only)	Moderate Adverse
Corridor 3	Would not directly affect any designated or known shellfishery beds; however would it directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release. Would not be located within the Q100 river and surface water floodplain associated with the Newry River or the Q200 Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The feeder stream to Bensons Glen Fish Hatchery would be directly affected.	N/A (Qualitative Assessment Only)	Moderate Adverse
Corridor 4 Option A	Would not directly affect any designated or known shellfishery beds but would be located in closest proximity to them at Narrow Water. It would also directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release. Would not be located within the Q100 river and surface water floodplain associated with the Newry River or the Q200 Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The feeder stream to Bensons Glen Fish Hatchery would be directly affected.	N/A (Qualitative Assessment Only)	Moderate Adverse

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 4 Option B	Would not directly affect any designated or known shellfishery beds but would be located in closest proximity to them at Narrow Water. It would also directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release. Would not be located within the Q100 river and surface water floodplain associated with the Newry River or the Q200 Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The feeder stream to Bensons Glen Fish Hatchery would be directly affected.	N/A (Qualitative Assessment Only)	Moderate Adverse
Corridor 5	Would not directly affect any designated or known shellfishery beds, nor would it directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would minimise the potential for establishment of preferential pathways and sediment release. Would be located within the Q100 floodplain which may affect the functionality of the road during an extreme flood event (However, would require modelling to verify).	N/A (Qualitative Assessment Only)	Slight Adverse

7.11 Geology and Soils

7.11.1 Introduction

Soils and geology 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 and consideration should be given to the impact of a proposal on ASSIs.

7.11.2 Methodology

Assessment of the southern relief road corridors will investigate the potential for issues to arise in 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.

The objective at this preliminary stage is to undertake sufficient assessment to identify the possible geological/soil constraints associated with each of the broadly defined corridors under consideration.

In accordance with the requirements of DMRB 11.3.11.7 (Stages of Assessment), the steps taken include:

- Consultation with the Northern Ireland Environment Agency (NIEA) – Natural Environment Division (NED) to obtain details on the location and nature of any designated sites within the study area;
- Obtaining information on the Solid and Drift geology, and nature of soils in the area; and
- Consultation with NIEA – Resource Efficiency Division (RED) to obtain information on any potential areas of contaminated land within the study area.

7.11.3 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 7.47 Summary of formal consultation responses in relation to Geology and Soils

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
DAERA NIEA – Natural Environment Division (NED)	22 July 2016 13 Oct 2016	19 Aug 2016 24 Nov 2016	Have concerns and potentially some objections re: some corridors. NED have fewest concerns with Corridor 1. With regard to Geology & Soils, NED requested: • A description of the geological resource of the site and surrounding area – this will be the hard rock geology for hard rock sites, and the geomorphology in relation to landforms;

Consultee	Consultation Date	Date of Response	Summary of Consultee Response(s)
			• An assessment of the significance of the geological features in a local and regional context; • An assessment of how the development will impact on these features and on the wider geological feature if the development site forms part of a larger definable feature; • A description of mitigation measures that may be relevant in retaining or redeveloping these geological features; • Any opportunities to enhance the geodiversity of the area through creation / retention of rock outcrop or improve accessibility of geological features. Second response gave no new information in relation to a geology and soils perspective.
DAERA NIEA – Resource Efficiency Division, Waste Management (Land and Groundwater Team)	22 July 2016 13 Oct 2016	12 Aug 2016 16 Nov 2016	Risk assessment should be completed that identifies all unacceptable risks to the water environment. WM's Historic Land Use Database is available for downloading information of relevance. Provided maps and tables of information from database in proximity to the Corridors. Second response provided information from database in proximity to the widened Corridors 1 and 2, and the new Corridor 5.
DfE - Geological Survey of Northern Ireland	22 July 2016 13 Oct 2016	18 Aug 2016 09 Nov 2016 18 Nov 2016	Outlined responsibilities for environmental assessment, including consideration of geological context of the proposed road (bedrock and drift deposits at site). Provided a list of principal geological considerations for the site. Second response provided information relating to resources available through GSNI, including GeoIndex and borehole data. A subsequent meeting was held between GSNI and AECOM Geotechnical Engineers on 18 November 2016.
NMDDC – Active and Healthy Communities (including Environmental Health)	22 July 2016 31 Aug 2016 13 Oct 2016 23 Nov 2016	-	No specific response.
NMDDC – Local Planning	22 July 2016 13 Oct 2016	30 Sep 2016 17 Nov 2016	Outlined the planning histories at Drumalane Quarry and Bigwood Quarry. Second response contained no information specific to Geology & Soils

7.11.4 Regulatory & Policy Framework

The following key planning policy and legislation is pertinent to the assessment of the scheme in relation to impacts upon geology and soils.

7.11.4.1 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).

7.11.4.2 The Waste and Contaminated Land (Northern Ireland) Order 1997

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.

7.11.4.3 Planning Policy Statement 2 (PPS 2) Natural Heritage

This Planning Policy Statement, PPS 2, sets out the 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.

7.11.5 Baseline Environmental Conditions & Constraints

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.

7.11.5.1 Solid Geology

Based on the 1:250,000 Solid Edition Geological Map for Northern Ireland (Figure 7.11.1), 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.

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 7.11.1). 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 7.11.1. 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.

7.11.5.2 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 7.11.2). 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 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.

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, 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.

7.11.5.3 Soils

With reference to the 1:50,000 Soils Map for the area (Sheet 29), a range of soil profile types are within the study area,, all with their own individual drainage and nutrient characteristics (Figure 7.11.3). 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 a shale till complex.

7.11.5.4 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.

7.11.5.5 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 and 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 7.11.4).

Drumalane Quarry (Fathom Line) is within the study area, although consultation with The Department for Infrastructure - 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 re-opened. Land to the west of Hillhead Road has also been affected and it is not known whether the movement is still active.

The second licensed mineral extraction area, Bigwood Quarry (Sandstone) is located east of the A2 Warrenpoint Road, within the Narrow Water Forest area (Figure 7.11.4).

7.11.5.6 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 study area where potentially contaminated land may be a development constraint (Figure 7.11.5).

7.11.5.7 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 study area, located immediately north of Cloghogue Roundabout (Figure 7.11.4). 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 main 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.

7.11.6 Assessment of Environmental Impacts

7.11.6.1 Solid Geology

With reference to Figure 7.11.1, Corridor 1 would largely be underlain by granodiorites, except in the vicinity of Hillhead Road where it would pass over an area of greywacke and shales. On the approach to Ellisholding, the corridor would traverse an area underlain by felsite.

Corridor 2 would begin within granodiorites at the eastern extents, but is largely underlain by an area of greywackes and shales. This corridor would traverse granodiorites and a felsite intrusion towards Cloghogue and the tie-in with the A1.

On the eastern flanks of the Newry River valley, Corridor 3 would be largely underlain by greywackes and red shales from the Hawick Group and granodiorites. On the western flanks, this corridor would pass over intrusive dykes before traversing granodiorites and felsites.

The eastern edge of Corridor 4 would be underlain by greywackes and red shales from the Hawick Group in the vicinity of the A2 Warrenpoint Road. The western boundary of the corridor would traverse granodiorites on the slopes of Fathom Mountain, passing over dyke intrusions adjacent to the Newry Canal. As the corridor sweeps up the side of Fathom Mountain, it would traverse grandiorites and felsites.

Corridor 5 is primarily underlain by the greywacke and shales, although it passes over felsites on the slopes of Fathom Mountain before traversing granodiorites towards the A1.

7.11.6.2 Drift Geology

With reference to Figure 7.11.2, the eastern portion of Corridor 1 would be underlain by an area of recent marine deposits, in the vicinity of the Greenbank Roundabout. From the Fathom Line area, the corridor then traverses an extensive area of glacial tills before encountering an area where the bedrock is at or near the surface around Cloghogue Junction, the A28 Dublin Road, and Ellisholding Junction.

Corridor 2 is generally underlain by an area of glacial till, though bedrock is likely to be at or near the surface in the vicinity of Flagstaff Road and Cloghogue Junction.

Corridor 3 again, is generally underlain by glacial till, though bedrock is likely to be at or near the surface on the western valley slopes.

Corridor 4 generally traverses very thin deposits where the bedrock is at or near the surface. From where the corridor sweeps round Fathom Mountain, close to Dublin Road, it would be underlain by an area of glacial till on the approach to Ellisholding Junction.

Corridor 5 is broadly similar to Corridor 2. Its northern boundary at A2 Warrenpoint Road may encroach upon some areas of recent marine deposits, the corridor then is generally underlain by areas of glacial tills before encountering bedrock at or near the surface in the vicinity of Flagstaff Road.

Any corridors which approach Ellisholding Junction from the north or north-eastern slope of Fathom Mountain would also encounter bedrock very close to the surface. Where the various corridors cross the valley floor, they would traverse recent marine deposits.

7.11.6.3 Soils

From Greenbank Roundabout, Corridor 1 would traverse both ‘Urban’ and ‘Disturbed’ ground over approximately half of its length (Figure 7.11.3). In the vicinity of Cloghogue Junction, Corridor 1 would traverse Brown Ranker soils, and an area of ‘Disturbed’ ground. At Ellisholding, Corridor 1 would largely traverse Brown Ranker soils on

a granite parent material with free drainage from Hillhead Road, this would fringe on a pocket of Alluvium north of Barracric Road.

Corridor 2 would traverse 'Disturbed' ground associated with the A2 Warrenpoint Road and Fathom Line, before traversing Brown Ranker soils on granite parent material on the northern slopes of Fathom Mountain. This area of Brown Ranker is considered as having free drainage. On the approach to Cloghogue, the corridor would traverse areas of 'Disturbed' and 'Urban' ground.

Corridor 3 east of the Newry River, would not only affect Brown Ranker soils, but also an area of Brown Podzols on a granite parent material, also with free drainage. West of the Newry River, the corridor would largely traverse Brown Rankers and also infringe on a pocket of Alluvium on the approach to Ellisholding Junction.

East of the Newry River, Corridor 4 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 corridor would initially traverse Brown Ranker soils on a felsite parent material on the lower slopes of Fathom Mountain, beside Fathom Line. It would then traverse Brown Rankers on a granite parent material from Fathom Forest to Ellisholding, though infringe on an area of Alluvium north of Barracric Road.

Corridor 5 would traverse 'Urban' ground in the vicinity of Greenbank Industrial Estate. To the west of the Newry River, this corridor would primarily traverse Brown Ranker soils on granite, but would also clip an area of Alluvium north of Barracric Road.

The various corridors would largely traverse similar soil types, due to their relative juxtaposition.

7.11.6.4 Agricultural Land

As with any proposed major rural road scheme, agricultural land will inevitably be lost to accommodate the infrastructural development. To this end, large expanses of agricultural land, of varying quality would be traversed to the south of Newry.

At this stage, an assessment cannot be accurately made of the potential impact on agricultural land. However, in general, Corridors 1 and 2 are the least likely to have a significant impact on areas of agricultural land, due to their partial location within a more urban setting. Corridors 3 and 4 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. Corridor 5, similar to Corridors 1 and 2, 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 to 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.

7.11.6.5 Minerals

As mentioned previously, 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 7.11.4).

Drumalane Quarry is within the study area, although consultation with The Department for Infrastructure - Newry Section Office has indicated that it is no longer in operation for mineral extraction. Again, as previously noted, 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 re-opened. Land to the west of Hillhead Road has also been affected and it is not known whether the movement is still active. Corridor 1 is underlain by an unstable area to the immediate western extents of the quarry. The quarry itself and these unstable areas would also underlie Corridor 2. Corridor 2 would also cause a degree of severance at the southern end of the existing quarry, which may require some infilling to support any road aligned through this area. This quarry and the surrounding area to the west of the quarry present a significant geohazard to Corridors 1 and 2 and should be avoided. Corridor 5 encroaches on the quarry floor, causing a small degree of severance.

Bigwood Quarry (Sandstone) licensed mineral extraction area, is located east of the A2 Warrenpoint Road, within the Narrow Water Forest area (Figure 7.11.4). It is unlikely that this would be directly affected by any of the corridors under consideration.

A number of other historical quarries have been identified (Figure 7.11.4). Corridor 1 passes close to and Corridor 2 includes the old Cloghogue quarry. All corridors, except Corridor 2, contain an old quarry that is located close to the existing railway. Two areas identified in the Historical Land Use Layer as being old quarries would lie within Corridor 3, although it may be that this was one large quarry area.

7.11.6.6 Contaminated Land

The potentially contaminated land site areas are indicated on Figure 7.11.5. 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 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 the corridors or close to their boundaries have been identified below.

- Corridor 1 would contain the following potentially contaminated land sources:
- Engineering works: mechanical engineering and ordnance works (source no. 33);
- Sewage works & sewage farms (source no. 34);
- Formula Karting (source no. 37);
- Garage/fuel stations (source nos. 35 & 36);
- Engineering works: mechanical engineering and ordnance works (source no. 38);
- Electrical substation (source no. 39);
- Smithy (source no. 71);
- Waste recycling: metal recycling site (source no. 72);
- Unspecified: industrial works and a tobacco pipe manufacturing works (source nos. 74 & 75);
- Mineral workings and a possible quarry (source nos. 81 & 82);
- The current Belfast – Dublin Railway Line at the western section of the corridor 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, 14, 19, 27, 73 & 80);
- Mineral workings (source no. 66) and a cemetery (source no. 70) are in close proximity to the corridor boundary near its western section;
- A waste recycling site (source no. 67) and a mineral workings (Drumalane Quarry)(source no. 69) are near the corridor boundary at Drumalane Road/Fathom Line; and
- An abattoir (source no.41) and a burial ground (source no. 44) are near the corridor's northern boundary.

An alignment within Corridor 1 may also impact potentially contaminative sources due to additional works/factories in the vicinity of the Greenbank Industrial Estate to the east of the Newry River.

Corridor 2 would contain the following potentially contaminated land sources:

- Oil storage depot (source no. 16);
- Landing place/ docks (source nos. 17 & 18);
- Mineral workings, including Drumalane Quarry (source nos. 66 & 69);

- Cemetery (source no. 70);
- Smithy (source no. 71);
- Waste recycling: metal recycling site (source no. 72);
- The current Belfast –Dublin Railway Line at the western section of the corridor 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, 14, 19, 27, 73 & 80);
- A dockyards/ docklands site (source no. 15) is located close to the corridor boundary on the Fathom Line; and
- An unspecified industrial works (source no. 74) is near to the corridor boundary on Flagstaff Road.

Corridor 3 would contain the following potentially contaminated land sources:

- Mineral workings and gravel pits east of Newry River (source nos. 8, 9, 10, 11 & 13);
- Dockyards & docklands (source no. 15);
- Mineral workings and a possible quarry (source nos. 81 & 82);
- The current Belfast –Dublin Railway Line at the western section of the corridor 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, 14, 19, 27, 73 & 80); and
- An oil storage depot is in close proximity to the corridor on the Fathom Line (source no. 16).

Corridor 4 would contain 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);
- The current Belfast – Dublin Railway Line at the western section of the corridor 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, 14, 19, 27, 73 & 80); and
- Two mineral workings near the eastern boundary of the corridor (source nos. 6 & 8).

Corridor 5 would contain the following potentially contaminated land sources:

- Factory/works, engineering works: mechanical engineering and ordnance works (source nos. 23, 26 & 28);
- Waste recycling: landfills & other waste disposal sites (source no. 24);
- Drumalane Quarry (source no. 69);
- Mineral workings and a possible quarry (source nos. 81 & 82);
- The current Belfast –Dublin Railway Line at the western section of the corridor 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, 14, 19, 27, 73 & 80);
- East of the Newry River, a garage and quarry are located close to the corridor boundary (source nos. 25 & 29); and
- West of the Newry River, an oil storage site and dockyard/dockland site are near the corridor boundary on the Fathom Line (source nos. 16 & 17).

In addition to the above sources, the historical and current road network, as well as activities associated with agricultural land, may also give rise to potential contaminated sites.

7.11.6.7 Designated and Non-Designated Sites

The Dublin Road Bridge SLNCI and Carrivemaclone ASSI both fall within or very close to the boundary of Corridors 1 and 2 in the vicinity of Cloghogue Roundabout (Figure 7.11.4). At this early stage, a predicted impact on the SLNCI and ASSI from either corridor cannot be determined.

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.

Corridors 3, 4 and 5 would potentially have the greatest 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 corridors, 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.

7.11.7 Mitigation & Enhancement Measures

In terms of solid geology, only at a more detailed design stage (e.g. post geotechnical investigation) would potential mitigation measures become apparent, such as slope gradients and stabilising measures (if necessary).

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. Similarly, as there would be no significant impact on licensed areas of mineral extraction, it is unlikely that mitigation would be necessary.

Again, 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 by 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.

7.11.8 Presentation of Key Issues

The key issues associated with the five broad corridors from a Geology & Soils perspective are listed below and a summary of the qualitative impacts and quantitative assessment (where relevant) is detailed within Table 7.48.

- 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. This area of instability would lie within Corridors 1 and 2. As the cause and extents of this instability is currently unknown, these corridors should be avoided from a geological perspective.
- The study area contains one area (Bigwood Quarry) currently licensed for mineral extraction.
- Corridor 1 would potentially have the least impact on soils of the five corridors under consideration, as a result of its location within urban and disturbed soil types. Similarly, Corridors 1 and 2 would have the least impact on agricultural soils, due to their more urban location.
- Potential contaminated land sources have been identified within each corridor. Further investigation will be required in order to assess the likely scale of impact each particular corridor may have on the suspected contaminated land sources.
- The greatest potential impact on contaminated soils/groundwater is likely to be within Corridor 1 as this corridor traverses the Greenbank Industrial Estate, east of the Newry River. Corridor 4 is likely to encounter the least significant sources of potential contaminated land.
- Dublin Road Bridge SLNCI and Carrivemaclone ASSI, designated for their earth science interest in the vicinity of Cloghogue Junction, are both located within Corridor 2. The SLNCI is also located on the edge of Corridor 1.
- As Corridors 1 and 2 should be avoided from a geological perspective, Corridors 3 and 5 would be preferred in terms of minimisation of impacts upon the underlying lithology. Corridor 4 would however be preferred from a contaminated land perspective.

Table 7.48 Geology and Soils Assessment Summary

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
Corridor 1	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. This area of geohazard instability would lie within this corridor. As the cause and extents of this instability is currently unknown, this corridor should be avoided from a geological perspective. Would potentially have the least impact on soils as a result of its location within urban and disturbed soil types, and the least impact on agricultural soils. Would have the greatest impact on potential contaminated soils/groundwater.	N/A (Qualitative Assessment Only)	Large Adverse
Corridor 2	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. This area of geohazard instability would lie within this corridor. As the cause and extents of this instability is currently unknown, this corridor should be avoided from a geological perspective. Would potentially have a lesser impact on soils as a result of it being partially within urban and disturbed soil types and would have the least impact on agricultural soils. Its partial location with the urban area would increase the potential to encounter contaminated soils/groundwater.	N/A (Qualitative Assessment Only)	Large Adverse
Corridor 3	Would potentially have a greater impact on soils as a result of its rural location and the associated affected soil types, with a greater impact on agricultural soils. Would have a lower potential to impact on contaminated soils/groundwater.	N/A (Qualitative Assessment Only)	Slight Adverse
Corridor 4 Option A	Would potentially have a greater impact on soils as a result of its rural location and affect associated soil types. Would have a greater impact on agricultural soils. Would have a lower potential impact on contaminated soils/groundwater.	N/A (Qualitative Assessment Only)	Slight Adverse
Corridor 4 Option B	Would potentially have a greater impact on soils as a result of its rural location and affect associated soil types. Would have a greater impact on agricultural soils. Would have a lower potential impact on contaminated soils/groundwater.	N/A (Qualitative Assessment Only)	Slight Adverse
Corridor 5	Would potentially have less impact on soils as a result of its being partially within urban and disturbed soil types and the least impact on agricultural soils. Its partial location within the urban area would increase the potential to encounter	N/A (Qualitative	Slight Adverse

Corridor	Qualitative Impacts	Quantitative Assessment	Assessment
	contaminated soils/groundwater (particularly within Greenbank Industrial Estate).	Assessment Only)	

Traffic and Economic Assessment

08

8. Traffic and Economic Assessment

8.1 Introduction

The objective of the 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 Improvement Corridors 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 Proposed Improvement Corridors and presents the results of an operational and economic assessment of the Improvement Corridors.

The study area for the traffic and economic assessment, as shown on Figure 8.1.1 in Appendix A, 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 Improvement Corridors. 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 illustrating the scope of the collective corridors is shown in Figure 1.1.2 in Appendix A. All figures in this section of the report will be contained in Appendix A.

8.2 Traffic Surveys and Data Collection

8.2.1 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, Queue Surveys, Automatic Traffic Counts, the measurement of typical Journey Times, Vehicle Registration Surveys and Pedestrian Surveys. These surveys were undertaken during May 2015 when traffic conditions were expected to be typical of average demand.

Full details of the data collection surveys are described in the Stage 1 Traffic Survey and Data Report, dated April 2016. The key findings and results of the data collected during these surveys are presented in this report.

8.2.2 Manual Classified Counts

8.2.2.1 Methodology

Manual Classified Counts were undertaken at nineteen locations around Newry on Tuesday 12 May 2015 to define current traffic volumes and turning movements.

The Manual Classified Counts were undertaken at the following locations:

- 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 – A2 / Greenbank Roundabout;
- M11 – A2 / Old Warrenpoint Road Junction;
- M12 – A2 / Warrenpoint Harbour Docks Junction;
- M13 – Damolly Roundabout;
- M14 – McCann's Corner Roundabout;
- M15 – Ellisholding Grade-Separated Junction;
- M16 – Cloghogue Grade-Separated Junction;
- M17 – Camlough Grade-Separated Junction;
- M18 – Carnbane Grade-Separated Junction; and
- M19 – Sheepbridge 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).

8.2.2.2 MCC Locations

The locations of the MCCs are shown in Figure 8.2.1.

Full turning counts of all movements were undertaken at each MCC site, as well as mainline counts on the A1 at MCC Site 15 and MCC Site 17.

8.2.2.3 MCC Survey Results

A summary of the MCC data is shown in Table 8.1 to Table 8.3.

Table 8.1 – Summary of Observed 12-Hour Traffic Volumes – A1 Mainline

MCC Site	Road Section	Northbound 12-Hour Flow	Southbound 12-Hour Flow	Two-Way 12-Hour Flow
M15	South of Ellisholding Junction	7,770	8,110	15,880
M15 – M16	Ellisholding Junction to Cloghogue Junction	10,070	9,920	19,990
M16	Cloghogue Junction to Chancellor's Road Junction	9,320	9,310	18,630
M17	Chancellor's Road Junction to Camlough Junction	9,410	9,500	18,910
M17 – M18	Camlough Junction to Carnbane Junction	9,240	9,070	18,310
M18 – M19	Carnbane Junction to Sheepbridge Junction	7,810	7,770	15,580
M19	Sheepbridge Junction to Beech Hill	10,530	10,720	21,250

Table 8.2 – Summary of Observed 12-Hour Traffic Volumes – Newry City Centre

MCC Site	Road Section	Two-Way 12-Hour Flow
M12 – M11	A2 – Warrenpoint Road	12,030
M11 – M10	A2 – Warrenpoint Road	11,390
M10	North of Greenbank Rbt	17,800
M5	Kilmorey Street	13,110
M4	River Street (One Way)	4,490
M5 – M4	William Street	15,330
M4 – M3	William Street	17,380
M3 – M2	Bridge Street	12,070
M2 – M1	Bridge Street	11,890
M1 – M16	Dublin Road	12,860 - 11,480

Table 8.3 – Summary of Observed 12-Hour MCC Total Junction Flows and Vehicle Proportions

MCC Site	Units	Car	LGV	OGV1	OGV2	PSV	Total	HGV Total
MCC 1	**Flow**	13,819	1,578	288	436	144	16,265	868
	%	85.0%	9.7%	1.8%	2.7%	0.9%	100.0%	5.3%
MCC 2	**Flow**	12,230	1,363	266	465	116	14,440	847
	%	84.7%	9.4%	1.8%	3.2%	0.8%	100.0%	5.9%
MCC 3	**Flow**	18,648	2,158	411	543	246	22,006	1,200
	%	84.7%	9.8%	1.9%	2.5%	1.1%	100.0%	5.5%
MCC 4	**Flow**	16,711	2,051	399	500	163	19,824	1,062
	%	84.3%	10.3%	2.0%	2.5%	0.8%	100.0%	5.4%
MCC 5	**Flow**	18,858	2,467	633	856	193	23,007	1,682
	%	82.0%	10.7%	2.8%	3.7%	0.8%	100.0%	7.3%
MCC 6	**Flow**	17,378	2,086	543	670	150	20,827	1,363
	%	83.4%	10.0%	2.6%	3.2%	0.7%	100.0%	6.5%
MCC 7	**Flow**	16,337	2,197	528	594	123	19,779	1,245
	%	82.6%	11.1%	2.7%	3.0%	0.6%	100.0%	6.3%
MCC 8	**Flow**	24,933	2,675	595	626	291	29,120	1,512
	%	85.6%	9.2%	2.0%	2.1%	1.0%	100.0%	5.2%
MCC 9	**Flow**	28,431	3,178	765	761	375	33,510	1,901
	%	84.8%	9.5%	2.3%	2.3%	1.1%	100.0%	5.7%
MCC 10	**Flow**	15,402	2,600	684	898	169	19,753	1,751
	%	78.0%	13.2%	3.5%	4.5%	0.9%	100.0%	8.9%
MCC 11	**Flow**	10,014	1,347	380	733	130	12,604	1,243
	%	79.5%	10.7%	3.0%	5.8%	1.0%	100.0%	9.9%
MCC 12	**Flow**	9,333	1,271	404	699	123	11,830	1,226
	%	78.9%	10.7%	3.4%	5.9%	1.0%	100.0%	**10.4%**
MCC 13	**Flow**	14,873	2,029	626	743	186	18,457	1,555
	%	80.6%	11.0%	3.4%	4.0%	1.0%	100.0%	8.4%
MCC 14	**Flow**	22,887	2,682	438	434	167	26,608	1,039
	%	86.0%	10.1%	1.6%	1.6%	0.6%	100.0%	3.9%
MCC 15	**Flow**	3,078	603	235	340	41	4,297	616
	%	71.6%	14.0%	5.5%	7.9%	1.0%	100.0%	**14.3%**
MCC 16	**Flow**	12,086	1,790	476	548	119	15,019	1,143
	%	80.5%	11.9%	3.2%	3.6%	0.8%	100.0%	7.6%
MCC 17	**Flow**	24,872	2,826	495	311	391	28,895	1,197
	%	86.1%	9.8%	1.7%	1.1%	1.4%	100.0%	4.1%
MCC 18a	**Flow**	10,777	1,813	497	951	64	14,102	1,512
	%	76.4%	12.9%	3.5%	6.7%	0.5%	100.0%	**10.7%**
MCC 18b	**Flow**	5,696	1,204	386	663	31	7,980	1,080
	%	71.4%	15.1%	4.8%	8.3%	0.4%	100.0%	**13.5%**
MCC 19	**Flow**	8,850	1,447	323	448	104	11,172	875
	%	79.2%	13.0%	2.9%	4.0%	0.9%	100.0%	7.8%
Total	**Flow**	**305,213**	**39,365**	**9,372**	**12,219**	**3,326**	**369,495**	**24,917**
	%	**82.6%**	**10.7%**	**2.5%**	**3.3%**	**0.9%**	**100.0%**	**6.7%**

Note 1: MCC Site 18A refers to the western roundabout. MCC Site 18B refers to the eastern roundabout.

Note 2: HGV Percentages greater than 10% are shown in bold.

From the above 12-hour MCC counts observed in May 2015 the following overall vehicle classification percentages were derived:

- 82.6% Cars;
- 10.7% Light Goods Vehicles (LGV);
- 2.5% Other Goods Vehicles 1 (OGV1);
- 3.3% 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 observed 12-hour, AM Peak Hour and PM Peak Hour traffic flows for all vehicles are shown in Figures 8.2.2 to 8.2.4. The 12-hour traffic flows for Light Vehicles (Cars and LGVs) and Heavy Vehicles (OGV1s, OGV2s and PSVs) are shown in Figures 8.2.5 to 8.2.6.

The results of the May 2015 surveys indicate that 33,510 vehicles passed through the double roundabout on Downshire Road, 22,000 vehicles passed through the signalised junction at Bridge Street / Buttercrane Quay and 19,750 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 Trevor Hill to the south of Sandyford Roundabout which carried 23,220 vehicles. Other sections of road network in the city centre which experience significant traffic demand include the A2 Warrenpoint Road / Kilmorey Street, which carried 17,800 vehicles and William Street, which carried 17,390 vehicles.

The traffic volumes on these road sections are comparable to traffic volumes on the A1 between Ellisholding and Sheepbridge junction which varied between 15,580 and 19,990 vehicles during the 12-hour period.

The results of the May 2015 surveys indicate that 19,750 vehicles passed through Greenbank Roundabout, 22,000 vehicles pass through the signalised junction at Bridge Street / Buttercrane Quay and that 33,510 vehicles pass through the double roundabout on Downshire Road.

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 8.2.7.

A bandwidth diagram indicating the two-way 12-hour flows recorded during the MCC surveys is shown in Figure 8.2.8.

8.2.3 Queue Surveys

8.2.3.1 Methodology

A programme of Queue Surveys was undertaken around Newry City centre on Tuesday 12 May 2015 to assist in establishing operating conditions on the approach roads to key roundabouts and junctions.

The Queue Surveys were undertaken at the following locations:

- Queue 1 – Dublin Road heading north to MCC Junction 1;
- Queue 2 – River Street heading north to junction with William Street;
- Queue 3 – Kilmorey Street heading north to junction with William Street;
- Queue 4 – Abbey Way heading south to MCC Junction 7; and
- Queue 5 – Greenbank Roundabout (all five approach roads).

The methodology adopted for this survey was to record the observed length of queue in equivalent passenger car unit (PCU) lengths from each queue survey. Queue lengths were recorded in each lane where possible.

The Queue Survey data for all sites were collected in 5-minute intervals between 08:00 hours and 10:00 hours, 12:00 hours to 14:00 hours and 16:30 hours to 18:30 hours over the survey period to provide an indication of levels of queuing throughout the peak periods.

8.2.3.2 Queue Survey Locations

The locations of the Queue Surveys are shown in Figure 8.2.9.

8.2.3.3 Queue Survey Results

The results from the Queue Surveys for each site are shown in Table 8.4.

The following colour code has been adopted to highlight junctions where significant queues were observed during the survey:

- Queue lengths of 0 to 9 PCUs are coloured green;
- Queue lengths of 10 to 19 PCUs are coloured amber; and
- Queue lengths of 20 PCUs or more are coloured red.

Table 8.4 – Queue Lengths (Total PCUs for All Lanes)

Time	Q1	Q2	Q3	Q4	Q5a	Q5b	Q5c	Q5d	Q5e
08:00	10	0	16	3	0	1	0	0	0
08:05	4	8	7	6	0	0	0	0	1
08:10	8	0	3	31	0	0	0	0	2
08:15	5	2	1	37	0	1	0	0	0
08:20	16	0	22	19	0	0	2	0	0
08:25	19	2	15	22	0	3	2	0	0
08:30	32	10	18	16	0	0	0	0	0
08:35	8	0	20	22	0	9	12	1	5
08:40	35	6	33	32	0	4	11	0	4
08:45	40	27	31	28	0	10	8	1	4
08:50	39	25	14	33	0	0	0	0	0
08:55	40	14	31	47	0	0	0	0	0
09:00	38	0	31	54	0	0	2	0	0
09:05	39	8	23	35	0	5	2	0	0
09:10	44	3	9	39	0	0	3	0	0
09:15	42	0	10	24	3	0	0	0	0
09:20	39	0	5	12	0	0	0	0	0
09:25	44	2	12	22	0	2	0	0	0
09:30	9	0	17	15	0	0	0	0	0
09:35	4	0	18	2	0	0	0	0	0
09:40	2	0	5	14	0	0	0	0	0
09:45	9	0	7	27	0	0	0	0	0
09:50	12	1	9	25	0	0	0	0	0
09:55	13	5	15	13	0	0	0	0	0
12:00	17	0	12	12	0	0	0	3	0
12:05	18	0	25	11	0	0	0	0	2
12:10	3	4	21	11	0	0	0	0	0
12:15	3	2	26	14	0	0	0	0	1
12:20	14	0	27	15	0	0	0	0	0
12:25	5	5	15	14	0	2	0	0	0
12:30	14	3	7	17	0	0	0	0	0
12:35	9	0	23	8	0	0	0	0	0
12:40	9	2	13	15	0	0	0	0	0

Time	Q1	Q2	Q3	Q4	Q5a	Q5b	Q5c	Q5d	Q5e
12:45	11	12	10	17	0	0	0	0	0
12:50	28	3	7	8	0	0	0	0	0
12:55	5	7	26	15	0	0	2	1	0
13:00	11	2	14	14	0	0	0	0	0
13:05	12	3	20	13	0	0	0	2	2
13:10	23	3	31	19	0	0	0	0	0
13:15	15	4	20	16	0	0	0	0	0
13:20	5	3	22	20	0	0	2	0	0
13:25	6	0	26	14	0	0	0	0	0
13:30	6	2	13	17	0	0	0	0	0
13:35	0	0	0	11	0	2	1	2	0
13:40	6	1	8	9	0	0	0	0	0
13:45	13	0	7	11	0	0	1	0	0
13:50	25	0	8	13	0	0	0	0	0
13:55	29	3	9	8	0	0	0	0	0

Table 8.5 – Queue Lengths (Total PCUs for All Lanes) (Continued)

Time	Q1	Q2	Q3	Q4	Q5a	Q5b	Q5c	Q5d	Q5e
16:30	12	0	15	7	4	0	0	0	3
16:35	10	1	23	23	0	2	0	0	2
16:40	8	0	21	24	0	0	0	0	0
16:45	11	5	26	35	0	0	0	0	0
16:50	12	0	24	33	0	0	0	0	2
16:55	10	9	31	21	0	0	0	0	0
17:00	22	4	0	13	0	0	0	0	1
17:05	25	8	22	29	0	3	0	0	2
17:10	21	0	23	29	0	0	0	0	0
17:15	21	14	24	54	0	0	0	0	1
17:20	20	13	28	30	0	4	0	0	0
17:25	22	8	21	19	0	1	0	0	0
17:30	14	0	10	25	4	0	0	0	0
17:35	18	4	18	36	0	0	0	0	0
17:40	15	0	19	63	0	0	0	0	0
17:45	3	10	20	30	0	0	0	0	0
17:50	20	0	14	23	0	2	0	0	0
17:55	14	9	15	27	3	0	0	0	0
18:00	6	0	7	8	0	2	0	0	0
18:05	7	0	13	12	0	1	0	0	0
18:10	12	3	13	13	0	0	0	0	0
18:15	4	2	17	8	0	2	0	0	0
18:20	11	1	12	6	0	0	1	0	0
18:25	9	0	5	9	0	0	0	0	0

The maximum queue lengths observed and the corresponding times during the AM Peak period and PM Peak periods are shown in Table 8.6. The colour code adopted for Table 8.5 has been used for Table 8.6.

Table 8.6 – Maximum Queue Lengths

Queue Site	Approach Road	AM Peak Queue		PM Peak Queue	
		Time	Length (PCUs)	Time	Length (PCUs)
Q1	Dublin Road	09:10 & 09:25	44	17:05	25
Q2	River Street	08:45	27	17:15	14
Q3	Kilmorey Street	08:40	33	16:55	31
Q4	Abbey Way	09:00	54	17:40	63
Q5a	Greenbank – Warrenpoint Road North	09:15	3	16:30 & 17:30	4
Q5b	Greenbank – Old Warrenpoint Road	08:45	10	17:20	4
Q5c	Greenbank – Warrenpoint Road South	08:35	12	18:20	1
Q5d	Greenbank (Industrial Estate)	08:35 & 08:45	1	-	0
Q5e	Greenbank (Rugby Club)	08:35	5	16:30	3

Within the city centre there can be significant localised queuing, especially during the AM and PM Peak periods.

In the AM Peak period, the maximum queue of 54 PCUs was recorded at 09:00 hours on Abbey Way heading south into William Street.

In the PM Peak period, the maximum queue of 63 PCUs was recorded at 17:40 hours on Abbey Way heading south into William Street.

The distribution of queue lengths recorded at each site during the survey period on Tuesday 12 May 2015 is shown in Figure 8.2.10.

8.2.4 Automatic Traffic Counts

8.2.4.1 Temporary Automatic Traffic Count Locations

Automatic Traffic Count (ATC) data was collected at seven temporary sites to provide a record of traffic flows within the study area over a two week period between Monday 11 May 2015 and Sunday 24 May 2015.

The Temporary ATCs were undertaken at the following locations:

- ATC 1 – A2 Warrenpoint Road, northbound;
- ATC 2 – A2 Warrenpoint Road, southbound;
- ATC 3 – Drumalane Road;
- ATC 4 – Dublin Road;
- ATC 5 – A28 Fairlawns Way;
- ATC 6 – A28 Belfast Road; and
- ATC 7 – Warrenpoint Harbour.

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 8.2.11.

8.2.4.2 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 8.7 to Table 8.18.

Table 8.7 – Two-Way ATC Traffic Volumes: ATC 1 & 2 – A2 Warrenpoint Road

WEEK 1	Mon 11/05	Tue 12/05	Wed 13/05	Thu 14/05	Fri 15/05	Sat 16/05	Sun 17/05	5-Day Avg.	7-Day Avg.
12-Hour	12,114	12,237	12,878	12,724	13,169	11,440	8,718	12,624	11,897
16-Hour	14,269	14,448	15,562	15,364	15,834	13,563	10,461	15,095	14,214
18-Hour	14,628	14,829	16,065	15,893	16,523	14,232	10,849	15,588	14,717
24-Hour	15,026	15,195	16,439	16,290	16,958	14,787	11,596	15,982	15,184
16/12	**1.18**	**1.18**	**1.21**	**1.21**	**1.20**	**1.19**	**1.20**	**1.20**	**1.19**
24/18	**1.03**	**1.02**	**1.02**	**1.02**	**1.03**	**1.04**	**1.07**	**1.03**	**1.03**
24/12	**1.24**	**1.24**	**1.28**	**1.28**	**1.29**	**1.29**	**1.33**	**1.27**	**1.28**
24/16	**1.05**	**1.05**	**1.06**	**1.06**	**1.07**	**1.09**	**1.11**	**1.06**	**1.07**

Table 8.8 – Two-Way ATC Traffic Volumes: ATC 1 & 2 – A2 Warrenpoint Road

WEEK 2	Mon 18/05	Tue 19/05	Wed 20/05	Thu 21/05	Fri 22/05	Sat 23/05	Sun 24/05	5-Day Avg.	7-Day Avg.
12-Hour	11,999	12,331	12,772	12,823	13,484	12,303	10,644	12,682	12,337
16-Hour	14,092	14,584	15,230	15,467	16,606	14,767	13,402	15,196	14,878
18-Hour	14,444	15,045	15,771	16,070	17,568	15,841	14,420	15,780	15,594
24-Hour	14,838	15,397	16,143	16,492	18,067	16,672	15,761	16,187	16,196
16/12	**1.17**	**1.18**	**1.19**	**1.21**	**1.23**	**1.20**	**1.26**	**1.20**	**1.21**
24/18	**1.03**	**1.02**	**1.02**	**1.03**	**1.03**	**1.05**	**1.09**	**1.03**	**1.04**
24/12	**1.24**	**1.25**	**1.26**	**1.29**	**1.34**	**1.36**	**1.48**	**1.28**	**1.31**
24/16	**1.05**	**1.06**	**1.06**	**1.07**	**1.09**	**1.13**	**1.18**	**1.07**	**1.09**

Note: ATC 2 has been infilled for all of Monday 11 May 2015 and part of Tuesday 12 May 2015. Also, Sunday 17 May 2015 has been partly infilled.

Table 8.9 – Two-Way ATC Traffic Volumes: ATC 3 – Drumalane Road

WEEK 1	Mon 11/05	Tue 12/05	Wed 13/05	Thu 14/05	Fri 15/05	Sat 16/05	Sun 17/05	5-Day Avg.	7-Day Avg.
12-Hour	2,494	2,548	2,777	2,628	2,809	3,251	3,009	2,651	2,788
16-Hour	2,970	3,084	3,389	3,239	3,395	3,848	3,533	3,215	3,351
18-Hour	3,037	3,168	3,494	3,353	3,505	3,998	3,649	3,311	3,458
24-Hour	3,111	3,220	3,542	3,416	3,575	4,070	3,810	3,373	3,535
16/12	**1.19**	**1.21**	**1.21**	**1.23**	**1.21**	**1.18**	**1.17**	**1.21**	**1.20**
24/18	**1.02**	**1.02**	**0.93**	**1.02**	**1.02**	**1.02**	**1.04**	**1.00**	**1.01**
24/12	**1.25**	**1.26**	**1.17**	**1.30**	**1.27**	**1.25**	**1.27**	**1.25**	**1.25**
24/16	**1.05**	**1.04**	**0.96**	**1.05**	**1.05**	**1.06**	**1.08**	**1.03**	**1.04**

Table 8.10 – Two-Way ATC Traffic Volumes: ATC 3 – Drumalane Road

WEEK 2	Mon 18/05	Tue 19/05	Wed 20/05	Thu 21/05	Fri 22/05	Sat 23/05	Sun 24/05	5-Day Avg.	7-Day Avg.
12-Hour	2,513	2,514	2,629	2,731	3,014	3,537	3,389	2,680	2,904
16-Hour	2,977	3,040	3,194	3,280	3,676	4,115	4,145	3,233	3,490
18-Hour	3,045	3,124	3,286	3,393	3,829	4,277	4,293	3,335	3,607
24-Hour	3,099	3,173	3,334	3,452	3,890	4,375	4,488	3,390	3,687
16/12	**1.18**	**1.21**	**1.21**	**1.20**	**1.22**	**1.16**	**1.22**	**1.21**	**1.20**
24/18	**1.02**	**1.02**	**1.01**	**1.02**	**1.02**	**1.02**	**1.05**	**1.02**	**1.02**
24/12	**1.23**	**1.26**	**1.27**	**1.26**	**1.29**	**1.24**	**1.32**	**1.26**	**1.27**
24/16	**1.04**	**1.04**	**1.04**	**1.05**	**1.06**	**1.06**	**1.08**	**1.05**	**1.06**

Note: ATC 3 has been infilled for part of Monday 11 May 2015 and part of Tuesday 12 May 2015.

Table 8.11 – Two-Way ATC Traffic Volumes: ATC 4 – Dublin Road

WEEK 1	Mon 11/05	Tue 12/05	Wed 13/05	Thu 14/05	Fri 15/05	Sat 16/05	Sun 17/05	5-Day Avg.	7-Day Avg.
12-Hour	11,198	11,325	11,388	11,950	12,103	10,742	8,453	11,593	11,023
16-Hour	13,139	13,360	13,701	14,494	14,742	12,742	10,150	13,887	13,190
18-Hour	13,503	13,755	14,135	14,964	15,357	13,349	10,606	14,343	13,667
24-Hour	13,871	14,044	14,394	15,262	15,719	13,860	11,232	14,658	14,055
16/12	**1.17**	**1.18**	**1.20**	**1.21**	**1.22**	**1.19**	**1.20**	**1.20**	**1.20**
24/18	**1.03**	**1.02**	**1.02**	**1.02**	**1.02**	**1.04**	**1.06**	**1.02**	**1.03**
24/12	**1.24**	**1.24**	**1.26**	**1.28**	**1.30**	**1.29**	**1.33**	**1.26**	**1.28**
24/16	**1.06**	**1.05**	**1.05**	**1.05**	**1.07**	**1.09**	**1.11**	**1.06**	**1.07**

Table 8.12 – Two-Way ATC Traffic Volumes: ATC 4 – Dublin Road

WEEK 2	Mon 18/05	Tue 19/05	Wed 20/05	Thu 21/05	Fri 22/05	Sat 23/05	Sun 24/05	5-Day Avg.	7-Day Avg.
12-Hour	11,403	11,448	11,309	11,770	12,228	11,056	9,047	11,632	11,180
16-Hour	13,378	13,516	13,551	14,171	14,890	12,970	10,856	13,901	13,333
18-Hour	13,757	13,969	14,057	14,710	15,558	13,604	11,381	14,410	13,862
24-Hour	14,142	14,264	14,393	15,039	15,945	14,064	12,032	14,757	14,268
16/12	**1.17**	**1.18**	**1.20**	**1.20**	**1.22**	**1.17**	**1.20**	**1.20**	**1.19**
24/18	**1.03**	**1.02**	**1.02**	**1.02**	**1.02**	**1.03**	**1.06**	**1.02**	**1.03**
24/12	**1.24**	**1.25**	**1.27**	**1.28**	**1.30**	**1.27**	**1.33**	**1.27**	**1.28**
24/16	**1.06**	**1.06**	**1.06**	**1.06**	**1.07**	**1.08**	**1.11**	**1.06**	**1.07**

Table 8.13 – Two-Way ATC Traffic Volumes: ATC 5 – A28 Fairlawns Way

WEEK 1	Mon 11/05	Tue 12/05	Wed 13/05	Thu 14/05	Fri 15/05	Sat 16/05	Sun 17/05	5-Day Avg.	7-Day Avg.
12-Hour	6,698	6,928	6,906	6,824	7,068	5,863	4,558	6,885	6,406
16-Hour	7,710	7,973	8,181	8,074	8,362	6,960	5,477	8,060	7,534
18-Hour	7,889	8,200	8,425	8,353	8,688	7,225	5,668	8,311	7,778
24-Hour	8,032	8,317	8,557	8,526	8,863	7,443	5,988	8,459	7,961
16/12	**1.15**	**1.15**	**1.18**	**1.18**	**1.18**	**1.19**	**1.20**	**1.17**	**1.18**
24/18	**1.02**	**1.01**	**1.02**	**1.02**	**1.02**	**1.03**	**1.06**	**1.02**	**1.02**
24/12	**1.20**	**1.20**	**1.24**	**1.25**	**1.25**	**1.27**	**1.31**	**1.23**	**1.24**
24/16	**1.04**	**1.04**	**1.05**	**1.06**	**1.06**	**1.07**	**1.09**	**1.05**	**1.06**

Table 8.14 – Two-Way ATC Traffic Volumes: ATC 5 – A28 Fairlawns Way

WEEK 2	Mon 18/05	Tue 19/05	Wed 20/05	Thu 21/05	Fri 22/05	Sat 23/05	Sun 24/05	5-Day Avg.	7-Day Avg.
12-Hour	6,773	7,020	6,784	7,089	7,232	5,885	5,282	6,980	6,581
16-Hour	7,751	8,125	8,052	8,364	8,614	6,989	6,346	8,181	7,749
18-Hour	7,937	8,345	8,286	8,619	8,966	7,253	6,620	8,431	8,004
24-Hour	8,077	8,484	8,425	8,794	9,175	7,522	6,947	8,591	8,203
16/12	**1.14**	**1.16**	**1.19**	**1.18**	**1.19**	**1.19**	**1.20**	**1.17**	**1.18**
24/18	**1.02**	**1.02**	**1.02**	**1.02**	**1.02**	**1.04**	**1.05**	**1.02**	**1.02**
24/12	**1.19**	**1.21**	**1.24**	**1.24**	**1.27**	**1.28**	**1.32**	**1.23**	**1.25**
24/16	**1.04**	**1.04**	**1.05**	**1.05**	**1.07**	**1.08**	**1.09**	**1.05**	**1.06**

Table 8.15 – Two-Way ATC Traffic Volumes: ATC 6 – A28 Belfast Road

WEEK 1	Mon 11/05	Tue 12/05	Wed 13/05	Thu 14/05	Fri 15/05	Sat 16/05	Sun 17/05	5-Day Avg.	7-Day Avg.
12-Hour	9,402	9,563	9,744	9,756	9,934	7,053	5,460	9,680	8,702
16-Hour	10,884	11,161	11,564	11,590	11,675	8,236	6,535	11,375	10,235
18-Hour	11,157	11,447	11,907	11,945	12,109	8,616	6,794	11,713	10,568
24-Hour	11,374	11,686	12,148	12,170	12,405	8,870	7,256	11,957	10,844
16/12	**1.16**	**1.17**	**1.19**	**1.19**	**1.18**	**1.17**	**1.20**	**1.18**	**1.18**
24/18	**1.02**	**1.02**	**1.02**	**1.02**	**1.02**	**1.03**	**1.07**	**1.02**	**1.03**
24/12	**1.21**	**1.22**	**1.25**	**1.25**	**1.25**	**1.26**	**1.33**	**1.24**	**1.25**
24/16	**1.05**	**1.05**	**1.05**	**1.05**	**1.06**	**1.08**	**1.11**	**1.05**	**1.06**

Table 8.16 – Two-Way ATC Traffic Volumes: ATC 6 – A28 Belfast Road

WEEK 2	Mon 18/05	Tue 19/05	Wed 20/05	Thu 21/05	Fri 22/05	Sat 23/05	Sun 24/05	5-Day Avg.	7-Day Avg.
12-Hour	9,253	9,334	9,627	9,550	9,832	7,456	5,996	9,519	8,721
16-Hour	10,773	10,924	11,308	11,236	11,666	8,664	7,228	11,181	10,257
18-Hour	10,997	11,222	11,592	11,645	12,102	9,042	7,619	11,512	10,603
24-Hour	11,249	11,494	11,842	11,882	12,387	9,357	8,028	11,771	10,891
16/12	**1.16**	**1.17**	**1.17**	**1.18**	**1.19**	**1.16**	**1.21**	**1.17**	**1.18**
24/18	**1.02**	**1.02**	**1.02**	**1.02**	**1.02**	**1.03**	**1.05**	**1.02**	**1.03**
24/12	**1.22**	**1.23**	**1.23**	**1.24**	**1.26**	**1.25**	**1.34**	**1.24**	**1.25**
24/16	**1.04**	**1.05**	**1.05**	**1.06**	**1.06**	**1.08**	**1.11**	**1.05**	**1.06**

Table 8.17 – Two-Way ATC Traffic Volumes: ATC 7 – Warrenpoint Harbour

WEEK 1	Mon 11/05	Tue 12/05	Wed 13/05	Thu 14/05	Fri 15/05	Sat 16/05	Sun 17/05	5-Day Avg.	7-Day Avg.
12-Hour	1,245	1,280	1,436	1,386	1,561	634	159	1,382	1,100
16-Hour	1,483	1,474	1,729	1,730	1,834	705	190	1,650	1,306
18-Hour	1,506	1,492	1,752	1,769	1,850	705	203	1,674	1,325
24-Hour	1,590	1,599	1,876	1,933	1,998	740	208	1,799	1,421
16/12	**1.19**	**1.15**	**1.20**	**1.25**	**1.17**	**1.11**	**1.19**	**1.19**	**1.19**
24/18	**1.06**	**1.07**	**1.07**	**1.09**	**1.08**	**1.05**	**1.02**	**1.07**	**1.07**
24/12	**1.28**	**1.25**	**1.31**	**1.39**	**1.28**	**1.17**	**1.31**	**1.30**	**1.29**
24/16	**1.07**	**1.08**	**1.09**	**1.12**	**1.09**	**1.05**	**1.09**	**1.09**	**1.09**

Table 8.18 – Two-Way ATC Traffic Volumes: ATC 7 – Warrenpoint Harbour

WEEK 2	Mon 18/05	Tue 19/05	Wed 20/05	Thu 21/05	Fri 22/05	Sat 23/05	Sun 24/05	5-Day Avg.	7-Day Avg.
12-Hour	1,443	1,384	1,621	1,706	1,677	574	125	1,566	1,219
16-Hour	1,728	1,677	1,928	2,023	1,888	646	158	1,849	1,435
18-Hour	1,753	1,721	1,982	2,071	1,913	651	160	1,888	1,464
24-Hour	1,903	1,877	2,115	2,228	2,036	704	175	2,032	1,577
16/12	**1.20**	**1.21**	**1.19**	**1.19**	**1.13**	**1.13**	**1.26**	**1.18**	**1.18**
24/18	**1.09**	**1.09**	**1.07**	**1.08**	**1.06**	**1.08**	**1.09**	**1.08**	**1.08**
24/12	**1.32**	**1.36**	**1.30**	**1.31**	**1.21**	**1.23**	**1.40**	**1.30**	**1.29**
24/16	**1.10**	**1.12**	**1.10**	**1.10**	**1.08**	**1.09**	**1.11**	**1.10**	**1.10**

The corresponding daily variations in traffic flows for the temporary ATCs recorded in May 2015 are shown in Figures 8.2.12 to 8.2.17.

Examination of the daily variations in ATC traffic flows indicates that there is a general trend of increasing traffic volumes between Monday and Friday at each of the ATC Sites in the study area. The data also indicates that the 12-hour traffic volumes on Tuesday 12 May 2015, the day of the MCC survey, are therefore lower than the average 12-hour 5-day ATC flows.

To adjust for the lower flows observed on Tuesday 12 May 2015, the MCC flows have been factored to represent typical annual average flows as set out later in this report under traffic annualisation.

Comparison of the MCC data and temporary ATC 12-hour flows recorded on the day of the MCC survey on Tuesday 12 May 2015 are shown in Table 8.19.

Table 8.19 – 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)	6,030	**MCC 11 (Arm B Nb)**	6,159	+2.1%
ATC 2 (Sb)	6,207	**MCC 11 (Arm B Sb)**	6,343	+2.2%
ATC 3 (Nb)	1,327[(1)]	***No Direct Comparison***	-	-
ATC 3 (Sb)	1,221[(1)]	***No Direct Comparison***	-	-
ATC 4 (Nb)	5,895	**MCC 16 (Sb)**	5,967	+1.2%
ATC 4 (Sb)	5,430	**MCC 16 (Nb)**	5,508	+1.4%
ATC 5 (Nb)	3,779	**MCC 18a (Nb)**	3,620	-4.2%
ATC 5 (Sb)	3,149	**MCC 18a (Sb)**	3,072	-2.4%
ATC 6 (Nb)	4,555	**MCC 19 (Sb)**	4,604	+1.1%
ATC 6 (Sb)	5,008	**MCC 19 (Nb)**	4,984	-0.5%
ATC 7 (Entry)	584	**MCC 12 (Entry)**	594	+1.7%
ATC 7 (Exit)	696(2)	**MCC 12 (Exit)**	541	-22.3%
Total (Excl. ATC3 & ATC7)	**40,053**		**40,265**	**+0.5%**

Note 1: ATC 3 on the Fathom Line is approximately 1.5 kilometres from the nearest MCC Site. The Quays shopping centre is also located between the two sites.

Note 2: ATC 7 (Exit) indicates a large difference compared to the comparable MCC flow which may be due to HGVs queuing at the junction.

Comparison of the ATC flows, excluding ATC 3 and ATC 7, indicate that these are within 0.5% 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 8.2.18.

8.2.4.3 Permanent Automatic Traffic Count Locations

The Department for Infrastructure maintains a system of permanent ATCs across the road network, one of which is located on the A2 Warrenpoint Road to the south of Newry and is a suitable source of long-term traffic flow data. This counter is referred to as ATC 421.

The location of this permanent ATC is shown in Figure 8.2.19.

8.2.4.4 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 from Permanent ATC 421 extends from September 2014 to August 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 8.20. This information has been used to estimate the Annual Average Daily Traffic (AADT) flow in 2015.

Table 8.20 – Permanent ATC 421: Count of Full Days Contributing to Annual Average Daily Traffic Flow

Month	Number of Full Days Available
September 2014	28 / 30
October 2014	30 / 31
November 2014	30 / 30
December 2014	13 / 31
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
Total	337 / 365

Examination of the ATC data indicates that the information is fragmented during December 2014. It should also be noted 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 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 8.21.

Table 8.21 – 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	14,501(1)	1.03
October 2015	14,142(1)	1.00
November 2015	13,755(1)	0.98
December 2015	12,637(1)	0.90
AADT	**14,074**	**–**

Note: Due to missing ATC data, September 2015 to December 2015 flows are based upon the equivalent 2014 flows and application of a growth factor.

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 8.2.20.

8.2.5 Journey Time Surveys

8.2.5.1 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 12 May 2015, Wednesday 13 May 2015, Thursday 28 May 2015 and Tuesday 9 June 2015 over two routes, namely the Red Route and the Blue Route.

It should be noted that the 2015 Irish Open golf tournament was held between Thursday 28 May 2015 and Sunday 31 May 2015 at the Royal County Down Golf Club in Newcastle, approximately 30 kilometres to the east of Newry and consequently the survey data for Thursday 28 May 2015 has been excluded from this stage of the analysis as traffic flows are not representative of typical conditions.

The survey was based on the standard moving observer technique to record journey times at each of the predefined measurement points along the route.

8.2.5.2 Journey Time Survey Locations

Various runs were carried out for the Red Route and Blue 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 limits of the journey time survey and the locations of the measurement points along the Red Route and Blue Route are shown in Figures 8.2.21 and 8.2.22 respectively.

8.2.5.3 Journey Time Survey Results

Weather conditions during the surveys were generally good. Delays were recorded at various times on each route during the days of survey.

The results from the Red Route and Blue Route journey time surveys are shown in Table 8.22 and Table 8.23 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 8.22– Summary of Journey Time Survey Results by Section (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)
TP 1 - TP 1x	0.082	60	00:00:08	22	00:00:08	24	00:00:12	16
TP 1x - TP 2	0.810	30	00:01:49	17	00:02:28	12	00:02:37	12
TP 2 - TP 3	0.129	30	00:00:32	9	00:01:01	5	00:01:06	4
TP 3 - TP 4	0.155	30	00:00:27	13	00:00:37	9	00:00:45	8
TP 4 - TP 5	0.191	30	00:00:54	8	00:00:35	12	00:00:55	8
TP 5 - TP 5a	0.617	30	00:00:53	26	00:00:49	28	00:00:49	28
TP 5a - TP 6	0.649	40	00:01:44	28	00:01:34	31	00:01:36	30
TP 6 - TP 7	0.253	40	00:00:23	21	00:00:24	21	00:00:24	21
TP 7 - TP 7x	0.313	40	00:01:30	33	00:01:30	33	00:01:28	33
TP 7x - TP 8	0.094	30	00:02:04	11	00:01:28	16	00:02:10	11
TP 8 - TP 9	0.219	30	00:01:01	6	00:01:09	5	00:00:53	7
TP 9 - TP 10	0.095	30	00:00:21	16	00:00:35	10	00:00:25	13
TP 10 - TP 11	0.315	30	00:00:22	16	00:00:39	9	00:00:45	8
TP 11 - TP 12	0.254	30	00:00:22	11	00:00:33	7	00:00:20	12
TP 12 - TP 13	0.650	30	00:00:26	24	00:00:25	26	00:00:25	25
TP 13 - TP 14	0.617	30	00:01:20	10	00:01:42	8	00:01:15	11
TP 14 - TP 15	0.166	30	00:00:30	16	00:00:34	14	00:00:34	14
TP 15 - TP 16	0.150	30	00:00:12	11	00:00:10	13	00:00:11	12
TP 16 - TP 17	0.163	30	00:01:03	25	00:01:00	26	00:01:02	26
TP 17 - TP 17x	0.108	30	00:00:30	30	00:00:29	32	00:00:30	31
TP 17x - TP 18	0.281	40	00:00:53	31	00:00:53	32	00:00:55	30
TP 18 - TP 19	0.351	50	00:01:00	36	00:01:01	35	00:01:01	35
TP 19 - TP 20	0.209	50	00:00:37	23	00:00:35	24	00:00:41	21
TP 20 - TP 21	0.060	40	00:01:29	31	00:01:29	31	00:01:34	29
TP 21 - TP 22	0.711	40	00:00:17	20	00:00:17	20	00:00:18	19
TP 22 - TP 23	0.409	40	00:01:20	31	00:01:36	25	00:01:20	31
TP 23 - TP 24	0.747	50	00:00:33	27	00:00:31	28	00:00:32	28
TP 24 - TP 25	0.959	50	00:01:04	35	00:01:05	34	00:01:07	34
TP 25 - TP 25x	0.380	40	00:01:10	26	00:01:04	29	00:01:05	28
TP 25x - TP 26	1.224	30	00:00:44	21	00:00:30	30	00:00:31	29
TP 26 - TP 27	0.154	30	00:01:12	21	00:01:26	18	00:01:30	17
TP 27 - TP 28	1.092	30	00:00:12	12	00:00:19	7	00:00:22	6
TP 28 - TP 29	0.393	30	00:00:36	14	00:00:37	14	00:00:36	14
TP 29 - TP 30	1.003	30	00:00:30	26	00:00:30	26	00:00:29	27
TP 30 - TP 31	0.817	30	00:01:08	9	00:01:00	10	00:01:25	7
TP 31 - TP 32	0.407	30	00:00:27	10	00:00:34	8	00:00:43	7
TP 32 - TP 32x	0.690	30	00:01:14	24	00:01:20	22	00:01:15	23
TP 32x - TP 33	0.061	60	00:00:08	24	00:00:08	23	00:00:09	22
Overall	**17.821**		**00:31:05**	**21**	**00:32:48**	**20**	**00:33:54**	**20**

Table 8.23 – Summary of Journey Time Survey Results by Section (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)
TP 1 - TP 2	5.204	70	00:03:27	56	00:03:18	59	00:03:21	58
TP 2 - TP 3	2.194	70	00:01:36	51	00:01:33	53	00:01:33	53
TP 3 - TP 3x	0.141	60	00:00:17	19	00:00:14	22	00:00:14	23
TP 3x - TP 4	0.839	30	00:02:02	15	00:01:33	20	00:02:16	14
TP 4 - TP 5	0.086	30	00:00:36	5	00:00:30	6	00:00:30	6
TP 5 - TP 6	0.157	30	00:00:24	15	00:00:45	8	00:00:52	7
TP 6 - TP 7	0.194	30	00:00:26	17	00:00:23	19	00:00:35	12
TP 7 - TP 7x	0.616	30	00:00:46	30	00:00:42	33	00:00:49	28
TP 7x - TP 8	1.314	40	00:01:30	33	00:01:32	32	00:01:42	29
TP 8 - TP 9	1.538	70	00:01:16	45	00:01:18	44	00:01:16	45
TP 9 - TP 10	0.265	60	00:00:32	18	00:00:31	19	00:00:32	19
TP 10 - TP 11	5.588	70	00:03:28	60	00:03:29	60	00:03:23	62
TP 11 - TP 12	5.035	70	00:03:10	59	00:03:08	60	00:03:06	61
TP 12 - TP 12x	2.161	60	00:01:47	45	00:01:43	47	00:01:48	45
TP 12x - TP 13	0.208	40	00:00:21	22	00:00:17	27	00:00:18	25
TP 13 - TP 14	0.098	40	00:00:13	17	00:00:12	18	00:00:22	10
TP 14 - TP 14x	0.204	40	00:00:14	34	00:00:13	35	00:00:13	34
TP 14x - TP 15	2.080	60	00:01:39	47	00:01:34	49	00:01:40	46
TP 15 - TP 16	4.804	70	00:03:06	58	00:03:00	60	00:02:58	60
TP 16 - TP 17	5.596	70	00:03:34	58	00:03:25	61	00:03:26	61
TP 17 - TP 18	0.265	60	00:00:33	18	00:00:31	19	00:00:32	19
TP 18 - TP 19	1.630	70	00:01:30	41	00:01:29	41	00:01:26	42
TP 19 - TP 19x	1.308	40	00:01:28	33	00:01:26	34	00:01:23	35
TP 19x - TP 20	0.616	30	00:02:00	11	00:01:26	16	00:02:59	8
TP 20 - TP 21	0.167	30	00:00:14	26	00:00:58	6	00:01:03	6
TP 21 - TP 22	0.151	30	00:01:13	5	00:00:35	10	00:00:23	14
TP 22 - TP 23	0.170	30	00:00:51	8	00:01:29	4	00:01:01	6
TP 23 - TP 23x	0.834	30	00:01:34	20	00:01:39	19	00:01:25	22
TP 23x - TP 24	0.085	60	00:00:08	25	00:00:08	25	00:00:08	25
TP 24 - TP 25	2.237	70	00:01:42	49	00:01:31	55	00:01:38	51
TP 25 - TP 26	5.193	70	00:03:29	56	00:03:13	60	00:03:23	57
Overall	**50.978**		**00:45:09**	**42**	**00:43:47**	**43**	**00:46:14**	**41**

The average directional speeds observed during the journey time surveys for the two routes are also shown in Figures 8.2.23 and 8.2.24.

The speeds observed for each journey time run undertaken for the two survey routes are shown in Figures 8.2.25 and 8.2.26 respectively. The corresponding variation in journey speeds is shown in Figures 8.2.27 and 8.2.28.

The average speeds observed during the Red Route and Blue Route surveys by time period are shown in Table 8.24 with the most typical run that represents each time period also shown. The colour code adopted for Table 8.22 and Table 8.23 has been used for Table 8.24.

Table 8.24 – Typical Journey Time Speeds by Time Period

Route / Time Period	Average Speed Across Time Period (mph)	Typical Run	Average Speed for Typical Run (mph)	Start Time of Run Chosen
RED ROUTE				
AM Peak Period	**21.4**	AM RUN 7	**21.5**	07:52:50
Inter-Peak Period	**20.3**	IP RUN 16	**20.2**	13:52:57
PM Peak Period	**19.6**	PM RUN 2	**19.7**	16:00:26
BLUE ROUTE				
AM Peak Period	**42.1**	AM RUN 4	**41.4**	09:17:17
Inter-Peak Period	**43.4**	IP RUN 7	**42.9**	13:16:54
PM Peak Period	**41.1**	PM RUN 1	**41.8**	16:01:58

GPS data for each survey run has been processed to provide an indication of speeds between each measurement point in both directions of travel.

Figures 8.2.29 to 8.2.31 indicate data for the survey runs that correspond to the average speeds during the AM peak, Inter-peak and PM peak for the Red Route survey. The corresponding information for the Blue Route survey is shown in Figures 8.2.32 to 8.2.34.

Examination of the information shown in the Figures, which has been colour-coded to indicate the variations in speed along the Red Route and 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 will be due in part to the presence of strategic traffic passing through the city in addition to the local traffic movements within the city.

8.2.6 Vehicle Registration Surveys

8.2.6.1 Methodology

Automatic Number Plate Recognition (ANPR) surveys were undertaken at 4 locations around Newry on Tuesday 12 May 2015 for a period of 12 hours from 07:00 hours to 19:00 hours to define trip patterns between strategic points on the network.

8.2.6.2 Vehicle Registration Survey Locations

The ANPR surveys were undertaken at the following locations:

- Site 1 – A2 Warrenpoint Road;
- Site 2 – Dublin Road;
- Site 3 – A28 Fairlawns Way; and
- Site 4 – A28 Belfast 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 8.2.35.

8.2.6.3 Vehicle Registration Survey Sampling

For the purpose of the initial analysis, all matched trips over any duration have been included in the dataset.

The sampling results from the vehicle registration number surveys and percentage matches for each survey location are shown in Table 8.25.

Table 8.25 – ANPR Achieved Survey Sample Rates (07:00 hours – 19:00 hours) (Any Trip Duration)

ANPR Site	Traffic Flow	ANPR Sample	ANPR Sample %	Matched ANPR Count	ANPR Matched %
Site 1 Entry	6,132	5,552	90.5%	2,983	53.7%
Site 1 Exit	6,299	5,863	93.1%	3,036	51.8%
Site 2 Entry	5,975	5,394	90.3%	2,535	47.0%
Site 2 Exit	5,481	5,020	91.6%	2,608	52.0%
Site 3 Entry	3,100	2,818	90.9%	1,415	50.2%
Site 3 Exit	3,698	3,306	89.4%	1,528	46.2%
Site 4 Entry	4,998	4,715	94.3%	2,243	47.6%
Site 4 Exit	4,584	4,237	92.4%	2,004	47.3%
Totals	40,267	36,905	91.7%	18,352	49.7%

Examination of the results from the ANPR survey indicates that the registration numbers of approximately 92% of all vehicles that passed the survey points on the key routes into Newry were recorded. Due to the high level of sampling achieved, the derived trip patterns can be used with a high degree of confidence.

An initial 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 20 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 within a 20 minute period.

8.2.6.4 Vehicle Registration Survey Results

Examination of the survey results provides the following matched trip matrices for the full 12-hour period, AM peak period, Inter-peak period and PM peak period are shown in Table 8.26 to Table 8.29.

Table 8.26 – ANPR Matched All-Vehicle Trips (Duration Less Than 20 minutes): 12-Hour Period (07:00 hours – 19:00 hours)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	105	492	223	344	**1,164**
Site 2 Entry	431	310	32	15	**788**
Site 3 Entry	233	17	137	12	**399**
Site 4 Entry	384	11	48	134	**577**
Total Trips	**1,153**	**830**	**440**	**505**	**2,928**

Table 8.27 – ANPR Matched All-Vehicle Trips (Duration Less Than 20 minutes): AM Peak Period (07:00 hours – 10:00 hours)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	34	177	80	127	**418**
Site 2 Entry	89	83	9	3	**184**
Site 3 Entry	69	5	36	2	**112**
Site 4 Entry	85	2	10	43	**140**
Total Trips	**277**	**267**	**135**	**175**	**854**

Table 8.28 – ANPR Matched All-Vehicle Trips (Duration Less Than 20 minutes): Inter-Peak Period (10:00 hours – 16:00 hours)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	51	205	88	142	**486**
Site 2 Entry	196	140	19	10	**365**
Site 3 Entry	93	8	63	8	**172**
Site 4 Entry	150	8	24	61	**243**
Total Trips	**490**	**361**	**194**	**221**	**1,266**

Table 8.29 – ANPR Matched All-Vehicle Trips (Duration Less Than 20 minutes): PM Peak Period (16:00 hours – 19:00 hours)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	20	110	55	75	**260**
Site 2 Entry	146	87	4	2	**239**
Site 3 Entry	71	4	38	2	**115**
Site 4 Entry	149	1	14	30	**194**
Total Trips	**386**	**202**	**111**	**109**	**808**

The trip pattern desire lines derived from the ANPR survey data are shown diagrammatically in **Figure 8.2.36** and indicate the directional trip movements observed between ANPR Site 1 and ANPR Sites 2, 3 and 4 for the full 12-hour survey period.

The sign-posted routes for vehicles travelling between the four strategic points are shown in Figure 8.2.37.

The distribution of trips entering the study area, based on the matched trips within a 20 minute period, is shown in Table 8.30.

Table 8.30 – Trip Distribution by Entry Points: 12-Hour Period (07:00 hours – 19:00 hours) (Duration Less Than 20 minutes)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	9%	42%	19%	30%	**100%**
Site 2 Entry	55%	39%	4%	2%	**100%**
Site 3 Entry	59%	4%	34%	3%	**100%**
Site 4 Entry	67%	2%	8%	23%	**100%**

Examination of the ANPR data indicates that the main two-way all vehicle movements are as follows:

- Between Site 1 and Site 2 accounts for 923 (32%) of the 2,928 matched trips;
- Between Site 1 and Site 3 accounts for 456 (16%) of the 2,928 matched trips; and
- Between Site 1 and Site 4 accounts for 728 (25%) of the 2,928 matched trips.

The number of trips identified by hour for the three main movements is shown in Table 8.31. It should be noted that these patterns could include vehicles that make the same movement throughout the course of a day on more than one occasion.

Table 8.31 – ANPR All-Vehicle Matched Trips by Time of Day (Duration Less Than 20 minutes)

Hour	Site 1 to Site 2	Site 2 to Site 1	Site 1 to Site 3	Site 3 to Site 1	Site 1 to Site 4	Site 4 to Site 1
07:00 – 08:00	**77**	23	**40**	**29**	**60**	19
08:00 – 09:00	72	**40**	25	19	43	**33**
09:00 – 10:00	28	26	15	21	24	**33**
10:00 – 11:00	22	27	**23**	11	27	22
11:00 – 12:00	**42**	**44**	16	16	22	24
12:00 – 13:00	35	36	10	9	20	30
13:00 – 14:00	30	30	8	21	23	30
14:00 – 15:00	35	28	14	**22**	21	18
15:00 – 16:00	41	31	17	14	**29**	26
16:00 – 17:00	36	24	17	20	29	35
17:00 – 18:00	**43**	**79**	**21**	**31**	**32**	**72**
18:00 – 19:00	31	43	17	20	14	42
Total Trips	**492**	**431**	**223**	**233**	**344**	**384**

Note: The largest counts by movement by time period are indicated in bold.

Examination of the ANPR data indicates that the highest number of matched trips was identified between Site 1 to Site 2 and vice versa, which equates to 492 and 431 journeys respectively. The information suggests that there is a tidal movement taking place with the majority of commuters making the journey from Site 1 to Site 2 (A2 Warrenpoint Road to Cloghogue Junction on the A1) in the AM peak period and returning during the PM peak period.

The next busiest movements identified were from Site 1 to Site 4 and vice versa with 344 and 384 journeys respectively. This information suggests that there is a tidal movement taking place with the majority of commuters making the journey from Site 1 to Site 4 (A2 Warrenpoint Road to A28 Belfast Road) in the AM peak period and returning during the PM peak period.

The next busiest movements identified were from Site 1 to Site 3 and vice versa with 223 and 233 journeys respectively.

The Heavy Vehicle trip patterns identified from the ANPR survey data and the corresponding Heavy Vehicle composition percentages are shown in Table 8.32 and Table 8.33 respectively.

Table 8.32 – ANPR Matched Heavy Vehicle Trips (Duration Less Than 20 minutes): 12-Hour Period (07:00 hours – 19:00 hours)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	5	99	41	61	**206**
Site 2 Entry	71	8	1	1	**81**
Site 3 Entry	67	0	3	1	**71**
Site 4 Entry	62	2	3	3	**70**
Total Trips	**205**	**109**	**48**	**66**	**428**

Table 8.33 – ANPR Matched Heavy Vehicle Trip Distribution by Entry Point (Duration Less Than 20 minutes): 12-Hour Period (07:00 hours – 19:00 hours)

	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit	Total Trips
Site 1 Entry	2%	48%	20%	30%	**100%**
Site 2 Entry	88%	10%	1%	1%	**100%**
Site 3 Entry	94%	0%	4%	1%	**100%**
Site 4 Entry	89%	3%	4%	4%	**100%**

In terms of Heavy Vehicle trips, the two most significant movements occur between Site 1 and Site 2 and vice versa, with 99 vehicles and 71 vehicles making these two movements respectively over a 12-hour period between the A1 and Warrenpoint Harbour.

Examination of the ANPR data indicates that the main two-way Heavy Vehicle movements are as follows:

- Between Site 1 and Site 2 accounts for 170 (40%) of the 428 matched trips;
- Between Site 1 and Site 3 accounts for 108 (25%) of the 428 matched trips; and
- Between Site 1 and Site 4 accounts for 123 (29%) of the 428 matched trips.

8.2.6.5 ANPR Journey Time Results

A summary of the traffic volumes and journey time information derived from the ANPR data between the four strategic points on the network during the 12-hour, AM peak period, Inter-peak period and PM peak period is shown in Table 8.34. This information is presented for matched trips less than 20 minutes, supported by details of additional trips up to 30 minutes or greater.

Table 8.34 –Summary of ANPR Traffic Volumes and Journey Times

Movement / Time Period		Total	Journey Time < 20 Minutes	20 Minutes ≤ Journey Time < 30 Minutes	Journey Time ≥ 30 Minutes
SITE 1 TO SITE 2					
12-Hour Period	**No.**	**548**	492	23	33
	%		89.8%	4.2%	6.0%
AM Peak Period	**No.**	**188**	177	5	6
	%		94.1%	2.7%	3.2%
PM Peak Period	**No.**	**122**	110	4	8
	%		90.2%	3.3%	6.6%
SITE 2 TO SITE 1					
12-Hour Period	**No.**	**503**	431	20	52
	%		85.7%	4.0%	10.3%
AM Peak Period	**No.**	**100**	89	1	10
	%		89.0%	1.0%	10.0%
PM Peak Period	**No.**	**164**	146	7	11
	%		89.0%	4.3%	6.7%
SITE 1 TO SITE 3					
12-Hour Period	**No.**	**263**	223	21	19
	%		84.8%	8.0%	7.2%
AM Peak Period	**No.**	**90**	80	4	6
	%		88.9%	4.4%	6.7%
PM Peak Period	**No.**	**59**	55	2	2
	%		93.2%	3.4%	3.4%
SITE 3 TO SITE 1					
12-Hour Period	**No.**	**267**	233	14	20
	%		87.3%	5.2%	7.5%
AM Peak Period	**No.**	**73**	69	1	3
	%		94.5%	1.4%	4.1%
PM Peak Period	**No.**	**80**	71	4	5
	%		88.8%	5.0%	6.3%
SITE 1 TO SITE 4					
12-Hour Period	**No.**	**404**	344	23	37
	%		85.1%	5.7%	9.2%
AM Peak Period	**No.**	**144**	127	6	11
	%		88.2%	4.2%	7.6%
PM Peak Period	**No.**	**86**	75	7	4
	%		87.2%	8.1%	4.7%
SITE 4 TO SITE 1					
12-Hour Period	**No.**	**469**	384	36	49
	%		81.9%	7.7%	10.4%
AM Peak Period	**No.**	**105**	85	12	8
	%		81.0%	11.4%	7.6%
PM Peak Period	**No.**	**176**	149	9	18
	%		84.7%	5.1%	10.2%
TOTAL					
12-Hour Period	**No.**	**2,454**	**2,107**	**137**	**210**
	%		**85.9%**	**5.6%**	**8.6%**
AM Peak Period	**No.**	**700**	627	29	44
	%		89.6%	4.1%	6.3%
PM Peak Period	**No.**	**687**	606	33	48
	%		88.2%	4.8%	7.0%

The above information indicates that approximately 86% of matched trips for the three main movements take place with a trip duration of 20 minutes or less. Excluding journey times greater than 20 minutes removes the potential for intermediate-stop trips to define a data-set that is more likely to represent only non-stop trips. The observed journey times for all matched trips that have a duration of less than 20 minutes are shown in Table 8.35.

Table 8.35 – ANPR Journey Times by AM Peak, Inter-Peak and PM Peak Time Periods (Duration Less Than 20 minutes)

	Time Period	Site 1 Exit	Site 2 Exit	Site 3 Exit	Site 4 Exit
Site 1 Entry	**AM (3 Hours)**	-	00:08:25	00:11:23	00:11:40
	IP (6 Hours)	-	**00:09:49**	**00:14:13**	**00:13:38**
	PM (3 Hours)	-	00:09:31	00:13:44	00:12:31
Site 2 Entry	**AM (3 Hours)**	00:09:58	-	**00:14:34**	**00:15:17**
	IP (6 Hours)	**00:10:33**	-	00:14:11	00:15:10
	PM (3 Hours)	00:09:51	-	00:13:39	00:13:09
Site 3 Entry	**AM (3 Hours)**	00:11:51	00:15:39	-	**00:15:46**
	IP (6 Hours)	**00:12:35**	**00:15:53**	-	00:10:54
	PM (3 Hours)	00:12:04	00:13:38	-	00:10:11
Site 4 Entry	**AM (3 Hours)**	**00:12:05**	00:15:54	**00:12:07**	-
	IP (6 Hours)	00:11:55	00:13:29	00:11:04	-
	PM (3 Hours)	00:12:03	**00:17:25**	00:08:20	-

8.2.7 Pedestrian Surveys

8.2.7.1 Methodology

Pedestrian surveys were undertaken at nine locations within the study area on Tuesday 12 May 2015 to define pedestrian volumes and movements around the city centre.

The Pedestrian Surveys were undertaken at the following locations:

- Site 1 – Dublin Road / The Glen / Dominic Street / Bridge Street / Drumalane Road Junction;
- Site 2 – Bridge Street / Buttercrane Shopping Centre / The Quays Junction;
- Site 3 – Bridge Street / Buttercrane Quay / William Street / Albert Basin Junction;
- Site 4 – William Street / River Street / St Marys Street Junction;
- Site 5 – William Street / Kilmorey Junction;
- Site 6 – Abbey Way / Boat Street / William Street Junction;
- Site 7 – Abbey Way / High Street Junction;
- Site 8 – Trevor Hill / Abbey Way / Kildare Street / Sugar Island Junction; and
- Site 9 – Trevor Hill / New Street / Downshire Road / Sandys Street Double Roundabout.

The Pedestrian 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 pedestrian movements.

8.2.7.2 Pedestrian Survey Locations

The locations of the Pedestrian Surveys are shown in Figure 8.2.38.

8.2.7.3 Pedestrian Survey Results

The results from the Pedestrian Surveys for each site are shown in Table 8.36.

Table 8.36 – Pedestrian Counts by Site

Time	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
07:00	6	23	23	8	15	1	0	12	20
07:15	6	26	45	5	16	3	0	25	35
07:30	15	65	28	4	7	0	4	42	18
07:45	29	126	29	5	19	1	4	20	16
08:00	24	44	41	4	15	5	6	28	49
08:15	25	62	52	10	41	18	3	46	42
08:30	22	79	111	8	42	9	3	90	97
08:45	47	126	51	11	49	5	0	95	149
09:00	31	90	56	1	10	3	0	45	68
09:15	27	135	36	2	26	11	0	58	67
09:30	10	101	60	9	34	9	11	75	51
09:45	31	96	60	7	28	5	8	85	68
10:00	22	86	36	6	21	0	12	73	42
10:15	19	108	57	9	23	9	6	77	50
10:30	23	126	46	4	19	2	2	74	45
10:45	43	190	50	4	10	1	11	59	42
11:00	23	232	49	6	12	3	6	98	47
11:15	33	177	41	9	30	5	6	80	72
11:30	30	151	83	5	26	2	12	53	48
11:45	28	194	103	3	51	7	11	113	42
12:00	31	213	117	14	66	6	11	103	46
12:15	37	236	112	6	24	11	9	86	38
12:30	16	247	70	7	30	9	12	52	36
12:45	23	243	95	4	18	10	2	57	37
13:00	28	210	162	16	54	8	4	131	92
13:15	20	200	107	6	31	4	12	88	40
13:30	33	198	102	5	22	2	9	103	68
13:45	29	205	74	4	26	13	18	119	95
14:00	20	177	78	6	25	7	11	109	70
14:15	29	182	70	3	21	7	5	103	39
14:30	19	149	87	7	19	7	13	79	31
14:45	29	170	72	7	28	5	5	81	49
15:00	19	185	82	4	40	10	7	113	155
15:15	19	176	87	11	30	0	9	155	53
15:30	16	239	109	2	15	5	21	114	66
15:45	19	230	46	1	19	4	11	121	58
16:00	25	222	80	5	25	0	14	98	78
16:15	25	170	90	9	31	15	10	119	58
16:30	41	145	83	7	17	2	10	59	37
16:45	40	179	96	11	51	5	9	71	46
17:00	42	208	88	10	32	2	19	74	47
17:15	22	136	56	4	25	5	1	75	54
17:30	43	173	67	7	18	3	8	103	52
17:45	14	91	49	6	10	0	11	56	22
18:00	14	111	69	8	19	7	6	71	59
18:15	23	31	83	11	21	7	11	35	26
18:30	13	37	55	6	9	9	2	33	35
18:45	17	30	42	3	12	5	5	43	34
Total	**1,200**	**7,030**	**3,385**	**310**	**1,232**	**267**	**370**	**3,699**	**2,589**

The observed pedestrian movements are summarised in Figure 8.2.39.

Examination of the survey information indicates a significant number of pedestrian movements within the city centre. A total of 2,363 pedestrian movements were observed crossing Bridge Street between Site 1 and Site 3. The majority of these movements can be attributed to the proximity of The Quays and Buttercrane Quay Shopping Centres, with pedestrians crossing between the two shopping centres and the associated parking facilities. A total of 1,341 pedestrian movements were observed crossing River Street and Kilmorey Street between Site 4 and Site 5.

A total of 3,299 pedestrian movements were observed crossing Abbey Way and Trevor Hill between Site 6 and Site 9. This movement can be attributed to local shops, offices, schools and council buildings typical of any city centre.

8.3 Indicative Costs, Risks and Optimism Bias

8.3.1 Basis of Cost Estimates

Cost estimates were prepared for each of the Proposed Improvement Corridors. These costs were used to define both the total construction cost and total land cost for the Proposed Improvement Corridors.

In accordance with the procedures established by The Department for Infrastructure policy and procedure guide RSPPG_E058, an appropriate allowance for risk was determined for the Proposed Improvement Corridors. These risk allowances are included in the estimated scheme costs.

A breakdown of the estimated costs of the Proposed Improvement Corridors in Quarter 2, 2014 prices is shown in Table 8.37 and Table 8.38.

Table 8.37 – Estimated Proposed Improvement Corridors Scheme Costs Summary: Corridor 1 to Corridor 3

Item	Scheme Cost (£m's)		
	Corridor 1	Corridor 2	Corridor 3
Total Construction Cost	£70.569	£62.808	£80.014
Total Land Cost	£4.200	£1.073	£1.395
Preparation (12% of Total Construction and Land Costs)	£8.972	£7.666	£9.769
Supervision (5% of Total Construction and Land Costs)	£3.738	£3.194	£4.070
Total Scheme Cost	**£87.480**	**£74.740**	**£95.249**

Note: All costs are in Quarter 2, 2014 prices and exclude VAT.

Table 8.38 – Estimated Proposed Improvement Corridors Scheme Costs Summary: Corridor 4 to Corridor 5

Item	Scheme Cost (£m's)		
	Corridor 4		Corridor 5
	Option A	Option B	
Total Construction Cost	£74.612	£68.932	£44.848
Total Land Cost	£1.339	£1.320	£1.412
Preparation (12% of Total Construction and Land Costs)	£9.114	£8.430	£5.551
Supervision (5% of Total Construction and Land Costs)	£3.798	£3.513	£2.313
Total Scheme Cost	**£88.862**	**£82.195**	**£54.123**

Note: All costs are in Quarter 2, 2014 prices and exclude VAT.

8.3.2 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 The Department for Infrastructure 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 44% for optimism bias has been used.

A breakdown of the estimated costs of the Proposed Improvement Corridors, including an allowance of 44% for optimism bias, is shown in Table 8.39 and Table 8.40. All costs are in Quarter 2, 2014 prices.

Table 8.39 – Estimated Proposed Improvement Corridors Scheme Costs Summary, Including 44% Optimism Bias: Corridor 1 to Corridor 3

Item	Scheme Cost (£m's)		
	Corridor 1	Corridor 2	Corridor 3
Total Construction Cost	£101.620	£90.443	£115.221
Total Land Cost	£6.048	£1.545	£2.009
Preparation (12% of Total Construction and Land Costs)	£12.920	£11.039	£14.068
Supervision (5% of Total Construction and Land Costs)	£5.383	£4.599	£5.861
Total Scheme Cost	**£125.971**	**£107.626**	**£137.159**

Note: All costs are in Quarter 2, 2014 prices and exclude VAT.

Table 8.40 – Estimated Proposed Improvement Corridors Scheme Costs Summary, Including 44% Optimism Bias: Corridor 4 to Corridor 5

Item	Scheme Cost (£m's)		
	Corridor 4		Corridor 5
	Option A	Option B	
Total Construction Cost	£107.441	£99.262	£64.581
Total Land Cost	£1.927	£1.901	£2.033
Preparation (12% of Total Construction and Land Costs)	£13.124	£12.140	£7.994
Supervision (5% of Total Construction and Land Costs)	£5.468	£5.058	£3.331
Total Scheme Cost	**£127.962**	**£118.361**	**£77.937**

Note: All costs are in Quarter 2, 2014 prices and exclude VAT.

8.3.3 Cost Profile

The traffic and economic assessment of the Proposed Improvement Corridors is based on a two year construction period. The associated cost profile shown in Table 8.41 has been adopted.

Table 8.41 – Proposed Improvement Corridors 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.

8.4 Development of Computer Models

8.4.1 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).

8.4.2 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 appraisal 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 appraisal 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 appraisal period. The procedures for developing and applying COBA are set out in the Design Manual for Roads and Bridges (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 appraisal period and the benefits accruing over the 60 year appraisal 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 16, which was released in 2014, 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 Improvement Corridors over a 60 year appraisal period after the road opens to traffic. COBA11 R16 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 R16 includes the latest Road Traffic Forecasts (2013) traffic growth as the default assumption of traffic growth for major road schemes, rather than the National Road Traffic Forecasts (NRTF) originally defined in 1997.

8.4.3 The COBA Model

A COBA model was developed to compare the cost and road user benefits of the Proposed Improvement Corridors, 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 Improvement Corridors being considered. Due to the strategic nature of the proposed improvement, the limits of the model extend significantly beyond the improvement corridors.

The modelled area is shown in Figure 8.4.1.

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 2015.

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 below.

8.4.4 COBA Do-Minimum Model

8.4.4.1 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 8.4.2.

8.4.4.2 Trip Matrix Building

As discussed earlier in this report, 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.

The surveys included Manual Classified Counts (MCCs), Queue Surveys, Automatic Traffic Counts (ATCs), the measurement of typical Journey Times, Vehicle Registration Surveys and Pedestrian Surveys. These surveys were undertaken during May 2015 when traffic conditions were expected to be typical of average demand.

Based on the MCC information collected within the study area, the 2015 12-hour weekday vehicle proportions defined in the COBA Do-Minimum model are as follows:

- 82.6% Cars;
- 10.7% Light Goods Vehicles (LGV);
- 2.5% Other Goods Vehicles 1 (OGV1);
- 3.3% Other Goods Vehicles 2 (OGV2); and
- 0.9% Buses and Coaches (PSV).

The information derived directly from the observed May 2015 traffic surveys has been used to define trip patterns within the study area.

8.4.4.3 Trip Assignment

The characteristics of the main routes in and around Newry and the nature of the Proposed Improvement Corridors 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 DMRB Stage 1 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.

8.4.4.4 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 appraisal of the Proposed Improvement Corridors.

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 2015 AAWDT Flow: 7,489 vehicles
- 16-Hour 2015 AAWDT Flow: 8,902 vehicles

This information is considered sufficient to derive a local 'E' factor, which at 1.19 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 1.19.

M-Factor

The calculation of a local M-Factor requires the derivation of 16-hour AAWDT flows and 24-hour AAWDT flows on the road network. The 24-hour AAWDT flow is available from the 2015 permanent ATC data. However, 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 2015 MCC Flow: 11,386 vehicles
- Local E-Factor: 1.19
- Derived 16-Hour AAWDT Flow: 13,549 vehicles

The 16-hour AAWDT flow derived from the observed 2015 traffic flows and the local E-Factor and the 24-hour AAWDT flows derived from 2015 permanent ATC data provide a reasonable indication of traffic flows on the road network. A local M-Factor, which converts the 16-hour AAWDT matrix to a 24-hour AADT matrix, has been derived from the following available information:

- 16-Hour 2015 AAWDT Flow: 13,549 vehicles
- 24-Hour 2015 AADT Flow: 14,074 vehicles

This information is considered sufficient to derive a local M-Factor, which at 379 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 379 is considered to be more representative of local conditions.

The M-Factor adopted for the COBA model is 379.

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): 14,747 vehicles

The Seasonality Index derived from the 2015 permanent ATC data is 1.09, 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 1.09.

8.4.4.5 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 May 2015 surveys.

To demonstrate that the model provides a reasonable representation of existing transport conditions in the area, the observed journey times and modelled times on the network derived from the COBA model were compared. The results of this comparison for the Red and Blue routes are shown in Table 8.42 and Table 8.43 respectively.

Table 8.42 – Model Calibration and Validation: Comparison of Observed and Modelled Link Times: Red Route

RED ROUTE	Average Total Time (secs)	Average Speed (kph)
Observed	1,952	32.5
Modelled	1,953	32.5
Difference	1	0.0
% Difference	0.1%	-0.1%

Table 8.43 – Model Calibration and Validation: Comparison of Observed and Modelled Link Times: Blue Route

BLUE ROUTE	Average Total Time (secs)	Average Speed (kph)
Observed	2,682	68.2
Modelled	2,663	68.7
Difference	-19	0.5
% Difference	-0.7%	0.7%

The correlation between the observed times on both the Red and Blue Routes and the modelled times derived from the calibrated model confirms that the model provides a reasonable representation of actual operating conditions on the network.

8.4.5 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 Indicative Alignment Options within each of the Proposed Improvement Corridors. The corresponding network diagrams indicating the various links and nodes which define the Do-Something Networks are shown in Figures 8.4.3 to 8.4.8.

The COBA Do-Something network consists of six discrete models for the six Proposed Improvement Corridors.

The volume of traffic likely to transfer on to the Indicative Alignment Options within each of the Proposed Improvement Corridors has been based on an analysis of observed traffic conditions within and around Newry.

8.4.6 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 Improvement Corridors, QUADRO models have not been developed to examine the effects of delays during the construction period.

8.4.7 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 Improvement Corridors.

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 Improvement Corridors can be defined by the application of national forecasts of traffic growth.

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. Given that uncertainty is inherently part of predicting future behaviour and trends, national predictions present a central forecast of growth bounded by lower and higher forecasts of growth.

To assist in defining the most appropriate national forecast, the data available from the long term Automatic Traffic Counts (ATCs) maintained by The Department for Infrastructure 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 8.4.9.

A summary of the 2004 to 2014 ATC data from the Permanent ATCs is shown below in Table 8.44. 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 8.44 – Summary of Permanent ATC Annual Average Daily Traffic Flows

Year	ATC 420 Flow	ATC 421 Flow	ATC 437 Flow	ATC 438 Flow	ATC 439 Flow	ATC 421 & 439 Average Flow
2004	-	13,790	-	-	17,380	15,585
2005	-	13,360	-	-	17,720	15,540
2006	-	13,910	-	-	18,060	15,985
2007	-	14,550	-	-	18,490	16,520
2008	-	14,170	-	-	19,250	16,710
2009	-	14,030	-	-	-	-
2010	-	13,650	-	-	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**

Note: Due to the opening of the A1 Newry bypass in 2010 the 2004 to 2010 ATC data has been excluded from the analysis at ATC Sites 420, 437 & 438.

The trend lines of the recorded Permanent ATC data from 2004 to 2014 are shown in Figure 8.4.10.

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 appraisal of the proposed Newry Southern Relief Road, it has therefore been assumed that traffic growth will generally follow National Road Traffic Forecast (NRTF) central growth projections which equates to approximately 1.1% growth per annum over the 8-year period between the 2015 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 central traffic growth from the 2015 Base Year to the 2023 Opening Year and the 2037 Design Year are shown in Table 8.45.

Whereas the published National Road Traffic Forecast (NRTF) central growth forecasts extend to the year 2031, the latest Road Traffic Forecast (RTF) extends further to 2040. To provide a reasonable growth forecast for the economic assessment, the NRTF predications have been extrapolated from 2031 to 2040 to reflect the trends defined in the RTF predictions.

Table 8.45 – National Road Traffic Forecasts Growth Factors

Period (Years)	NRTF Central Growth (Main Assessment)	NRTF Low Growth (Sensitivity Test)
2015 Base Year to 2023 Opening Year	1.091	1.059
2023 Opening Year to 2037 Design Year	1.101	1.052

8.4.8 Accident Data

An analysis of recent trends in road traffic collisions was undertaken to assist in defining accident characteristics within the study area and to estimate local average personal injury accident rates (PIAs).

To assist in assessing conditions within the study area, information on all road traffic collisions within the Newry study area involving personal injury over the five year period between April 2011 and March 2016 was obtained from The Department for Infrastructure. The prevailing accident trends have been compared with the national default accident rates and severities defined in COBA, the standard computer program introduced in the 1970s to examine proposed investments in the trunk road network.

Examination of the road traffic collision data indicates that 351 collisions occurred on the road network over the five year period between 2011 and 2016. The number of collisions, as well as local accident rates, recorded on urban (30/40 mph) and rural (50/60/70 mph) road sections and on single and dual carriageways are shown in Table 8.46.

Table 8.46 – Number of Collisions and Local Accident Rates Recorded on Urban and Rural Road Sections: 2011 – 2016

Carriageway Type	Urban Roads (30 / 40 mph)		Rural Roads (50 / 60 / 70 mph)		Total Number of Collisions
	Number of Collisions	Local Accident Rate	Number of Collisions	Local Accident Rate	
Single	232	0.629	45	0.259	277
Dual	33	0.890	41	0.048	74
Total	**265**	**-**	**86**	**-**	**351**

Note: Accident Rates are based on the number of Personal Injury Accidents per Million Vehicle Kilometres (PIAs / mvkm)

For comparison, the corresponding default rates defined in COBA are shown in Table 8.47.

Table 8.47 – COBA Default Accident Rates

Carriageway Type	Urban Roads (30 / 40 mph)	Rural Roads (50 / 60 / 70 mph)
Single	0.844	0.171 – 0.381
Dual	1.004	0.131 – 0.226

Note: Accident Rates are based on the number of Personal Injury Accidents per Million Vehicle Kilometres (PIAs / mvkm)

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.

8.5 Operational Assessment of Proposed Improvement Corridors

8.5.1 Traffic Flows

8.5.1.1 Do-Minimum Network

The Proposed Improvement Corridors 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 Improvement Corridors, 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 2015 Base Year, the 2023 Opening Year and the 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.1.

8.5.1.2 Do-Something Network: Corridor 1

The two-way 24-hour AADT traffic flows for the Do-Something Network: Corridor 1 in the 2023 Opening Year and 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.2.

Examination of the predicted changes in trip patterns indicates that the proposed improvement in Corridor 1 could attract some 4,650 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 2,970 vpd (13%) from 23,430 vpd to 20,460 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,690 vpd (9%) from 19,580 vpd to 17,890 vpd, which should significantly reduce delays and congestion at this location.

8.5.1.3 Do-Something Network: Corridor 2

The two-way 24-hour AADT traffic flows for the Do-Something Network: Corridor 2 in the 2023 Opening Year and 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.3.

Examination of the predicted changes in trip patterns indicates that the proposed improvement in Corridor 2 would attract some 4,110 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 2,430 vpd (10%) from 23,430 vpd to 21,000 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,690 vpd (9%) from 19,580 vpd to 17,890 vpd, which should significantly reduce delays and congestion at this location.

8.5.1.4 Do-Something Network: Corridor 3

The two-way 24-hour AADT traffic flows for the Do-Something Network: Corridor 3 in the 2023 Opening Year and 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.4.

Examination of the predicted changes in trip patterns indicates that the proposed improvement in Corridor 3 would attract some 3,100 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 1,420 vpd (6%) from 23,430 vpd to 22,010 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,690 vpd (9%) from 19,580 vpd to 17,890 vpd, which should significantly reduce delays and congestion at this location.

8.5.1.5 Do-Something Network: Corridor 4 – Option A

The two-way 24-hour AADT traffic flows for the Do-Something Network: Corridor 4 – Option A in the 2023 Opening Year and 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.5.

Examination of the predicted changes in trip patterns indicates that the proposed improvement in Corridor 4 – Option A would attract some 3,100 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 1,420 vpd (6%) from 23,430 vpd to 22,010 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,690 vpd (9%) from 19,580 vpd to 17,890 vpd, which should significantly reduce delays and congestion at this location.

8.5.1.6 Do-Something Network: Corridor 4 – Option B

The two-way 24-hour AADT traffic flows for the Do-Something Network: Corridor 4 – Option B in the 2023 Opening Year and 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.6.

Examination of the predicted changes in trip patterns indicates that the proposed improvement in Corridor 4 – Option B would attract some 3,100 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 1,420 vpd (6%) from 23,430 vpd to 22,010 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,690 vpd (9%) from 19,580 vpd to 17,890 vpd, which should significantly reduce delays and congestion at this location.

8.5.1.7 Do-Something Network: Corridor 5

The two-way 24-hour AADT traffic flows for the Do-Something Network: Corridor 5 in the 2023 Opening Year and 2037 Design Year under NRTF central traffic growth forecasts are shown in Figure 8.5.7.

Examination of the predicted changes in trip patterns indicates that the proposed improvement in Corridor 5 would attract some 4,650 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 2,970 vpd (13%) from 23,430 vpd to 20,460 vpd, which should significantly reduce delays and congestion at this location.

Similarly, traffic flows on William Street, east of Kilmorey Street, would reduce by 1,690 vpd (9%) from 19,580 vpd to 17,890 vpd, which should significantly reduce delays and congestion at this location.

8.5.2 Journey Times

8.5.2.1 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 Improvement Corridors 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 Flow Group 2 and Flow Group 4 traffic flow conditions. 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 three strategic routes through Newry:

- Between Narrow Water Roundabout and B113 Carrickcarnan Junction, towards Dublin;
- Between Narrow Water Roundabout and Carnbane Junction, towards Armagh; and
- Between Narrow Water Roundabout and Sheepbridge Junction, towards Belfast.
- The journey time routes for the Do-Minimum network are shown in Figure 8.5.8.

The modelled journey times for the Do-Something Networks have also been extracted for the same routes through Newry using the proposed Newry Southern Relief Road.

8.5.2.2 Journey Time Savings – Flow Group 2

A comparison of journey times under Flow Group 2 conditions for the routes in the Do-Minimum and Do-Something Networks is shown in Table 8.48 to Table 8.53. This comparison includes details for the 2023 year of opening and 2037 design year.

Table 8.48 – Summary of Journey Time Savings: 2023 Opening Year, Flow Group 2 (Corridor 1 and Corridor 2)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 1			Corridor 2		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	(%)	Journey Time (mins)	Time Saving (mins)	(%)
Warrenpoint – Carrickcarnan	15.17	10.10	5.08	33%	10.02	5.16	34%
Carrickcarnan – Warrenpoint	15.48	10.58	4.90	32%	9.91	5.57	36%
Warrenpoint – Carnbane	16.26	12.62	3.64	22%	10.67	5.59	34%
Carnbane – Warrenpoint	15.91	12.97	2.94	18%	10.96	4.94	31%
Warrenpoint – Sheepbridge	15.68	14.15	1.53	10%	12.20	3.48	22%
Sheepbridge – Warrenpoint	14.82	13.85	0.98	7%	11.80	3.02	20%

Table 8.49 – Summary of Journey Time Savings: 2023 Opening Year, Flow Group 2 (Corridor 3 and Corridor 4 – Option A)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 3			Corridor 4 – Option A		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	(%)	Journey Time (mins)	Time Saving (mins)	(%)
Warrenpoint – Carrickcarnan	15.17	8.34	6.83	45%	8.63	6.55	43%
Carrickcarnan – Warrenpoint	15.48	8.82	6.65	43%	9.10	6.37	41%
Warrenpoint – Carnbane	16.26	10.88	5.38	33%	11.16	5.10	31%
Carnbane – Warrenpoint	15.91	11.18	4.73	30%	11.46	4.45	28%
Warrenpoint – Sheepbridge	15.68	12.41	3.27	21%	12.69	2.99	19%
Sheepbridge – Warrenpoint	14.82	12.06	2.76	19%	12.34	2.48	17%

Table 8.50 – Summary of Journey Time Savings: 2023 Opening Year, Flow Group 2 (Corridor 4 – Option B and Corridor 5)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 4 – Option B			Corridor 5		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	15.17	9.00	6.17	41%	10.58	4.59	30%
Carrickcarnan – Warrenpoint	15.48	9.41	6.07	39%	11.19	4.28	28%
Warrenpoint – Carnbane	16.26	11.54	4.72	29%	13.11	3.15	19%
Carnbane – Warrenpoint	15.91	11.77	4.14	26%	13.54	2.37	15%
Warrenpoint – Sheepbridge	15.68	13.07	2.61	17%	14.64	1.04	7%
Sheepbridge – Warrenpoint	14.82	12.65	2.18	15%	14.42	0.40	3%

Table 8.51 – Summary of Journey Time Savings: 2037 Design Year, Flow Group 2 (Corridor 1 and Corridor 2)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 1			Corridor 2		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	15.49	10.13	5.36	35%	10.07	5.42	35%
Carrickcarnan – Warrenpoint	15.82	10.61	5.21	33%	9.95	5.87	37%
Warrenpoint – Carnbane	16.76	12.67	4.10	24%	10.72	6.04	36%
Carnbane – Warrenpoint	16.37	13.02	3.35	20%	11.02	5.34	33%
Warrenpoint – Sheepbridge	16.16	14.20	1.96	12%	12.25	3.90	24%
Sheepbridge – Warrenpoint	15.24	13.90	1.34	9%	11.86	3.38	22%

Table 8.52 – Summary of Journey Time Savings: 2037 Design Year, Flow Group 2 (Corridor 3 and Corridor 4 – Option A)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 3			Corridor 4 – Option A		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	15.49	8.36	7.12	46%	8.65	6.84	44%
Carrickcarnan – Warrenpoint	15.82	8.85	6.97	44%	9.13	6.69	42%
Warrenpoint – Carnbane	16.76	10.92	5.85	35%	11.20	5.57	33%
Carnbane – Warrenpoint	16.37	11.23	5.14	31%	11.51	4.86	30%
Warrenpoint – Sheepbridge	16.16	12.45	3.71	23%	12.73	3.43	21%
Sheepbridge – Warrenpoint	15.24	12.10	3.14	21%	12.38	2.86	19%

Table 8.53 – Summary of Journey Time Savings: 2037 Design Year, Flow Group 2 (Corridor 4 – Option B and Corridor 5)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 4 – Option B			Corridor 5		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	15.49	9.03	6.46	42%	10.61	4.87	31%
Carrickcarnan – Warrenpoint	15.82	9.44	6.38	40%	11.23	4.59	29%
Warrenpoint – Carnbane	16.76	11.58	5.19	31%	13.16	3.61	22%
Carnbane – Warrenpoint	16.37	11.82	4.55	28%	13.60	2.77	17%
Warrenpoint – Sheepbridge	16.16	13.11	3.05	19%	14.69	1.47	9%
Sheepbridge – Warrenpoint	15.24	12.69	2.55	17%	14.48	0.77	5%

8.5.2.3 Do-Something Network: Corridor 1

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 1 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 15.17 minutes to 10.10 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 5.08 minutes results in a 33% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.49 minutes to 10.13 minutes. This decrease of 5.36 minutes results in a 35% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.48 minutes to 10.58 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.90 minutes results in a 32% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.82 minutes to 10.61 minutes. This decrease of 5.21 minutes results in a 33% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 16.26 minutes to 12.62 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 3.64 minutes results in a 22% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.76 minutes to 12.67 minutes. This decrease of 4.10 minutes results in a 24% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 15.91 minutes to 12.97 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.94 minutes results in an 18% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.37 minutes to 13.02 minutes. This decrease of 3.35 minutes results in a 20% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 15.68 minutes to 14.15 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 1.53 minutes results in a 10% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.16 minutes to 14.20 minutes. This decrease of 1.96 minutes results in a 12% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 14.82 minutes to 13.85 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 0.98 minutes results in a 7% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.24 minutes to 13.90 minutes. This decrease of 1.34 minutes results in a 9% reduction in journey times.

8.5.2.4 Do-Something Network: Corridor 2

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 2 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 15.17 minutes to 10.02 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 5.16 minutes results in a 34% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.49 minutes to 10.07 minutes. This decrease of 5.42 minutes results in a 35% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.48 minutes to 9.91 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 5.57 minutes results in a 36% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.82 minutes to 9.95 minutes. This decrease of 5.87 minutes results in a 37% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 16.26 minutes to 10.67 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 5.59 minutes results in a 34% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.76 minutes to 10.72 minutes. This decrease of 6.04 minutes results in a 36% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 15.91 minutes to 10.96 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.94 minutes results in a 31% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.37 minutes to 11.02 minutes. This decrease of 5.34 minutes results in a 33% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 15.68 minutes to 12.20 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 3.48 minutes results in a 22% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.16 minutes to 12.25 minutes. This decrease of 3.90 minutes results in a 24% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 14.82 minutes to 11.80 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 3.02 minutes results in a 20% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.24 minutes to 11.86 minutes. This decrease of 3.38 minutes results in a 22% reduction in journey times.

8.5.2.5 Do-Something Network: Corridor 3

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 3 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 15.17 minutes to 8.34 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 6.83 minutes results in a 45% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.49 minutes to 8.36 minutes. This decrease of 7.12 minutes results in a 46% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.48 minutes to 8.82 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 6.65 minutes results in a 43% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.82 minutes to 8.85 minutes. This decrease of 6.97 minutes results in a 44% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 16.26 minutes to 10.88 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 5.38 minutes results in a 33% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.76 minutes to 10.92 minutes. This decrease of 5.85 minutes results in a 35% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 15.91 minutes to 11.18 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.73 minutes results in a 30% reduction in journey times.

By the 2037 Design Year, journey times would reduce from approximately 16.37 minutes to 11.23 minutes. This decrease of 5.14 minutes results in a 31% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 15.68 minutes to 12.41 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 3.27 minutes results in a 21% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.16 minutes to 12.45 minutes. This decrease of 3.71 minutes results in a 23% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 14.82 minutes to 12.06 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.76 minutes results in a 19% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.24 minutes to 12.10 minutes. This decrease of 3.14 minutes results in a 21% reduction in journey times.

8.5.2.6 Do-Something Network: Corridor 4 – Option A

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 4 - Option A journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 15.17 minutes to 8.63 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 6.55 minutes results in a 43% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.49 minutes to 8.65 minutes. This decrease of 6.84 minutes results in a 44% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.48 minutes to 9.10 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 6.37 minutes results in a 41% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.82 minutes to 9.13 minutes. This decrease of 6.69 minutes results in a 42% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 16.26 minutes to 11.16 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 5.10 minutes results in a 31% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.76 minutes to 11.20 minutes. This decrease of 5.57 minutes results in a 33% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 15.91 minutes to 11.46 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.45 minutes results in a 28% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.37 minutes to 11.51 minutes. This decrease of 4.86 minutes results in a 30% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 15.68 minutes to 12.69 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.99 minutes results in a 19% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.16 minutes to 12.73 minutes. This decrease of 3.43 minutes results in a 21% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 14.82 minutes to 12.34 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.48 minutes results in a 17% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.24 minutes to 12.38 minutes. This decrease of 2.86 minutes results in a 19% reduction in journey times.

8.5.2.7 Do-Something Network: Corridor 4 – Option B

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 4 - Option B journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 15.17 minutes to 9.00 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 6.17 minutes results in a 41% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.49 minutes to 9.03 minutes. This decrease of 6.46 minutes results in a 42% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.48 minutes to 9.41 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 6.07 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.82 minutes to 9.44 minutes. This decrease of 6.38 minutes results in a 40% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 16.26 minutes to 11.54 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.72 minutes results in a 29% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.76 minutes to 11.58 minutes. This decrease of 5.19 minutes results in a 31% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 15.91 minutes to 11.77 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.14 minutes results in a 26% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.37 minutes to 11.82 minutes. This decrease of 4.55 minutes results in a 28% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 15.68 minutes to 13.07 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.61 minutes results in a 17% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.16 minutes to 13.11 minutes. This decrease of 3.05 minutes results in a 19% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 14.82 minutes to 12.65 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.18 minutes results in a 15% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.24 minutes to 12.69 minutes. This decrease of 2.55 minutes results in a 17% reduction in journey times.

8.5.2.8 Do-Something Network: Corridor 5

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 5 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 15.17 minutes to 10.58 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.59 minutes results in a 30% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.49 minutes to 10.61 minutes. This decrease of 4.87 minutes results in a 31% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 15.48 minutes to 11.19 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 4.28 minutes results in a 28% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.82 minutes to 11.23 minutes. This decrease of 4.59 minutes results in a 29% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 16.26 minutes to 13.11 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 3.15 minutes results in a 19% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.76 minutes to 13.16 minutes. This decrease of 3.61 minutes results in a 22% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 15.91 minutes to 13.54 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 2.37 minutes results in a 15% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.37 minutes to 13.60 minutes. This decrease of 2.77 minutes results in a 17% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 15.68 minutes to 14.64 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 1.04 minutes results in a 7% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 16.16 minutes to 14.69 minutes. This decrease of 1.47 minutes results in a 9% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 14.82 minutes to 14.42 minutes in the 2023 Opening Year under Flow Group 2 conditions. This decrease of 0.40 minutes results in a 3% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 15.24 minutes to 14.48 minutes. This decrease of 0.77 minutes results in a 5% reduction in journey times.

8.5.2.9 Journey Time Savings – Flow Group 4

A comparison of journey times under Flow Group 4 conditions for the routes in the Do-Minimum and Do-Something Networks are shown in Table 8.54 to Table 8.59. This includes details for the 2023 year of opening and 2037 design year.

Table 8.54 – Summary of Journey Time Savings: 2023 Opening Year, Flow Group 4 (Corridor 1 and Corridor 2)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 1			Corridor 2		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	17.64	10.21	7.43	42%	10.63	7.01	40%
Carrickcarnan – Warrenpoint	17.67	10.76	6.91	39%	10.24	7.43	42%
Warrenpoint – Carnbane	21.84	12.87	8.97	41%	11.35	10.49	48%
Carnbane – Warrenpoint	19.96	13.41	6.55	33%	11.66	8.31	42%
Warrenpoint – Sheepbridge	21.02	14.34	6.68	32%	12.82	8.19	39%
Sheepbridge – Warrenpoint	18.49	14.13	4.36	24%	12.33	6.15	33%

Table 8.55 – Summary of Journey Time Savings: 2023 Opening Year, Flow Group 4 (Corridor 3 and Corridor 4 – Option A)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 3			Corridor 4 – Option A		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	17.64	8.43	9.21	52%	8.72	8.91	51%
Carrickcarnan – Warrenpoint	17.67	8.93	8.74	49%	9.24	8.43	48%
Warrenpoint – Carnbane	21.84	11.11	10.73	49%	11.40	10.44	48%
Carnbane – Warrenpoint	19.96	11.55	8.41	42%	11.86	8.10	41%
Warrenpoint – Sheepbridge	21.02	12.58	8.44	40%	12.87	8.15	39%
Sheepbridge – Warrenpoint	18.49	12.27	6.22	34%	12.58	5.91	32%

Table 8.56 – Summary of Journey Time Savings: 2023 Opening Year, Flow Group 4 (Corridor 4 – Option B and Corridor 5)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 4 – Option B			Corridor 5		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	17.64	9.11	8.52	48%	10.74	6.90	39%
Carrickcarnan – Warrenpoint	17.67	9.56	8.11	46%	11.41	6.26	35%
Warrenpoint – Carnbane	21.84	11.79	10.05	46%	13.40	8.44	39%
Carnbane – Warrenpoint	19.96	12.18	7.78	39%	14.01	5.95	30%
Warrenpoint – Sheepbridge	21.02	13.25	7.76	37%	14.87	6.15	29%
Sheepbridge – Warrenpoint	18.49	12.90	5.59	30%	14.67	3.82	21%

Table 8.57 – Summary of Journey Time Savings: 2037 Design Year, Flow Group 4 (Corridor 1 and Corridor 2)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 1			Corridor 2		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	18.91	10.26	8.66	46%	11.05	7.86	42%
Carrickcarnan – Warrenpoint	18.19	10.83	7.36	40%	10.40	7.79	43%
Warrenpoint – Carnbane	24.81	12.97	11.84	48%	11.82	12.99	52%
Carnbane – Warrenpoint	21.33	13.59	7.74	36%	12.07	9.26	43%
Warrenpoint – Sheepbridge	23.90	14.41	9.49	40%	13.26	10.65	45%
Sheepbridge – Warrenpoint	19.68	14.23	5.46	28%	12.67	7.01	36%

Table 8.58 – Summary of Journey Time Savings: 2037 Design Year, Flow Group 4 (Corridor 3 and Corridor 4 – Option A)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 3			Corridor 4 – Option A		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	18.91	8.47	10.45	55%	8.76	10.15	54%
Carrickcarnan – Warrenpoint	18.19	8.97	9.22	51%	9.29	8.90	49%
Warrenpoint – Carnbane	24.81	11.20	13.61	55%	11.49	13.32	54%
Carnbane – Warrenpoint	21.33	11.70	9.63	45%	12.02	9.31	44%
Warrenpoint – Sheepbridge	23.90	12.64	11.26	47%	12.93	10.97	46%
Sheepbridge – Warrenpoint	19.68	12.34	7.34	37%	12.66	7.03	36%

Table 8.59 – Summary of Journey Time Savings: 2037 Design Year, Flow Group 4 (Corridor 4 – Option B and Corridor 5)

Route	Do-Minimum Network	Do-Something Network					
		Corridor 4 – Option B			Corridor 5		
	Journey Time (mins)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)	Journey Time (mins)	Time Saving (mins)	Time Saving (%)
Warrenpoint – Carrickcarnan	18.91	9.15	9.76	52%	10.79	8.12	43%
Carrickcarnan – Warrenpoint	18.19	9.61	8.57	47%	11.49	6.70	37%
Warrenpoint – Carnbane	24.81	11.88	12.93	52%	13.51	11.30	46%
Carnbane – Warrenpoint	21.33	12.34	8.99	42%	14.20	7.13	33%
Warrenpoint – Sheepbridge	23.90	13.32	10.58	44%	14.95	8.96	37%
Sheepbridge – Warrenpoint	19.68	12.98	6.70	34%	14.84	4.85	25%

8.5.2.10 Do-Something Network: Corridor 1

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 1 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.64 minutes to 10.21 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 7.43 minutes results in a 42% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.91 minutes to 10.26 minutes. This decrease of 8.66 minutes results in a 46% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 17.67 minutes to 10.76 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.91 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.19 minutes to 10.83 minutes. This decrease of 7.36 minutes results in a 40% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 21.84 minutes to 12.87 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.97 minutes results in a 41% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 24.81 minutes to 12.97 minutes. This decrease of 11.84 minutes results in a 48% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 19.96 minutes to 13.41 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.55 minutes results in a 33% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 21.33 minutes to 13.59 minutes. This decrease of 7.74 minutes results in a 36% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 21.02 minutes to 14.34 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.68 minutes results in a 32% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 23.90 minutes to 14.41 minutes. This decrease of 9.49 minutes results in a 40% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 18.49 minutes to 14.13 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 4.36 minutes results in a 24% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 19.68 minutes to 14.23 minutes. This decrease of 5.46 minutes results in a 28% reduction in journey times.

8.5.2.11 Do-Something Network: Corridor 2

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 2 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.64 minutes to 10.63 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 7.01 minutes results in a 40% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.91 minutes to 11.05 minutes. This decrease of 7.86 minutes results in a 42% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 17.67 minutes to 10.24 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 7.43 minutes results in a 42% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.19 minutes to 10.40 minutes. This decrease of 7.79 minutes results in a 43% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 21.84 minutes to 11.35 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 10.49 minutes results in a 48% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 24.81 minutes to 11.82 minutes. This decrease of 12.99 minutes results in a 52% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 19.96 minutes to 11.66 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.31 minutes results in a 42% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 21.33 minutes to 12.07 minutes. This decrease of 9.26 minutes results in a 43% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 21.02 minutes to 12.82 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.19 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 23.90 minutes to 13.26 minutes. This decrease of 10.65 minutes results in a 45% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 18.49 minutes to 12.33 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.15 minutes results in a 33% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 19.68 minutes to 12.67 minutes. This decrease of 7.01 minutes results in a 36% reduction in journey times.

8.5.2.12 Do-Something Network: Corridor 3

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 3 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.64 minutes to 8.43 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 9.21 minutes results in a 52% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.91 minutes to 8.47 minutes. This decrease of 10.45 minutes results in a 55% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 17.67 minutes to 8.93 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.74 minutes results in a 49% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.19 minutes to 8.97 minutes. This decrease of 9.22 minutes results in a 51% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 21.84 minutes to 11.11 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 10.73 minutes results in a 49% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 24.81 minutes to 11.20 minutes. This decrease of 13.61 minutes results in a 55% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 19.96 minutes to 11.55 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.41 minutes results in a 42% reduction in journey times.

By the 2037 Design Year, journey times would reduce from approximately 21.33 minutes to 11.70 minutes. This decrease of 9.63 minutes results in a 45% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 21.02 minutes to 12.58 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.44 minutes results in a 40% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 23.90 minutes to 12.64 minutes. This decrease of 11.26 minutes results in a 47% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 18.49 minutes to 12.27 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.22 minutes results in a 34% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 19.68 minutes to 12.34 minutes. This decrease of 7.34 minutes results in a 37% reduction in journey times.

8.5.2.13 Do-Something Network: Corridor 4 – Option A

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 4 - Option A journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.64 minutes to 8.72 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.91 minutes results in a 51% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.91 minutes to 8.76 minutes. This decrease of 10.15 minutes results in a 54% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 17.67 minutes to 9.24 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.43 minutes results in a 48% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.19 minutes to 9.29 minutes. This decrease of 8.90 minutes results in a 49% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 21.84 minutes to 11.40 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 10.44 minutes results in a 48% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 24.81 minutes to 11.49 minutes. This decrease of 13.32 minutes results in a 54% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 19.96 minutes to 11.86 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.10 minutes results in a 41% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 21.33 minutes to 12.02 minutes. This decrease of 9.31 minutes results in a 44% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 21.02 minutes to 12.87 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.15 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 23.90 minutes to 12.93 minutes. This decrease of 10.97 minutes results in a 46% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 18.49 minutes to 12.58 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 5.91 minutes results in a 32% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 19.68 minutes to 12.66 minutes. This decrease of 7.03 minutes results in a 36% reduction in journey times.

8.5.2.14 Do-Something Network: Corridor 4 – Option B

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 4 - Option B journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.64 minutes to 9.11 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.52 minutes results in a 48% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.91 minutes to 9.15 minutes. This decrease of 9.76 minutes results in a 52% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 17.67 minutes to 9.56 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.11 minutes results in a 46% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.19 minutes to 9.61 minutes. This decrease of 8.57 minutes results in a 47% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 21.84 minutes to 11.79 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 10.05 minutes results in a 46% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 24.81 minutes to 11.88 minutes. This decrease of 12.93 minutes results in a 52% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 19.96 minutes to 12.18 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 7.78 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 21.33 minutes to 12.34 minutes. This decrease of 8.99 minutes results in a 42% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 21.02 minutes to 13.25 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 7.76 minutes results in a 37% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 23.90 minutes to 13.32 minutes. This decrease of 10.58 minutes results in a 44% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 18.49 minutes to 12.90 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 5.59 minutes results in a 30% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 19.68 minutes to 12.98 minutes. This decrease of 6.70 minutes results in a 34% reduction in journey times.

8.5.2.15 Do-Something Network: Corridor 5

Examination of the above journey time information indicates that for the Do-Something Network: Corridor 5 journey times from Warrenpoint Harbour to B113 Carrickcarnan Junction would reduce from approximately 17.64 minutes to 10.74 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.90 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.91 minutes to 10.79 minutes. This decrease of 8.12 minutes results in a 43% reduction in journey times.

In the reverse direction, journey times from B113 Carrickcarnan Junction to Warrenpoint Harbour would reduce from approximately 17.67 minutes to 11.41 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.26 minutes results in a 35% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 18.19 minutes to 11.49 minutes. This decrease of 6.70 minutes results in a 37% reduction in journey times.

Journey times from Warrenpoint Harbour to Carnbane Junction would reduce from approximately 21.84 minutes to 13.40 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 8.44 minutes results in a 39% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 24.81 minutes to 13.51 minutes. This decrease of 11.30 minutes results in a 46% reduction in journey times.

In the reverse direction, journey times from Carnbane Junction to Warrenpoint Harbour would reduce from approximately 19.96 minutes to 14.01 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 5.95 minutes results in a 30% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 21.33 minutes to 14.20 minutes. This decrease of 7.13 minutes results in a 33% reduction in journey times.

Journey times from Warrenpoint Harbour to Sheepbridge Junction would reduce from approximately 21.02 minutes to 14.87 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 6.15 minutes results in a 29% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 23.90 minutes to 14.95 minutes. This decrease of 8.96 minutes results in a 37% reduction in journey times.

In the reverse direction, journey times from Sheepbridge Junction to Warrenpoint Harbour would reduce from approximately 18.49 minutes to 14.67 minutes in the 2023 Opening Year under Flow Group 4 conditions. This decrease of 3.82 minutes results in a 21% reduction in journey times. By the 2037 Design Year, journey times would reduce from approximately 19.68 minutes to 14.84 minutes. This decrease of 4.85 minutes results in a 25% reduction in journey times.

An overall summary of the two-way journey time savings associated with the Proposed Improvement Corridors is shown below in Table 8.60.

Table 8.60 – Summary of Two-Way Journey Time Savings, Do-Something Networks: Corridor 1 to Corridor 5

Route	Year	Flow Group	Two-Way Journey Time Savings (%)					
			Corridor 1	Corridor 2	Corridor 3	Corridor 4 Option A	Corridor 4 Option B	Corridor 5
Warrenpoint to / from Carrickcarnan	2023	FG2	33%	35%	44%	42%	40%	29%
Warrenpoint to / from Carnbane	2023	FG2	20%	33%	31%	30%	28%	17%
Warrenpoint to / from Sheepbridge	2023	FG2	8%	21%	20%	18%	16%	5%
Warrenpoint to / from Carrickcarnan	2037	FG2	34%	36%	45%	43%	41%	30%
Warrenpoint to / from Carnbane	2037	FG2	22%	34%	33%	31%	29%	19%
Warrenpoint to / from Sheepbridge	2037	FG2	11%	23%	22%	20%	18%	7%
Warrenpoint to / from Carrickcarnan	2023	FG4	41%	41%	51%	49%	47%	37%
Warrenpoint to / from Carnbane	2023	FG4	37%	45%	46%	44%	43%	34%
Warrenpoint to / from Sheepbridge	2023	FG4	28%	36%	37%	36%	34%	25%
Warrenpoint to / from Carrickcarnan	2037	FG4	43%	42%	53%	51%	49%	40%
Warrenpoint to / from Carnbane	2037	FG4	42%	48%	50%	49%	47%	40%
Warrenpoint to / from Sheepbridge	2037	FG4	34%	41%	43%	41%	40%	32%

8.5.3 Network Capacity

8.5.3.1 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 2015 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 NRTF central traffic growth forecasts is summarised in Table 8.61.

Table 8.61 – Number of Over-Capacity Links and Junctions, Do-Minimum Network

Year	Flow Group	Do-Minimum Network	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	5	2
	Flow Group 8 / 9	4	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	7	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	1	0
	Flow Group 3 / 4	10	6
	Flow Group 8 / 9	7	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 5 links and 2 junctions. By the 2023 Opening Year, this would increase to 7 links and 3 junctions and to 10 links and 6 junctions in 2037.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Minimum Network are shown in Figure 8.5.9.

8.5.3.2 Do-Something Network: Corridor 1

The number of over-capacity links and junctions in the Do-Something Network: Corridor 1 under NRTF central traffic growth forecasts is summarised in Table 8.62.

It should be noted that although the Proposed Improvement Corridor would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2015 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 8.62 – Number of Over-Capacity Links and Junctions, Do-Something Network: Corridor 1

Year	Flow Group	Do-Something Network: Corridor 1	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	4	2
	Flow Group 8 / 9	3	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	4
	Flow Group 8 / 9	6	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 4 links and 2 junctions. By the 2023 Opening Year, this would increase to 6 links and 3 junctions and to 9 links and 4 junctions in 2037.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Something Network: Corridor 1 are shown in Figure 8.5.10.

8.5.3.3 Do-Something Network: Corridor 2

The number of over-capacity links and junctions in the Do-Something Network: Corridor 2 under NRTF central traffic growth forecasts is summarised in Table 8.63.

It should be noted that although the Proposed Improvement Corridor would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2015 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 8.63 – Number of Over-Capacity Links and Junctions, Do-Something Network: Corridor 2

Year	Flow Group	Do-Something Network: Corridor 2	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	4	2
	Flow Group 8 / 9	3	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	5
	Flow Group 8 / 9	6	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 4 links and 2 junctions. By the 2023 Opening Year, this would increase to 6 links and 3 junctions and to 9 links and 5 junctions in 2037.

The results from the model indicate that demand at Cloghogue junction is likely to exceed operational capacity by the 2037 Design Year in Flow Group 3 / 4.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Something Network: Corridor 2 are shown in Figure 8.5.11.

8.5.3.4 Do-Something Network: Corridor 3

The number of over-capacity links and junctions in the Do-Something Network: Corridor 3 under NRTF central traffic growth forecasts is summarised in Table 8.64.

It should be noted that although the Proposed Improvement Corridor would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2015 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 8.64 – Number of Over-Capacity Links and Junctions, Do-Something Network: Corridor 3

Year	Flow Group	Do-Something Network: Corridor 3	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	4	2
	Flow Group 8 / 9	3	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	4
	Flow Group 8 / 9	6	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 4 links and 2 junctions. By the 2023 Opening Year, this would increase to 6 links and 3 junctions and to 9 links and 4 junctions in 2037.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Something Network: Corridor 3 are shown in Figure 8.5.12.

8.5.3.5 Do-Something Network: Corridor 4 – Option A

The number of over-capacity links and junctions in the Do-Something Network: Corridor 4 – Option A under NRTF central traffic growth forecasts is summarised in Table 8.65.

It should be noted that although the Proposed Improvement Corridor would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2015 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 8.65 – Number of Over-Capacity Links and Junctions, Do-Something Network: Corridor 4 - Option A

Year	Flow Group	Do-Something Network: Corridor 4 – Option A	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	4	2
	Flow Group 8 / 9	3	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	4
	Flow Group 8 / 9	6	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 4 links and 2 junctions. By the 2023 Opening Year, this would increase to 6 links and 3 junctions and to 9 links and 4 junctions in 2037.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Something Network: Corridor 4 – Option A are shown in Figure 8.5.13.

8.5.3.6 Do-Something Network: Corridor 4 – Option B

The number of over-capacity links and junctions in the Do-Something Network: Corridor 4 – Option B under NRTF central traffic growth forecasts is summarised in Table 8.66.

It should be noted that although the Proposed Improvement Corridor would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2015 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 8.66 – Number of Over-Capacity Links and Junctions, Do-Something Network: Corridor 4 - Option B

Year	Flow Group	Do-Something Network: Corridor 4 – Option B	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	4	2
	Flow Group 8 / 9	3	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	4
	Flow Group 8 / 9	6	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 4 links and 2 junctions. By the 2023 Opening Year, this would increase to 6 links and 3 junctions and to 9 links and 4 junctions in 2037.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Something Network: Corridor 4 – Option B are shown in Figure 8.5.14.

8.5.3.7 Do-Something Network: Corridor 5

The number of over-capacity links and junctions in the Do-Something Network: Corridor 5 under NRTF central traffic growth forecasts is summarised in Table 8.67.

It should be noted that although the Proposed Improvement Corridor would not be completed until 2023, details of over-capacity links and junctions have been extracted from the 2015 model to assist in comparing the performance of the Do-Minimum and Do-Something scenarios in the base year.

Table 8.67 – Number of Over-Capacity Links and Junctions, Do-Something Network: Corridor 5

Year	Flow Group	Do-Something Network: Corridor 5	
		Link	Junction
2015	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	4	2
	Flow Group 8 / 9	3	1
2023	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	6	3
	Flow Group 8 / 9	4	2
2037	Flow Group 1 / 2	0	0
	Flow Group 3 / 4	9	4
	Flow Group 8 / 9	6	2

Examination of the above results indicates that traffic demand in 2015 under Flow Group 3 / 4 traffic conditions would exceed capacity on 4 links and 2 junctions. By the 2023 Opening Year, this would increase to 6 links and 3 junctions and to 9 links and 4 junctions in 2037.

The locations of the links and junctions that are over-capacity under NRTF central traffic growth forecasts for the Do-Something Network: Corridor 5 are shown in Figure .15.

8.6 Road Safety

8.6.1 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.

8.6.2 Do-Something Network Road Safety

8.6.2.1 Do-Something Network: Corridor 1

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under NRTF central traffic growth forecasts due to the provision of the Do-Something Network: Corridor 1 are shown in Table 8.68 and Table 8.69. The associated Present Value of Benefits are also shown in these tables.

Table 8.68 – Accident Numbers and Costs, Do-Something Network: Corridor 1

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	84.1	89.5	5,360.1	305.992
Do-Something: Corridor 1	81.0	86.1	5,157.3	296.687
Benefits	3.2	3.4	202.9	9.305

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.69 – Casualties by Severity, Do-Something Network: Corridor 1

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	58.2	601.7	7,059.0	5,360.1
Do-Something: Corridor 1	58.2	586.9	6,800.9	5,157.3
Benefits	0.0	14.7	258.1	202.9

From the above information, the Do-Something Network: Corridor 1 would save approximately 203 personal injury accidents over the 60-year period, which equates to an economic benefit of £9.3m under NRTF central growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Do-Something Network: Corridor 1 would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

8.6.2.2 Do-Something Network: Corridor 2

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under NRTF central traffic growth forecasts due to the provision of the Do-Something Network: Corridor 2 are shown in Table 8.70 and Table 8.71. The associated Present Value of Benefits are also shown in these tables.

Table 8.70 – Accident Numbers and Costs, Do-Something Network: Corridor 2

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	84.1	89.5	5,360.1	305.992
Do-Something: Corridor 2	81.3	86.5	5,178.4	297.312
Benefits	2.8	3.0	181.8	8.680

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.71 – Casualties by Severity, Do-Something Network: Corridor 2

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	58.2	601.7	7,059.0	5,360.1
Do-Something: Corridor 2	57.9	587.4	6,826.8	5,178.4
Benefits	0.3	14.3	232.3	181.8

From the above information, the Do-Something Network: Corridor 2 would save approximately 182 personal injury accidents over the 60-year period, which equates to an economic benefit of £8.7m under NRTF central growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Do-Something Network: Corridor 2 would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

8.6.2.3 Do-Something Network: Corridor 3

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under NRTF central traffic growth forecasts due to the provision of the Do-Something Network: Corridor 3 are shown in Table 8.72 and Table 8.73. The associated Present Value of Benefits are also shown in these tables.

Table 8.72 – Accident Numbers and Costs, Do-Something Network: Corridor 3

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	84.1	89.5	5,360.1	305.992
Do-Something: Corridor 3	81.6	86.8	5,198.5	298.356
Benefits	2.5	2.7	161.6	7.636

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.73 – Casualties by Severity, Do-Something Network: Corridor 3

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	58.2	601.7	7,059.0	5,360.1
Do-Something: Corridor 3	58.0	589.2	6,851.6	5,198.5
Benefits	0.2	12.5	207.5	161.6

From the above information, the Do-Something Network: Corridor 3 would save approximately 162 personal injury accidents over the 60-year period, which equates to an economic benefit of £7.6m under NRTF central growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Do-Something Network: Corridor 3 would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

8.6.2.4 Do-Something Network: Corridor 4 – Option A

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under NRTF central traffic growth forecasts due to the provision of the Do-Something Network: Corridor 4 – Option A are shown in Table 8.74 and Table 8.75. The associated Present Value of Benefits are also shown in these tables.

Table 8.74 – Accident Numbers and Costs, Do-Something Network: Corridor 4 – Option A

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	84.1	89.5	5,360.1	305.992
Do-Something: Corridor 4 – Option A	81.6	86.8	5,198.0	298.471
Benefits	2.5	2.7	162.2	7.521

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.75 – Casualties by Severity, Do-Something Network: Corridor 4 – Option A

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	58.2	601.7	7,059.0	5,360.1
Do-Something: Corridor 4 – Option A	58.1	589.6	6,850.5	5,198.0
Benefits	0.1	12.1	208.5	162.2

From the above information, the Do-Something Network: Corridor 4 – Option A would save approximately 162 personal injury accidents over the 60-year period, which equates to an economic benefit of £7.5m under NRTF central growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Do-Something Network: Corridor 4 – Option A would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

8.6.2.5 Do-Something Network: Corridor 4 – Option B

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under NRTF central traffic growth forecasts due to the provision of the Do-Something Network: Corridor 4 – Option B are shown in Table 8.76 and Table 8.77. The associated Present Value of Benefits are also shown in these tables.

Table 8.76 – Accident Numbers and Costs, Do-Something Network: Corridor 4 – Option B

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	84.1	89.5	5,360.1	305.992
Do-Something: Corridor 4 – Option B	81.0	86.2	5,163.6	295.697
Benefits	3.1	3.3	196.5	10.295

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.77 – Casualties by Severity, Do-Something Network: Corridor 4 – Option B

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	58.2	601.7	7,059.0	5,360.1
Do-Something: Corridor 4 – Option B	57.0	582.9	6,803.5	5,163.6
Benefits	1.2	18.7	255.6	196.5

From the above information, the Do-Something Network: Corridor 4 – Option B would save approximately 197 personal injury accidents over the 60-year period, which equates to an economic benefit of £10.3m under NRTF central growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Do-Something Network: Corridor 4 – Option B would lead to a decrease in road safety costs over the 60-year economic life of the scheme.

8.6.2.6 Do-Something Network: Corridor 5

The changes in the number of personal injury accidents and the corresponding casualty severities over the 60-year assessment period under NRTF central traffic growth forecasts due to the provision of the Do-Something Network: Corridor 5 are shown in Table 8.78 and Table 8.79. The associated Present Value of Benefits are also shown in these tables.

Table 8.78 – Accident Numbers and Costs, Do-Something Network: Corridor 5

Network	Number of Accidents			Accident Total Cost (£m's)
	2023 Opening Year	2037 Design Year	60-Year Total	
Do-Minimum	84.1	89.5	5,360.1	305.992
Do-Something: Corridor 5	81.0	86.2	5,160.4	297.054
Benefits	3.1	3.3	199.7	8.938

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.79 – Casualties by Severity, Do-Something Network: Corridor 5

Network	Accident Severity			Total Accidents
	Fatal	Serious	Slight	
Do-Minimum	58.2	601.7	7,059.0	5,360.1
Do-Something: Corridor 5	58.4	587.9	6,805.1	5,160.4
Benefits	-0.2	13.8	254.0	199.7

From the above information, the Do-Something Network: Corridor 5 would save approximately 200 personal injury accidents over the 60-year period, which equates to an economic benefit of £8.9m under NRTF central growth traffic forecasts.

The results of the COBA analysis, based on the application of default accident rates, indicate that the provision of the Do-Something Network: Corridor 5 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 Improvement Corridors is shown below in Table 8.80.

Table 8.80 – Accident Benefits, Do-Something Networks: Corridor 1 to Corridor 5

Accident Benefits	Do-Something Network					
	Corridor 1	Corridor 2	Corridor 3	Corridor 4 Option A	Corridor 4 Option B	Corridor 5
Accident Benefits (£m's)	9.305	8.680	7.636	7.521	10.295	8.938
Accident Benefits (No.)	202.9	181.8	161.6	162.2	196.5	199.7
Proposed Improvement Corridor Cost Savings Ranking	**2nd**	**4th**	**5th**	**6th**	**1st**	**3rd**

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Examination of the above information indicates that the accident benefits range from £7.521m for Proposed Improvement Corridor 4 – Option A to £10.295m for Proposed Improvement Corridor 4 – Option B.

8.7 Economic Appraisal of Proposed Improvement Corridors

8.7.1 COBA Appraisal

The economic results from the COBA models for the Proposed Improvement Corridors, based on the scheme costs defined previously including optimism bias and the application of the National Road Traffic Forecasts (NRTF) central traffic growth projection, are summarised in Table 8.81 and Table 8.82.

Table 8.81 – COBA Proposed Improvement Corridors Appraisal Summary, Do-Something Networks: Corridor 1 to Corridor 3

Item	Do-Something Network		
	Corridor 1	Corridor 2	Corridor 3
Present Value of Benefits (PVB) (£m's)	£111.758	£99.156	£112.172
Present Value of Costs (PVC) (£m's)	£70.543	£60.288	£76.781
Net Present Value (NPV)	£41.215	£38.868	£35.392
Benefit to Cost Ratio (BCR)	1.584	1.645	1.461

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.82 – COBA Proposed Improvement Corridors Appraisal Summary, Do-Something Networks: Corridor 4 to Corridor 5

Item	Do-Something Network		
	Corridor 4		Corridor 5
	Option A	Option B	
Present Value of Benefits (PVB) (£m's)	£106.997	£123.404	£96.819
Present Value of Costs (PVC) (£m's)	£71.750	£66.390	£43.790
Net Present Value (NPV)	£35.246	£57.015	£53.029
Benefit to Cost Ratio (BCR)	1.491	1.859	2.211

Note: Assessment is based on NRTF central 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 appraisal 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 8.83 and Table 8.84 and indicates the transport economic efficiency, public accounts and monetised costs and benefits as defined in COBA11 Tables 15A to 15C.

Table 8.83 – COBA Proposed Improvement Corridors Appraisal, Do-Something Networks: Corridor 1 to Corridor 3

Item	Do-Something Network		
	Corridor 1	Corridor 2	Corridor 3
Consumers (User Benefits)			
Travel Time	£60.647	£51.715	£59.496
Approx. Link Transit Time	£46.011	£45.822	£45.908
Approx. Junction Delay	£14.636	£5.893	£13.588
Vehicle Operating Costs	-£1.461	£0.999	£1.784
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	**£59.186**	**£52.714**	**£61.279**
Business Users (User Benefits)			
Travel Time	£43.252	£37.113	£42.290
Approx. Link Transit Time	£32.814	£32.884	£32.632
Approx. Junction Delay	£10.438	£4.229	£9.658
Vehicle Operating Costs	-£0.640	£0.828	£1.137
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	£42.612	£37.941	£43.427
Private Sector Provider Impacts (Operating Costs)	£0.138	£0.287	£0.346
Net Business Impact	**£42.750**	**£38.228**	**£43.772**
Total Present Value of TEE Benefits	**£101.935**	**£90.942**	**£105.052**
Public Accounts			
Government Funding			
Operating Costs	£0.393	£0.393	£0.450
Investment Costs	£70.149	£59.895	£76.331
Present Value of Costs	**£70.543**	**£60.288**	**£76.781**
Analysis of Monetised Costs and Benefits			
TEE Benefits			
Consumer User Benefits	£59.186	£52.714	£61.279
Business Benefits	£42.612	£37.941	£43.427
Private Sector Provider Impacts	£0.138	£0.287	£0.346
Accident Benefits	£9.305	£8.680	£7.636
Indirect Tax Revenues	£0.716	-£0.628	-£0.688
Emissions Benefits	-£0.199	£0.162	£0.173
Present Value of Benefits (PVB)	**£111.758**	**£99.156**	**£112.172**
Present Value of Costs (PVC)	**£70.543**	**£60.288**	**£76.781**
Overall Impact			
Net Present Value (NPV)	**£41.215**	**£38.868**	**£35.392**
Benefit to Cost Ratio (BCR)	**1.584**	**1.645**	**1.461**

Source: COBA11 Release 16 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 8.84 – COBA Proposed Improvement Corridors Appraisal, Do-Something Networks: Corridor 4 to Corridor 5

Item	Do-Something Network		
	Corridor 4		Corridor 5
	Option A	Option B	
Consumers (User Benefits)			
Travel Time	£55.960	£61.284	£52.286
Approx. Link Transit Time	£47.097	£54.506	£43.857
Approx. Junction Delay	£8.863	£6.778	£8.429
Vehicle Operating Costs	£2.392	£6.113	-£2.002
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	**£58.353**	**£67.397**	**£50.284**
Business Users (User Benefits)			
Travel Time	£39.974	£43.513	£37.768
Approx. Link Transit Time	£33.643	£38.700	£31.679
Approx. Junction Delay	£6.331	£4.813	£6.089
Vehicle Operating Costs	£1.487	£3.625	-£0.940
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	£41.461	£47.138	£36.828
Private Sector Provider Impacts (Operating Costs)	£0.391	£0.655	£0.091
Net Business Impact	**£41.853**	**£47.793**	**£36.919**
Total Present Value of TEE Benefits	**£100.206**	**£115.190**	**£87.203**
Public Accounts			
Government Funding			
Operating Costs	£0.538	£0.519	£0.407
Investment Costs	£71.212	£65.871	£43.383
Present Value of Costs	**£71.750**	**£66.390**	**£43.790**
Analysis of Monetised Costs and Benefits			
TEE Benefits			
Consumer User Benefits	£58.353	£67.397	£50.284
Business Benefits	£41.461	£47.138	£36.828
Private Sector Provider Impacts	£0.391	£0.655	£0.091
Accident Benefits	£7.521	£10.295	£8.938
Indirect Tax Revenues	-£0.980	-£2.821	£0.935
Emissions Benefits	£0.251	£0.740	-£0.256
Present Value of Benefits (PVB)	**£106.997**	**£123.404**	**£96.819**
Present Value of Costs (PVC)	**£71.750**	**£66.390**	**£43.790**
Overall Impact			
Net Present Value (NPV)	**£35.246**	**£57.015**	**£53.029**
Benefit to Cost Ratio (BCR)	**1.491**	**1.859**	**2.211**

Source: COBA11 Release 16 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 appraisal indicate that all six Proposed Improvement Corridors 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 Proposed Improvement Corridors, which are based on the application of the National Road Traffic Forecasts (NRTF) central traffic growth projection, is shown in Table 8.85.

Table 8.85 – Proposed Improvement Corridors Estimated Scheme Costs and COBA Appraisal Summary, Do-Something Networks: Corridor 1 to Corridor 5

Item	Do-Something Network					
	Corridor 1	Corridor 2	Corridor 3	Corridor 4		Corridor 5
				Option A	Option B	
Total Scheme Cost (£m's)	£125.971	£107.626	£137.159	£127.962	£118.361	£77.937
Present Value of Costs (£m's)	£70.543	£60.288	£76.781	£71.750	£66.390	£43.790
Present Value of Benefits (£m's)	£111.758	£99.156	£112.172	£106.997	£123.404	£96.819
Net Present Value (£m's)	£41.215	£38.868	£35.392	£35.246	£57.015	£53.029
Benefit to Cost Ratio (BCR)	1.584	1.645	1.461	1.491	1.859	2.211
Proposed Improvement Corridor BCR Ranking	**4th**	**3rd**	**6th**	**5th**	**2nd**	**1st**

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Based on the above results, Proposed Improvement Corridor 5 would represent high value for money; Proposed Improvement Corridor 4 – Option B, Corridor 2 and Corridor 1 would represent medium value for money; and Proposed Improvement Corridor 4 – Option A and Corridor 3 would represent low value for money.

In considering the results of the economic assessment it should be noted that some of the Proposed Improvement Corridors include an opening structure over the Newry River or the Newry Canal to maintain navigation. For this DMRB Stage 1 economic assessment, the road user delays associated with the effects of including a typical opening bridge have been considered based on an estimate of the number and average duration of openings per annum.

For the purpose of the initial economic assessment, it has been estimated that the bridge would open on average once or twice per week throughout the year with an overall duration of 15 minutes to allow time for the bridge to open and close and for boats to navigate along the canal to and from Newry.

Based on this scenario, it is estimated that the 60-year road user delay cost associated with the opening bridge is approximately £100k in 2010 prices.

8.8 Sensitivity Tests

A series of sensitivity tests has been undertaken to examine the extent to which the results from the COBA economic appraisal varies under various scenarios. The results of these sensitivity tests are shown below.

8.8.1 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 appraisals vary under various scenarios.

The Proposed Improvement Corridors have therefore been tested considering the effects of NRTF low growth projections from the year 2013 onwards.

The results of the COBA sensitivity test based on NRTF low growth projections are shown in Table 8.86 to Table 8.88. The results of the main COBA run, which is based on NRTF central growth traffic forecasts, are also included for comparison.

Table 8.86 – COBA Proposed Improvement Corridors Appraisal Summary, Traffic Forecast Sensitivity Test, Do-Something Networks: Corridor 1 and Corridor 2

Item	Do-Something Network			
	Corridor 1		Corridor 2	
	Low Growth	Central Growth	Low Growth	Central Growth
Present Value of Benefits (PVB) (£m's)	£82.000	£111.758	£72.586	£99.156
Present Value of Costs (PVC) (£m's)	£70.543	£70.543	£60.288	£60.288
Net Present Value (NPV)	£11.457	£41.215	£12.298	£38.868
Benefit to Cost Ratio (BCR)	1.162	1.584	1.204	1.645

Note: Assessment is based on NRTF low and central growth with results expressed in 2010 prices.

Table 8.87 – COBA Proposed Improvement Corridors Appraisal Summary, Traffic Forecast Sensitivity Test, Do-Something Networks: Corridor 3 and Corridor 4 – Option A

Item	Do-Something Network			
	Corridor 3		Corridor 4 – Option A	
	Low Growth	Central Growth	Low Growth	Central Growth
Present Value of Benefits (PVB) (£m's)	£84.164	£112.172	£79.367	£106.997
Present Value of Costs (PVC) (£m's)	£76.781	£76.781	£71.750	£71.750
Net Present Value (NPV)	£7.383	£35.392	£7.617	£35.246
Benefit to Cost Ratio (BCR)	1.096	1.461	1.106	1.491

Note: Assessment is based on NRTF low and central growth with results expressed in 2010 prices.

Table 8.88 – COBA Proposed Improvement Corridors Appraisal Summary, Traffic Forecast Sensitivity Test, Do-Something Networks: Corridor 4 – Option B and Corridor 5

Item	Do-Something Network			
	Corridor 4 – Option B		Corridor 5	
	Low Growth	Central Growth	Low Growth	Central Growth
Present Value of Benefits (PVB) (£m's)	£94.639	£123.404	£68.113	£96.819
Present Value of Costs (PVC) (£m's)	£66.390	£66.390	£43.790	£43.790
Net Present Value (NPV)	£28.249	£57.015	£24.324	£53.029
Benefit to Cost Ratio (BCR)	1.426	1.859	1.555	2.211

Note: Assessment is based on NRTF low and central growth with results expressed in 2010 prices.

The results of the COBA traffic forecast sensitivity test indicate that the Net Present Values of the Proposed Improvement Corridors reduces as the level of future traffic growth decreases. The results also indicate that each of the Proposed Improvement Corridors continue to provide a positive economic return under a range of future traffic growth forecasts.

8.8.2 Accident Benefits Sensitivity Test

As described previously in this report, the COBA appraisal is based on the application of default accident rates and costs to provide a reasonable estimate of the long-term effects of the Proposed Improvement Corridors over the 60-year assessment period. Based on the above approach, the Proposed Improvement Corridors would provide the following economic road safety benefits:

- Do-Something Network: Corridor 1: £9.305m
- Do-Something Network: Corridor 2: £8.680m
- Do-Something Network: Corridor 3: £7.636m
- Do-Something Network: Corridor 4 – Option A: £7.521m
- Do-Something Network: Corridor 4 – Option B: £10.295m
- Do-Something Network: Corridor 5: £8.938m

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 Improvement Corridors.

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. The results of the COBA sensitivity test based on no accident benefits are shown in Table 8.89 to Table 8.91. The results of the main COBA run are also included for comparison.

Table 8.89 – COBA Proposed Improvement Corridors Appraisal Summary, Accident Benefits Sensitivity Test, Do-Something Networks: Corridor 1 and Corridor 2

Item	Do-Something Network			
	Corridor 1		Corridor 2	
	Accident Benefits Excluded	Accident Benefits Included	Accident Benefits Excluded	Accident Benefits Included
Present Value of Benefits (PVB) (£m's)	£102.453	£111.758	£90.476	£99.156
Present Value of Costs (PVC) (£m's)	£70.543	£70.543	£60.288	£60.288
Net Present Value (NPV)	£31.910	£41.215	£30.188	£38.868
Benefit to Cost Ratio (BCR)	1.452	1.584	1.501	1.645

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.90 – COBA Proposed Improvement Corridors Appraisal Summary, Accident Benefits Sensitivity Test, Do-Something Networks: Corridor 3 and Corridor 4 – Option A

Item	Do-Something Network			
	Corridor 3		Corridor 4 – Option A	
	Accident Benefits Excluded	Accident Benefits Included	Accident Benefits Excluded	Accident Benefits Included
Present Value of Benefits (PVB) (£m's)	£104.537	£112.172	£99.476	£106.997
Present Value of Costs (PVC) (£m's)	£76.781	£76.781	£71.750	£71.750
Net Present Value (NPV)	£27.756	£35.392	£27.726	£35.246
Benefit to Cost Ratio (BCR)	1.361	1.461	1.386	1.491

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Table 8.91 – COBA Proposed Improvement Corridors Appraisal Summary, Accident Benefits Sensitivity Test, Do-Something Networks: Corridor 4 – Option B and Corridor 5

Item	Do-Something Network			
	Corridor 4 – Option B		Corridor 5	
	Accident Benefits Excluded	Accident Benefits Included	Accident Benefits Excluded	Accident Benefits Included
Present Value of Benefits (PVB) (£m's)	£113.109	£123.404	£87.882	£96.819
Present Value of Costs (PVC) (£m's)	£66.390	£66.390	£43.790	£43.790
Net Present Value (NPV)	£46.719	£57.015	£44.092	£53.029
Benefit to Cost Ratio (BCR)	1.704	1.859	2.007	2.211

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

The results of the COBA accident benefits sensitivity test indicate that each of the Proposed Improvement Corridors provides a positive economic return with the exclusion of the default accident benefits.

8.9 Summary and Conclusions

Five potential route corridors linking the A1 Dublin Road to the A2 Warrenpoint Road have been identified to assist in defining a preferred route corridor for the Newry Southern Relief Road. A series of Indicative Alignment Options within each corridor has also been prepared to assist in the assessment of the various route corridors.

A COBA model was developed to compare the costs and road user benefits of the Proposed Improvement Corridors, taking into account both transport economic efficiency and road safety issues.

8.9.1 Journey Times

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 Improvement Corridors in the 2023 Opening Year under Flow Group 4 conditions is shown below in Table 8.92.

Table 8.92 – Summary of Two-Way Journey Time Savings, 2023 Opening Year - Flow Group 4, Do-Something Networks: Corridor 1 to Corridor 5,

Route	Year	Flow Group	Two-Way Journey Time Savings (%)					
			Corridor 1	Corridor 2	Corridor 3	Corridor 4 Option A	Corridor 4 Option B	Corridor 5
Warrenpoint to / from Carrickcarnan	2023	FG4	41%	41%	51%	49%	47%	37%
Warrenpoint to / from Carnbane	2023	FG4	37%	45%	46%	44%	43%	34%
Warrenpoint to / from Sheepbridge	2023	FG4	28%	36%	37%	36%	34%	25%

Examination of the above information indicates that for strategic movements between Warrenpoint Harbour and B113 Carrickcarnan Junction, the two-way journey time savings range from 37% for Proposed Improvement Corridor 5 to 51% for Proposed Improvement Corridor 3 in the 2023 Opening Year under Flow Group 4 conditions.

For strategic movements between Warrenpoint Harbour and Carnbane Junction, the two-way journey time savings range from 34% for Proposed Improvement Corridor 5 to 46% for Proposed Improvement Corridor 3 in the 2023 Opening Year under Flow Group 4 conditions.

For strategic movements between Warrenpoint Harbour and Sheepbridge Junction, the two-way journey time savings range from 25% for Proposed Improvement Corridor 5 to 37% for Proposed Improvement Corridor 3 in the 2023 Opening Year under Flow Group 4 conditions.

By the 2037 Design Year, it is expected that the two-way journey time savings would increase by up to 7% under Flow Group 4 conditions.

8.10 Network Capacity

Examination of the over-capacity links and junctions in the Do-Minimum Network under NRTF central traffic growth forecasts indicates that traffic demand in the 2023 Opening Year under Flow Group 3 / 4 conditions would exceed capacity on 7 links and 3 junctions, increasing to 10 links and 6 junctions by the 2037 Design Year.

Examination of the over-capacity links and junctions in all of the Do-Something Networks under NRTF central 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 3 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 9 links and 4 junctions relative to the Do-Minimum Network, with the exception of Proposed Improvement Corridor 2 where demand at the existing Cloghogue junction is likely to exceed capacity.

8.10.1 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 Improvement Corridors is shown below in Table 8.93.

Table 8.93 – Accident Benefits, Do-Something Networks: Corridor 1 to Corridor 5

Accident Benefits	Do-Something Network					
	Corridor 1	Corridor 2	Corridor 3	Corridor 4 Option A	Corridor 4 Option B	Corridor 5
Accident Benefits (£m's)	9.305	8.680	7.636	7.521	10.295	8.938
Accident Benefits (No.)	202.9	181.8	161.6	162.2	196.5	199.7
Proposed Improvement Corridor Cost Savings Ranking	**2nd**	**4th**	**5th**	**6th**	**1st**	**3rd**

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Examination of the above information indicates that the accident benefits range from £7.521m for Proposed Improvement Corridor 4 – Option A to £10.295m for Proposed Improvement Corridor 4 – Option B.

8.10.2 Economic Appraisal of Proposed Improvement Corridors

Based on the results of the COBA models presented in this report, it is concluded that all of the Proposed Improvement Corridors would return a positive Net Present Value under NRTF central traffic growth projections.

An overall summary of the estimated scheme costs including 44% optimism bias and the economic results from the COBA models for the Proposed Improvement Corridors based on the application of the National Road Traffic Forecasts (NRTF) central traffic growth projection is shown in Table 8.94.

Table 8.94 – Proposed Improvement Corridors Estimated Scheme Costs and COBA Appraisal Summary, Do-Something Networks: Corridor 1 to Corridor 5

Item	Do-Something Network					
	Corridor 1	Corridor 2	Corridor 3	Corridor 4		Corridor 5
				Option A	Option B	
Total Scheme Cost (£m's)	£125.971	£107.626	£137.159	£127.962	£118.361	£77.937
Present Value of Costs (£m's)	£70.543	£60.288	£76.781	£71.750	£66.390	£43.790
Present Value of Benefits (£m's)	£111.758	£99.156	£112.172	£106.997	£123.404	£96.819
Net Present Value (£m's)	£41.215	£38.868	£35.392	£35.246	£57.015	£53.029
Benefit to Cost Ratio (BCR)	1.584	1.645	1.461	1.491	1.859	2.211
Proposed Improvement Corridor BCR Ranking	**4th**	**3rd**	**6th**	**5th**	**2nd**	**1st**

Note: Assessment is based on NRTF central growth with results expressed in 2010 prices.

Based on the above results:

- Proposed Improvement Corridor 5 would represent high value for money;
- Proposed Improvement Corridor 4 – Option B, Corridor 2 and Corridor 1 would represent medium value for money; and
- Proposed Improvement Corridor 4 – Option A and Corridor 3 would represent low value for money.

It is therefore concluded that the Indicative Alignment Options examined within Proposed Improvement Corridor 5 and Corridor 4 provide the highest overall economic returns.

Conclusions and Recommendations

09

9. Conclusions and recommendations

9.1 Conclusions

Five corridor options were considered and assessed to the southwest of Newry City for strategic traffic wishing to transfer between the A1/N1 Belfast to Dublin Corridor and the A2 Warrenpoint Road, as well as a Do Minimum (leave as is) case.

All corridor options considered provide significant benefits to strategic traffic seeking to avoid the city centre of Newry when compared to the existing route through the city.

All options may require some lifting/articulating bridge mechanism to facilitate marine traffic on either the Newry River or Canal, except Corridor 3. Two options, (Corridor 1 and 2) pass through an area that now is considered to be geologically unstable and should not be considered further.

All corridor options have some significant detrimental environmental impact, if not avoided or mitigated.

All corridor options indicate a reduction in Personal Injury Accidents and have positive Benefit to Cost Ratios.

As the cost of an opening structure significantly increases the cost of the respective bridges by up to 80%, then the need for an opening structure would have to be fully investigated in any future study.

Corridor 5 is the least expensive (£78M), has the highest Cost to Benefit Ratio (2.2) and has broadly less environmental impact when compared to the other options; it does however present fewer opportunities for alignment options during any subsequent evaluation process.

Corridor 4 has a range of possible route options, but all Corridor 4 options are much more costly than Corridor 5, Cost to Benefit Ratios (1.9 – 1.5) are all lower than Corridor 5, and all Corridor 4 options potentially have significant environmental constraints that require further studies to establish their relative significance.

Corridor 3 is the high-level option and has the highest cost (£137M), the Cost to Benefit Ratio (1.5) is lower than Corridor 5, and would have major visual issues, though has the potential to be an iconic landmark structure.

Currently, Corridor 5 would appear to provide the best opportunity for a sustainable solution, however given the limited alignment scope within Corridor 5, and the potential of Corridor 4, both should be included within the Stage 2 study.

9.2 Recommendations

It is recommended that Corridors 4 and 5, as indicated on Figure 9.1.1 in Appendix A, should be subject to a Stage 2 Assessment and report in accordance with DMRB TD37/93, which satisfies the requirements of a Preferred Options Report under RSPPG_E030.

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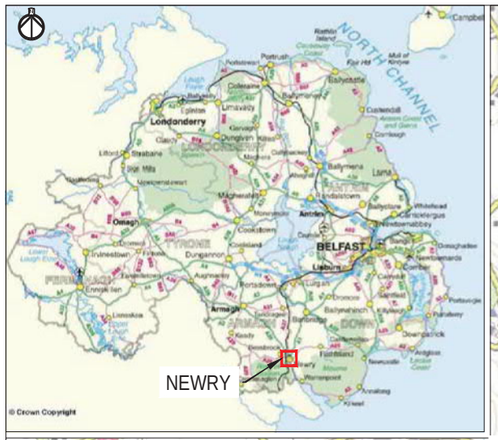
Newry Southern Relief Road

Stage 1 Scheme Assessment Report Final
Appendix A

Project Number: 60472927

June 2017

Appendix A - Figures not in the main text body of the report



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SCALE 1:25,000

0M 200M 500M 1000M 1500M 2000M

B79 DRUMALANE ROAD

FATHOM LINE

A28 DUBLIN ROAD

A2 WARRENPOINT ROAD DUAL CARRIAGEWAY

CLOGHOGUE ROUNDABOUT

B79 FATHOM LINE

ELLISHOLDING JUNCTION

A1/N1 DUAL CARRIAGEWAY

FLAGSTAFF ROAD

OLD A1

FERRYHILL ROAD

BELFAST

DUBLIN

A1

N1

B113

B79

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
GENERAL LOCATION PLAN
AND STUDY AREA

KEY

Study Area Boundary

International Border

Scale @ A3

1:25,000

AECOM Internal Project Number

60472927

FIGURE 1.1.2

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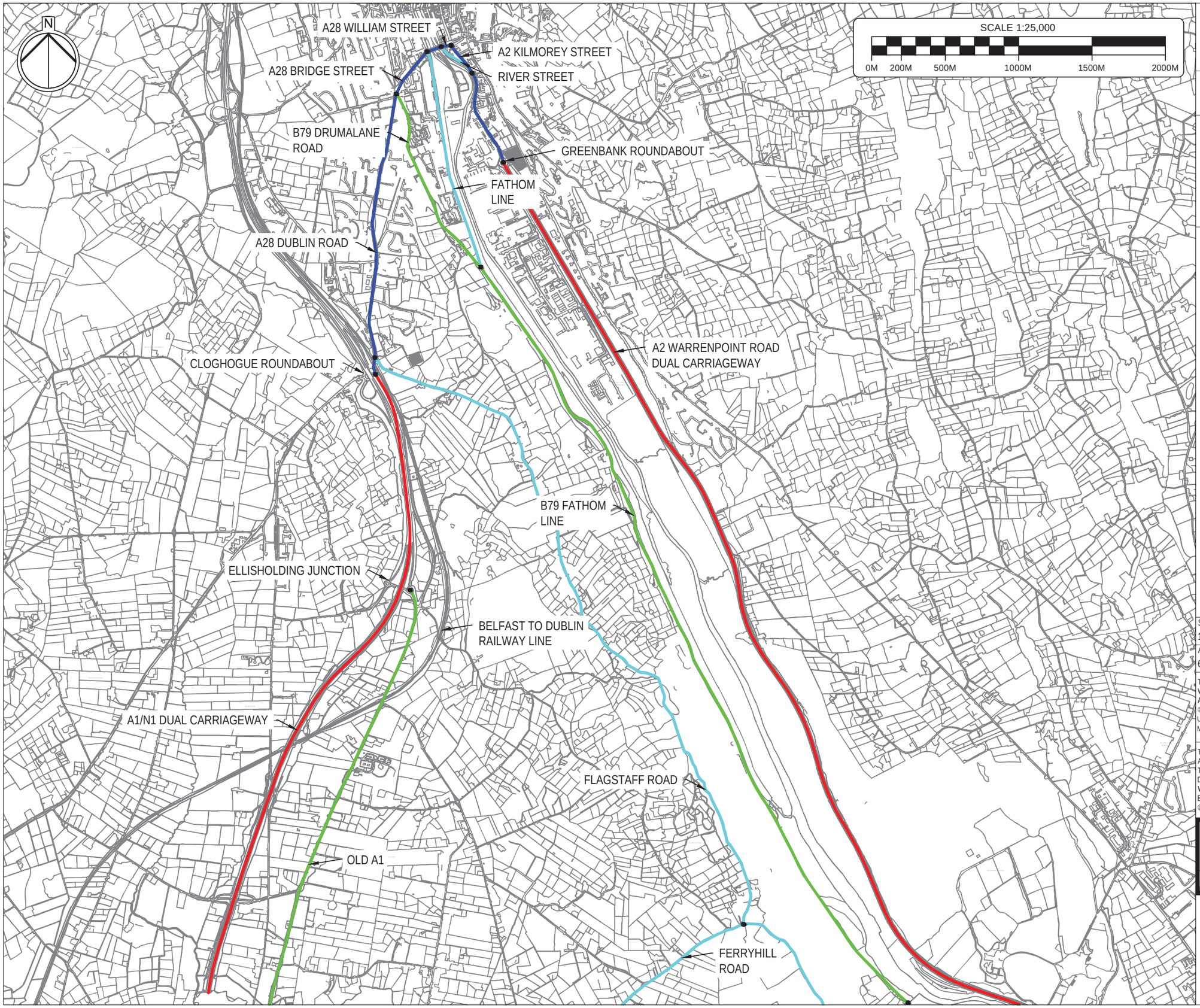

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
EXISTING CONDITIONS
EXISTNG ROAD NETWORK

KEY

- A Road Dual Carriageway
- A Road
- B Road
- C Road or Unclassified Road
- Origin/Destination Node

Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

FIGURE 2.3.6

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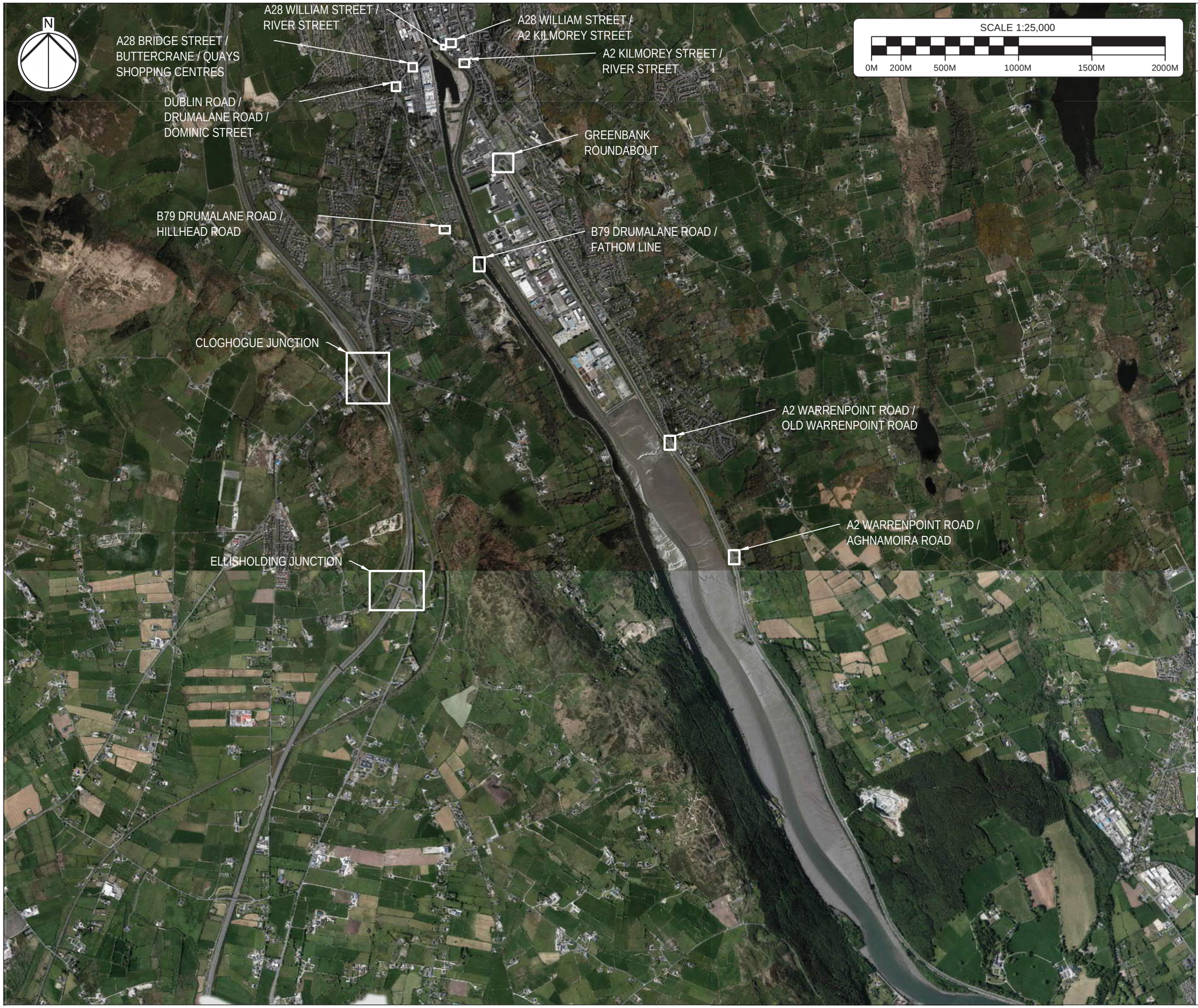

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

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Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
EXISTING CONDITIONS
EXISTNG JUNCTION LOCATIONS

Scale @ A3

1:25,000

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FIGURE 2.3.7

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ELLISHOLDING
JUNCTION

CLOGHOGUE
JUNCTION

B79 DRUMALANE ROAD /
FATHOM LINE

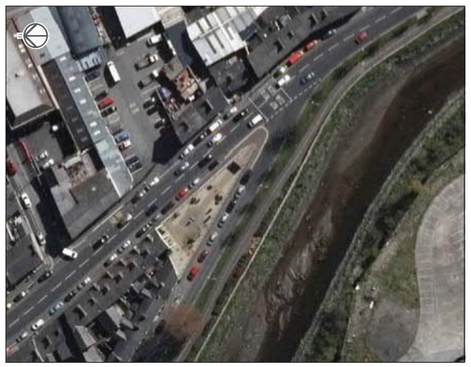
B79 DRUMALANE ROAD /
HILLHEAD ROAD

DUBLIN ROAD /
DRUMALANE ROAD /
DOMINIC STREET

A28 BRIDGE STREET /
BUTTERCRANE / QUAYS
SHOPPING CENTRES

A28 WILLIAM STREET /
RIVER STREET

A28 WILLIAM STREET /
A2 KILMOREY STREET



A2 KILMOREY STREET /
RIVER STREET

GREENBANK
ROUNDABOUT

A2 WARRENPOINT ROAD /
OLD WARRENPOINT ROAD

A2 WARRENPOINT ROAD /
AGHNAMOIRA ROAD

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
EXISTING CONDITIONS
EXISTNG JUNCTION DETAILS

Scale @ A3
NTS

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FIGURE 2.3.8

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N

SCALE 1:25,000

0M 200M 500M 1000M 1500M 2000M

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
PROPOSED CORRIDORS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Corridor Study Area
- International Border

Scale @ A3
1:25,000

AECOM Internal Project Number
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FIGURE 5.2.1

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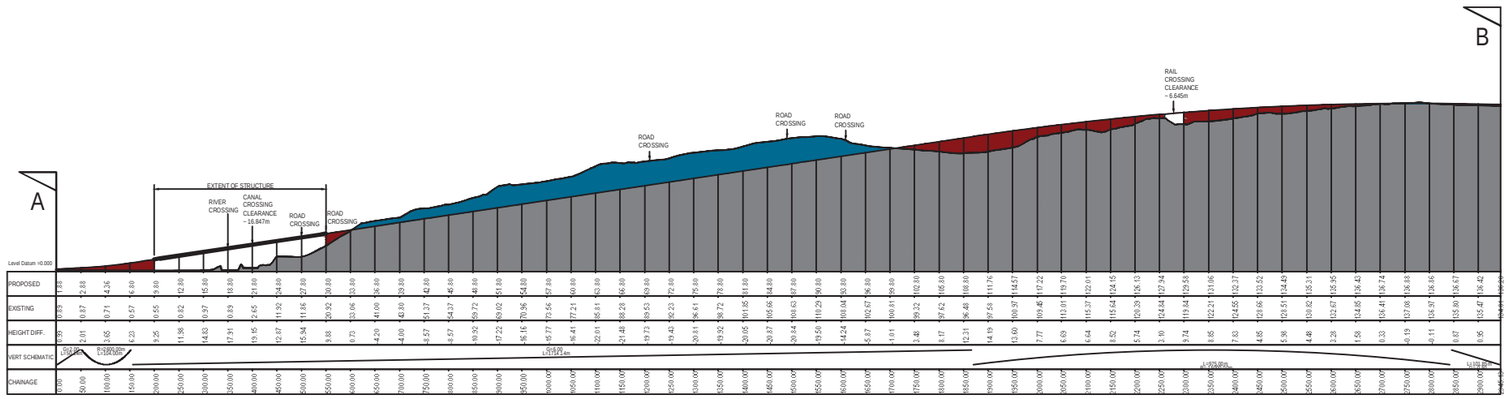
PLAN
Scale: 1:12500



Warrenpoint Road to Ellisholding

PROFILE
Scale: Horz 1:12500 Vert 1:5000

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
CORRIDOR 1

KEY

- Existing Ground
- Fill
- Excavation
- Indicative Alignment and Chainage

Scale @ A3
1:12,500

AECOM Internal Project Number
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FIGURE 5.3.1

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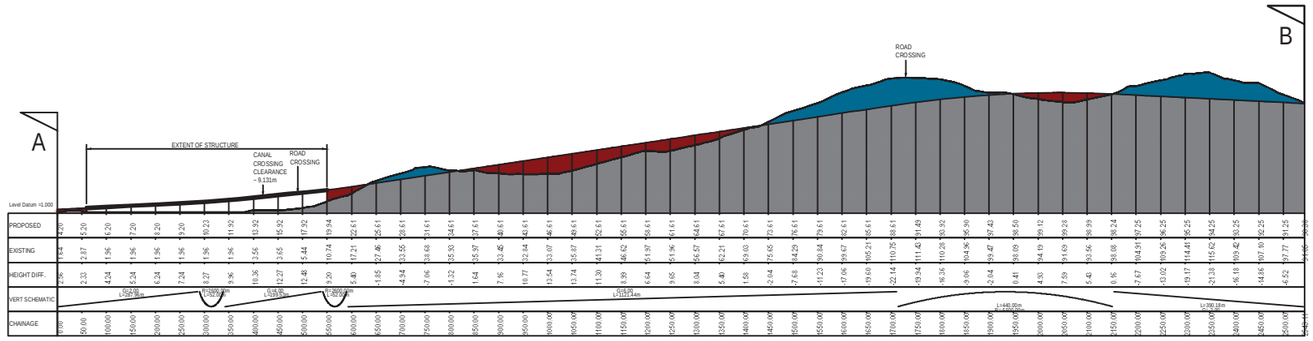
Scale: 1:12500



Warrenpoint Road to Dublin Road/Chancellors Road Junction

PROFILE
Scale: Horz 1:12500 Vert 1:5000

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
CORRIDOR 2

KEY

- Existing Ground
- Fill
- Excavation
- Indicative Alignment and Chainage (0+000)

Scale @ A3
1:12,500

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FIGURE 5.3.2

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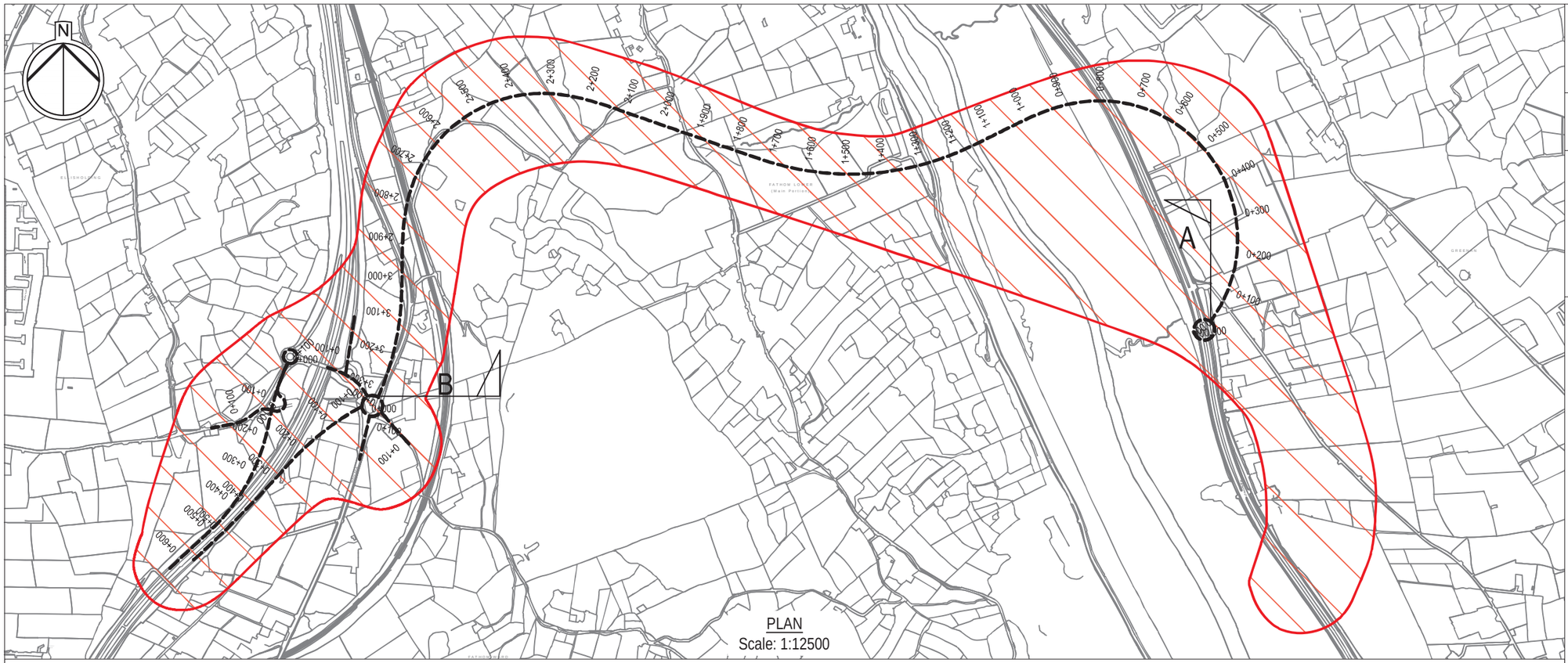

PLAN
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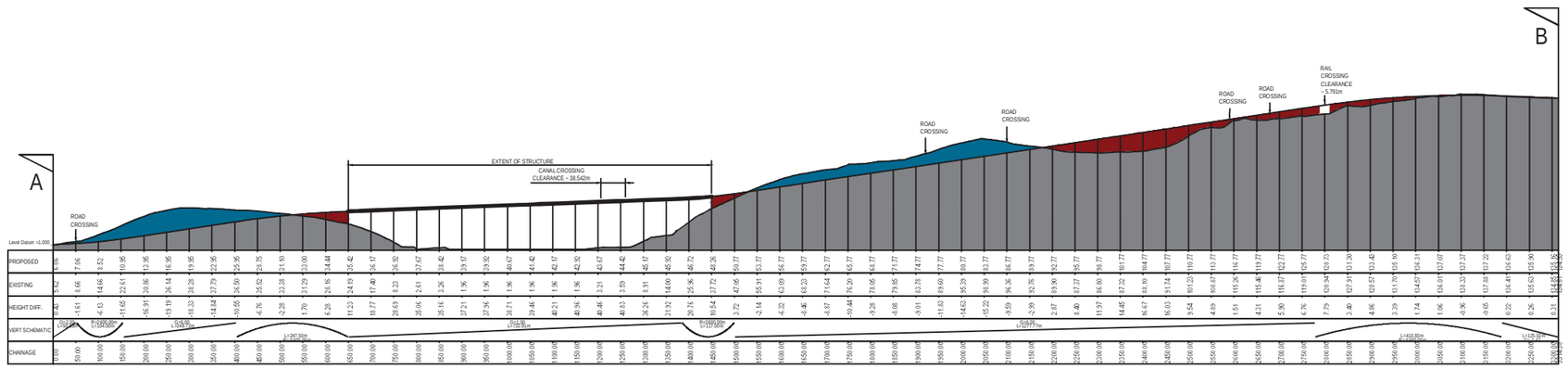

A2 Warrenpoint Road to Ellisholding

PROFILE
Scale: Horz 1:12500 Vert 1:5000

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
CORRIDOR 3

KEY

- Existing Ground
- Fill
- Excavation
- Indicative Alignment and Chainage (0+000)

Scale @ A3
1:12,500

AECOM Internal Project Number
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FIGURE 5.3.3

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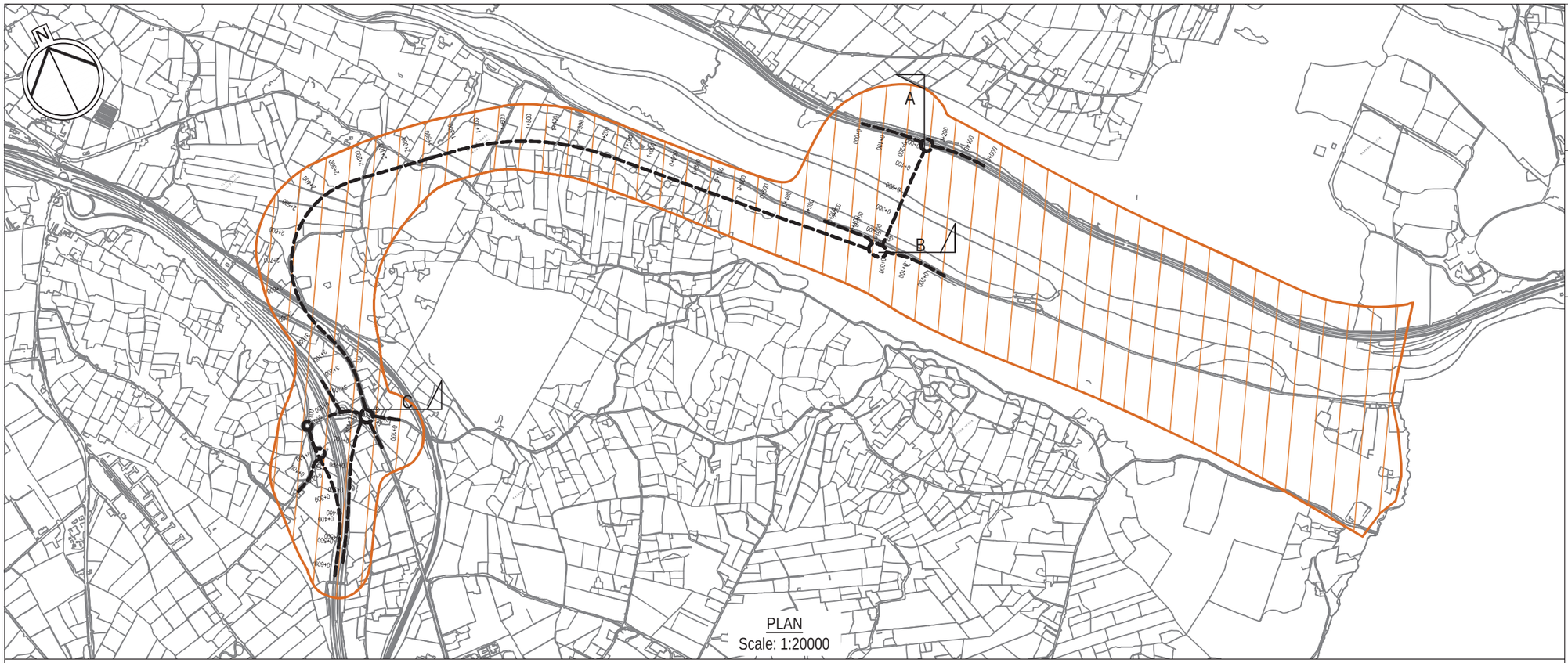
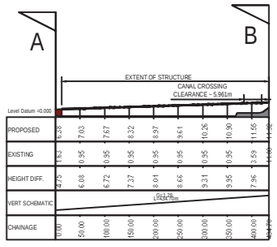
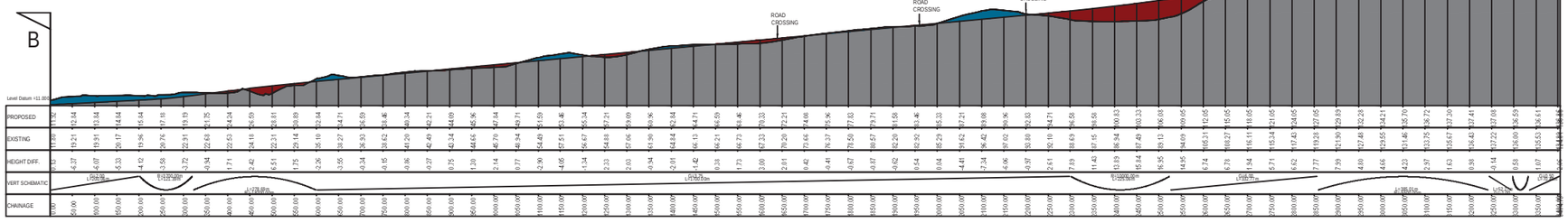




River / Canal Crossing



Fathom Line to Ellisholding

PROFILE
Scale: Horz 1:12500 Vert 1:5000

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
CORRIDOR 4 OPTION A

KEY

- Existing Ground
- Fill
- Excavation
- Indicative Alignment and Chainage

Scale @ A3
1:20,000

AECOM Internal Project Number
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FIGURE 5.3.4

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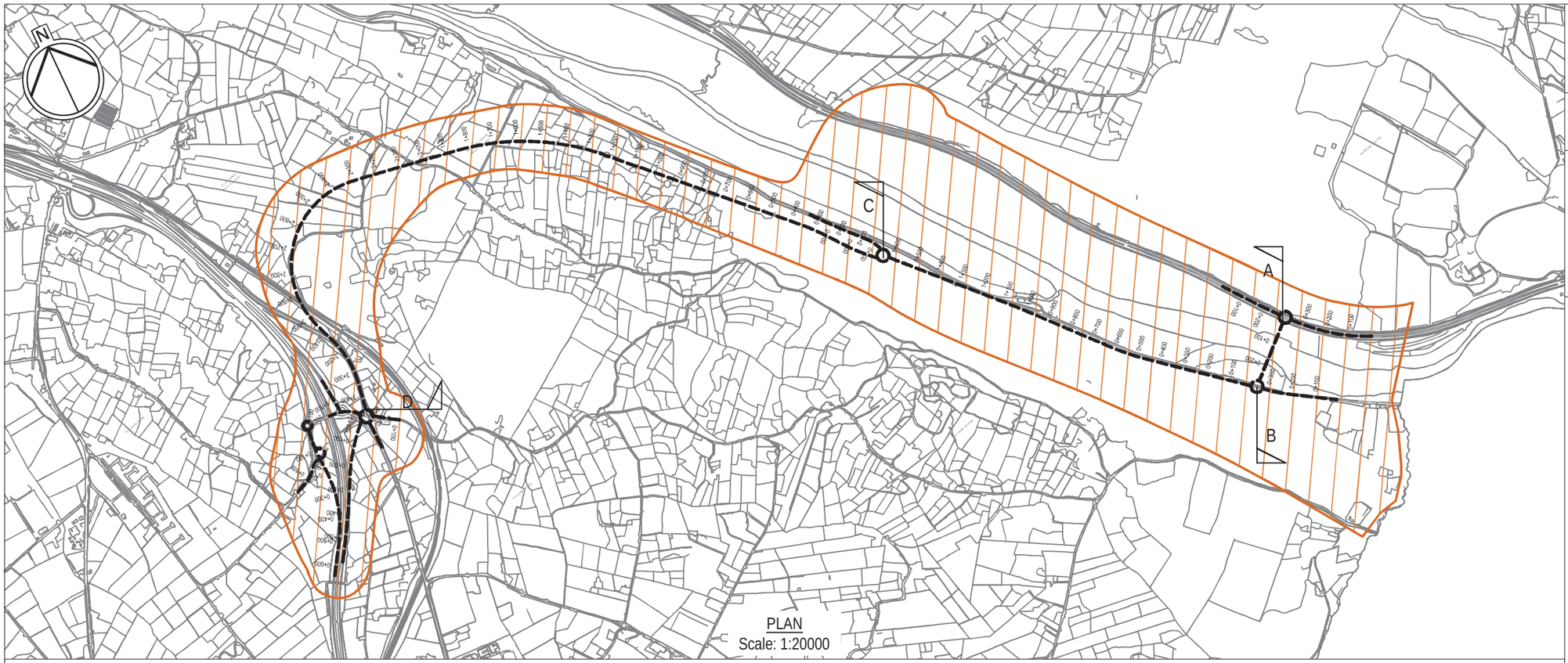

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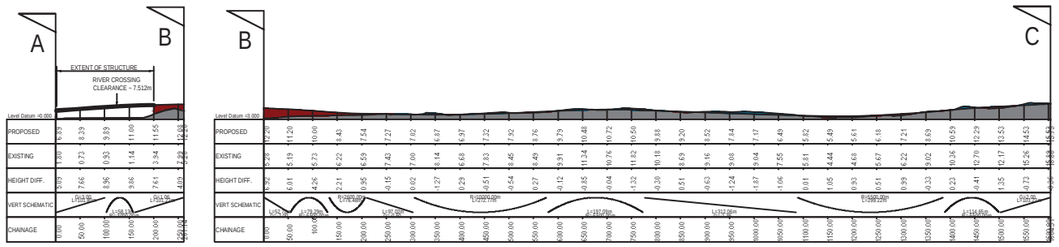
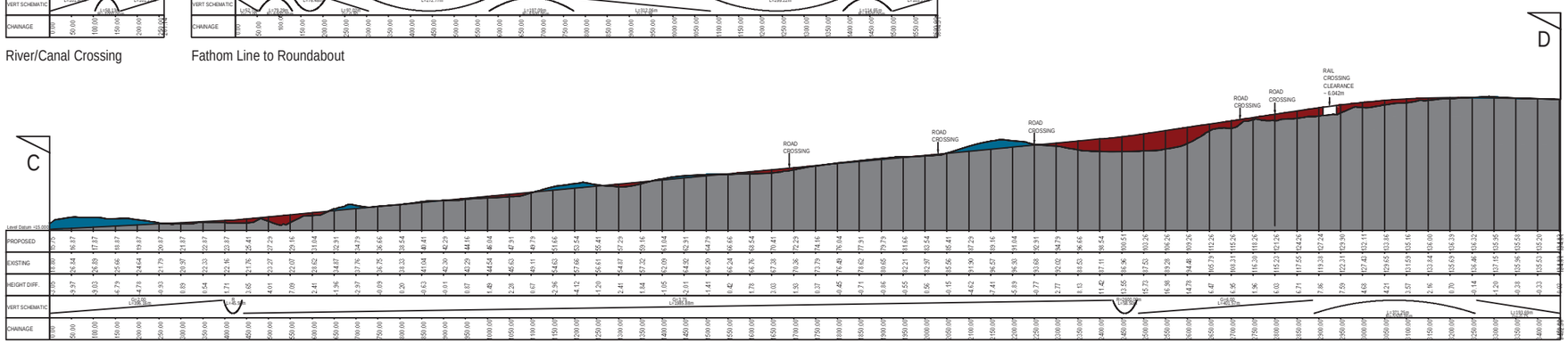


River/Canal Crossing

Fathom Line to Roundabout



Roundabout to Ellisholding

PROFILE
Scale: Horz 1:12500 Vert 1:5000

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
CORRIDOR 4 OPTION B

KEY

- Existing Ground
- Fill
- Excavation
- Indicative Alignment and Chainage

Scale @ A3
1:20,000

AECOM Internal Project Number
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FIGURE 5.3.5

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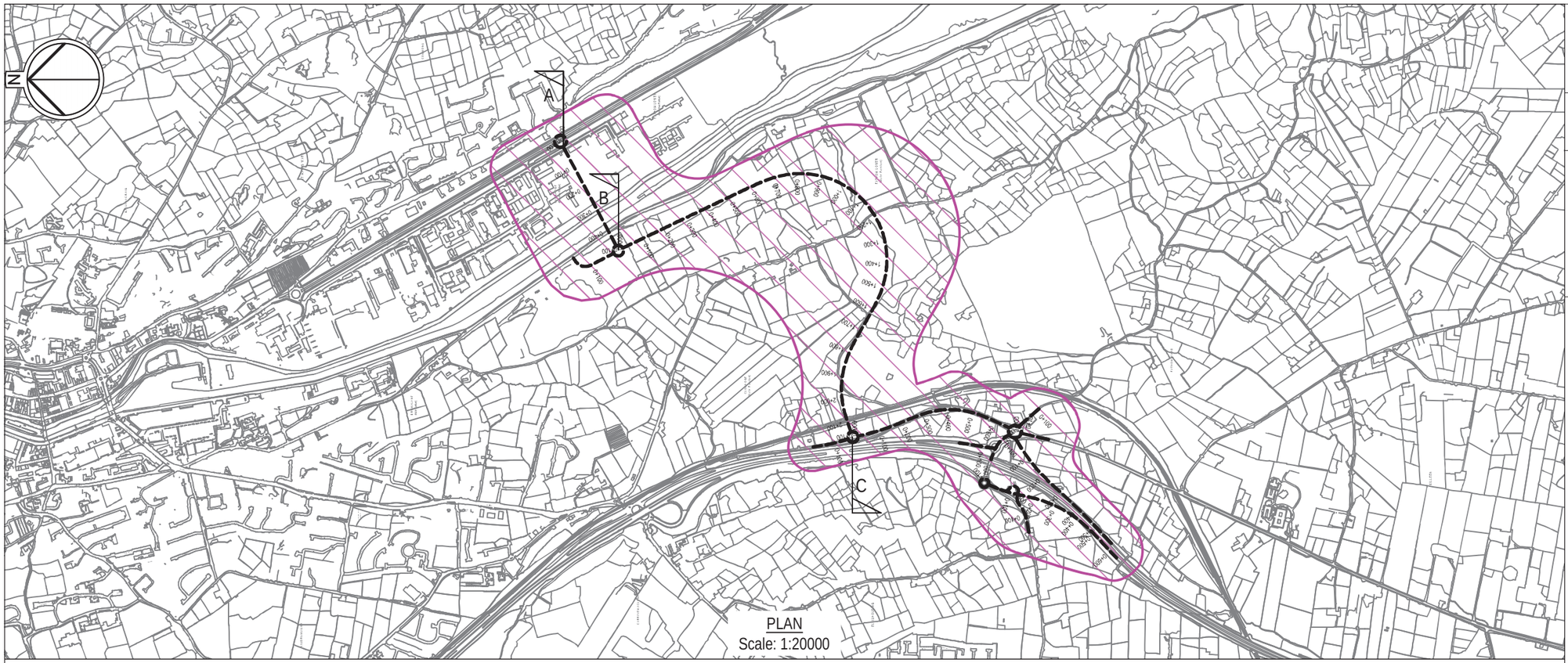

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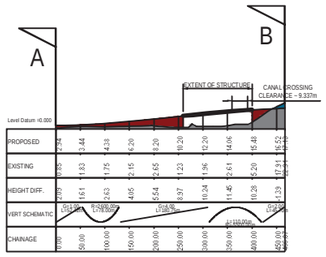
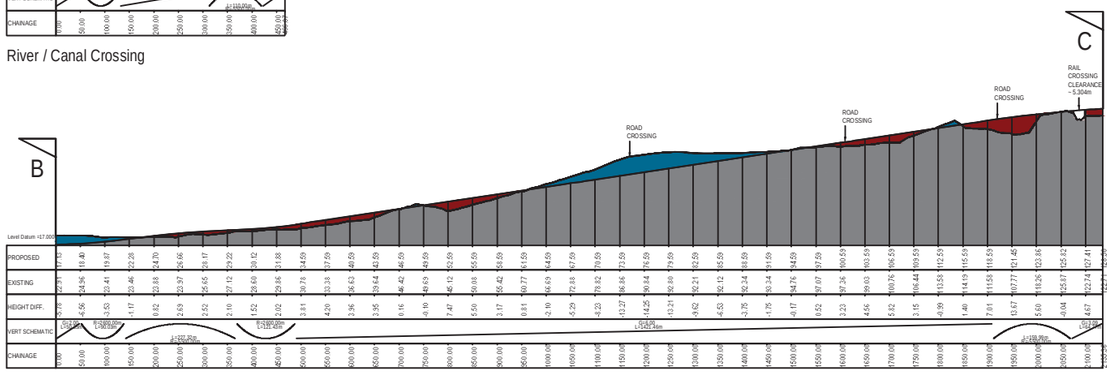


River / Canal Crossing



Fathom Line to Dublin Road Roundabout

PROFILE
Scale: Horz 1:12500 Vert 1:5000

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
CORRIDOR 5

KEY

- Existing Ground
- Fill
- Excavation
- Indicative Alignment and Chainage (+400)

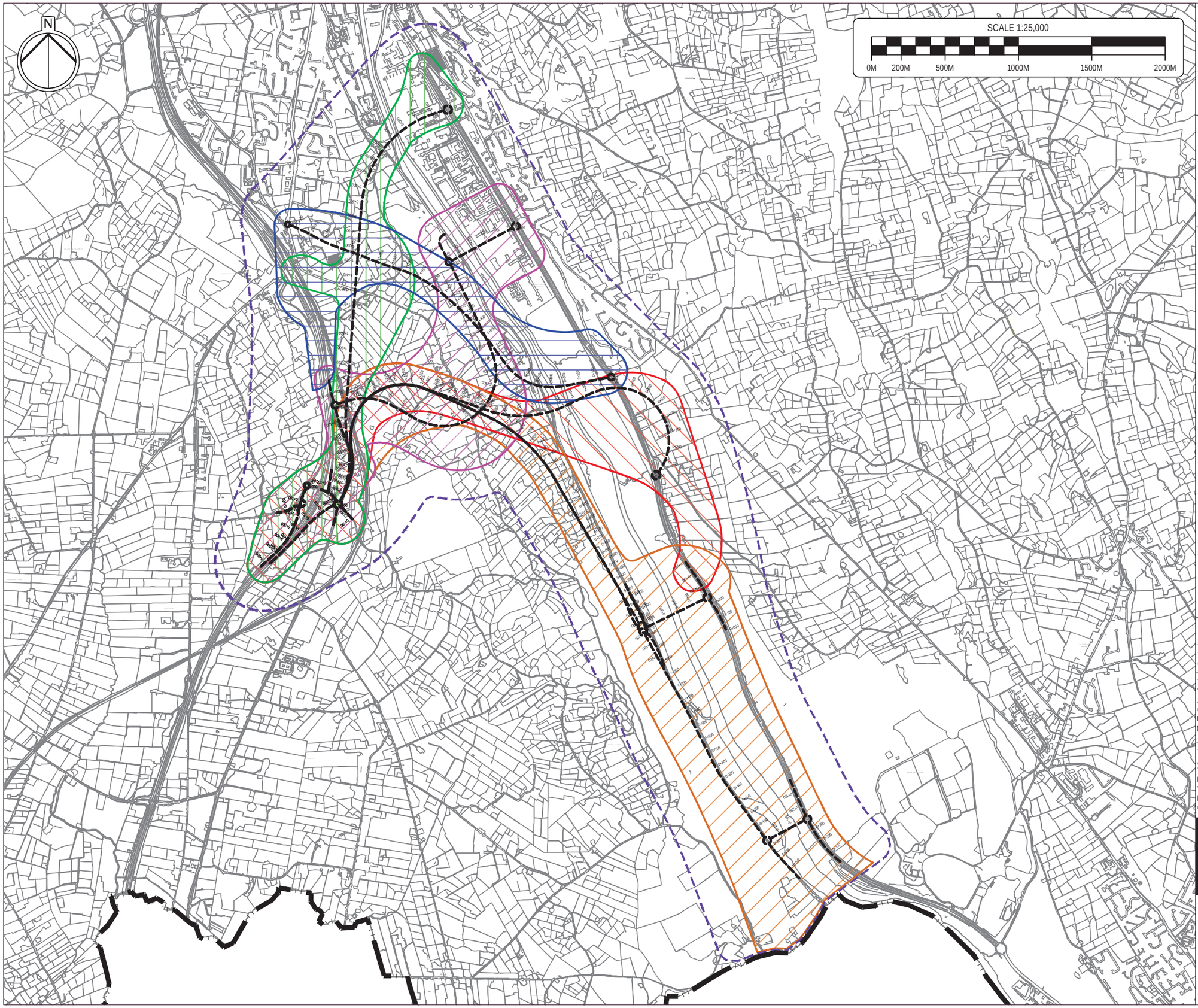
Scale @ A3
1:20,000

AECOM Internal Project Number
60472927

FIGURE 5.3.6

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDOR OPTIONS
PROPOSED CORRIDORS
AND INDICATIVE ALIGNMENTS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Corridor Study Area
- International Border
- Indicative Alignment and Chainage

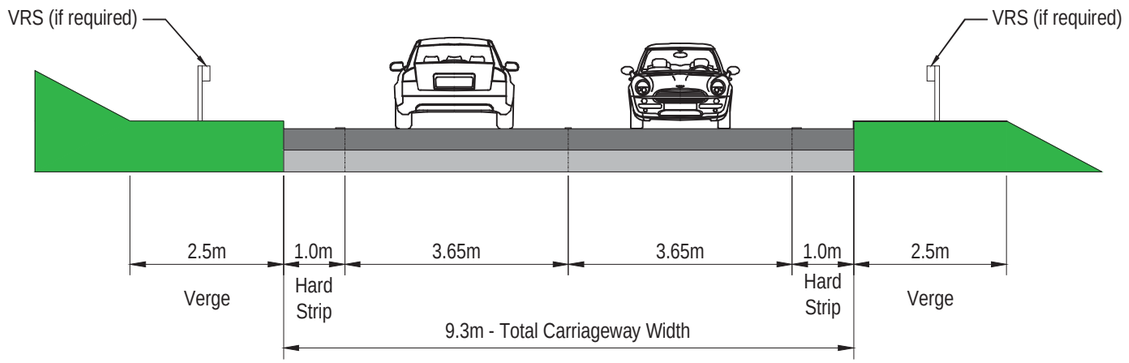
Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

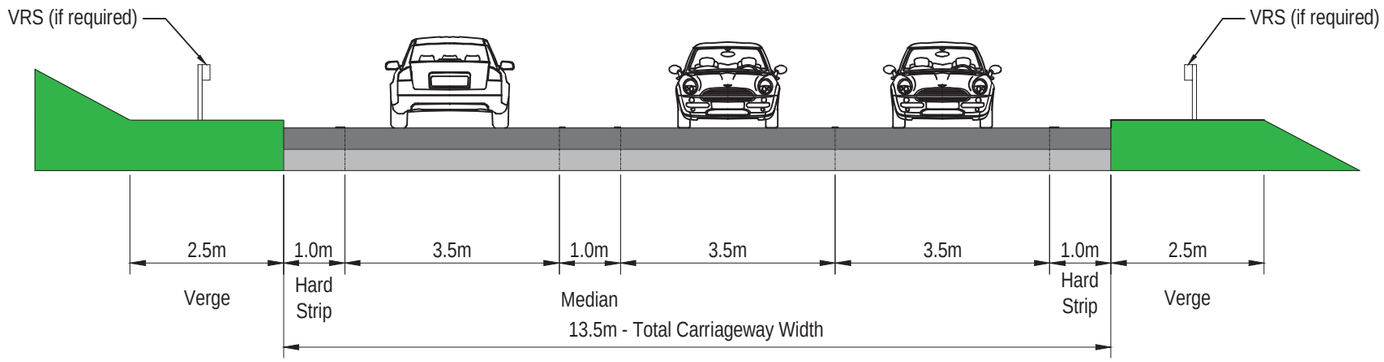
FIGURE 6.1.1

REV. 0

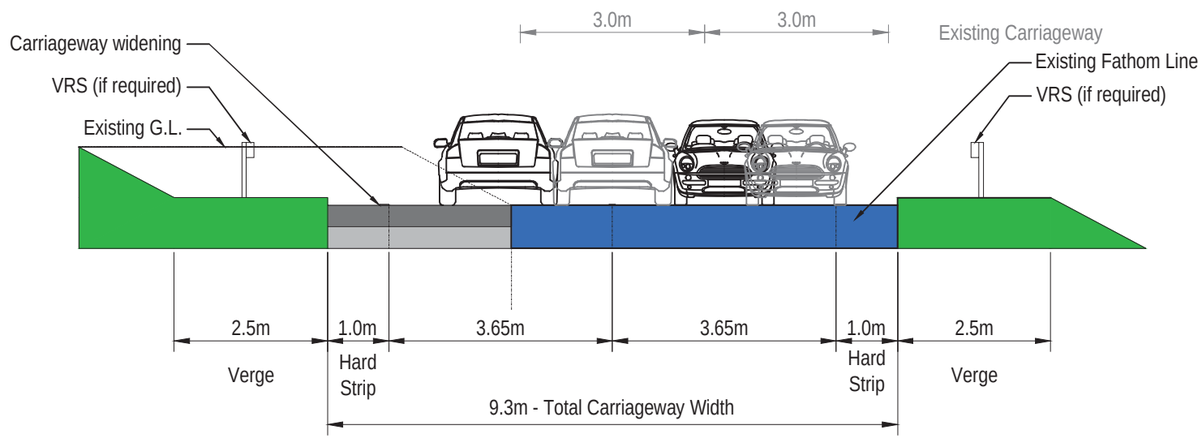
AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Proposed S2 Standard Carriageway - New Construction



Proposed WS2+1 Standard Carriageway - New Construction



Proposed S2 Standard Carriageway - Upgrade to Fathom Line

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
STANDARD DETAIL
CROSS SECTION DETAILS

Scale @ A3

NTS

AECOM Internal Project Number

60472927

FIGURE 6.6.1

REV. 0

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www.aecom.com

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
UTILITIES
ELECTRICITY

KEY

- NIE 33kV
- NIE 11kV
- NIE Medium Voltage

Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

FIGURE 6.7.1

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
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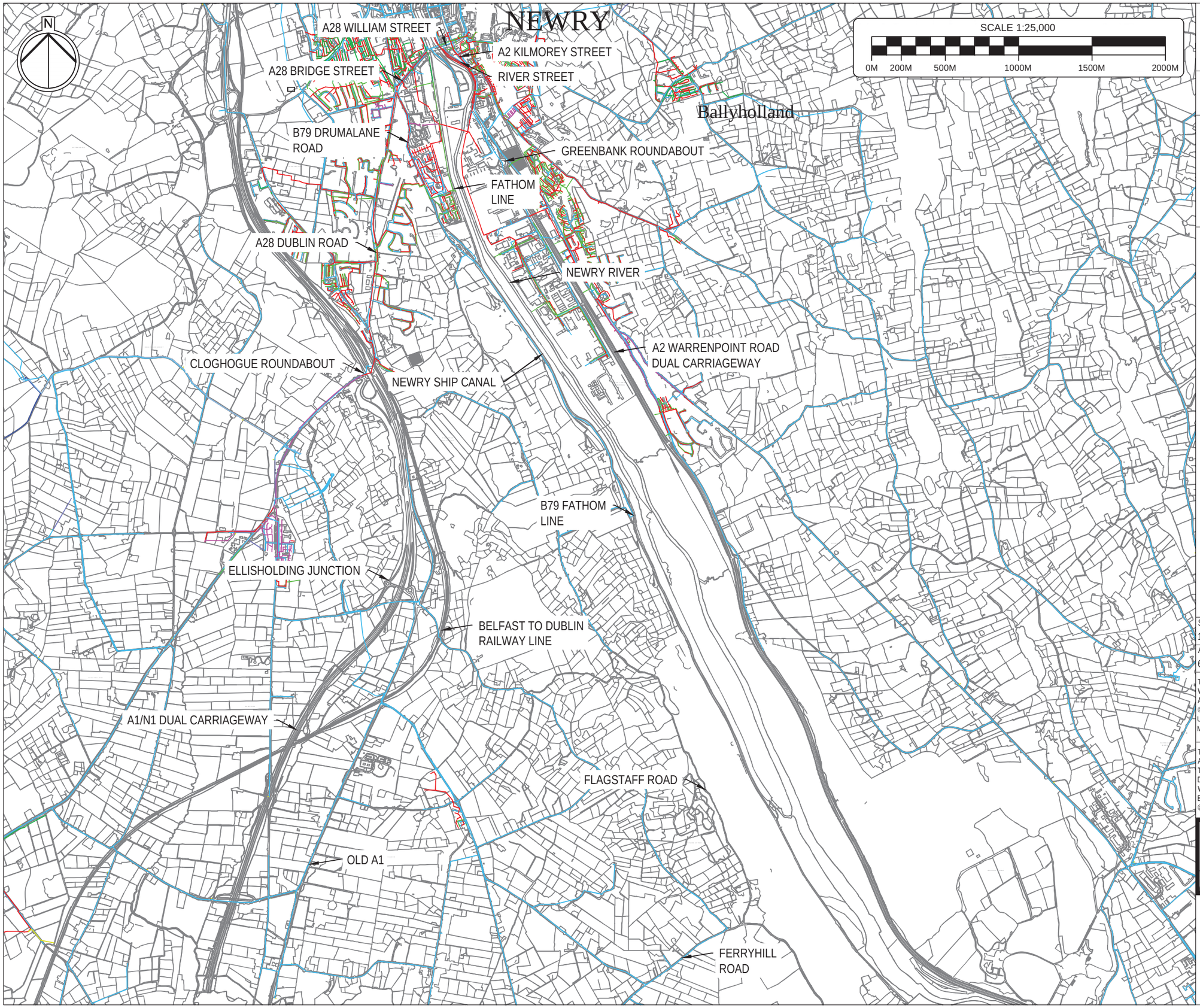
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
UTILITIES
SEWERAGE AND WATERMAINS

KEY

- Watermain
- Combined Foul and Strorm Sewer
- Foul Sewer
- Storm Sewer

Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

FIGURE 6.7.2

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
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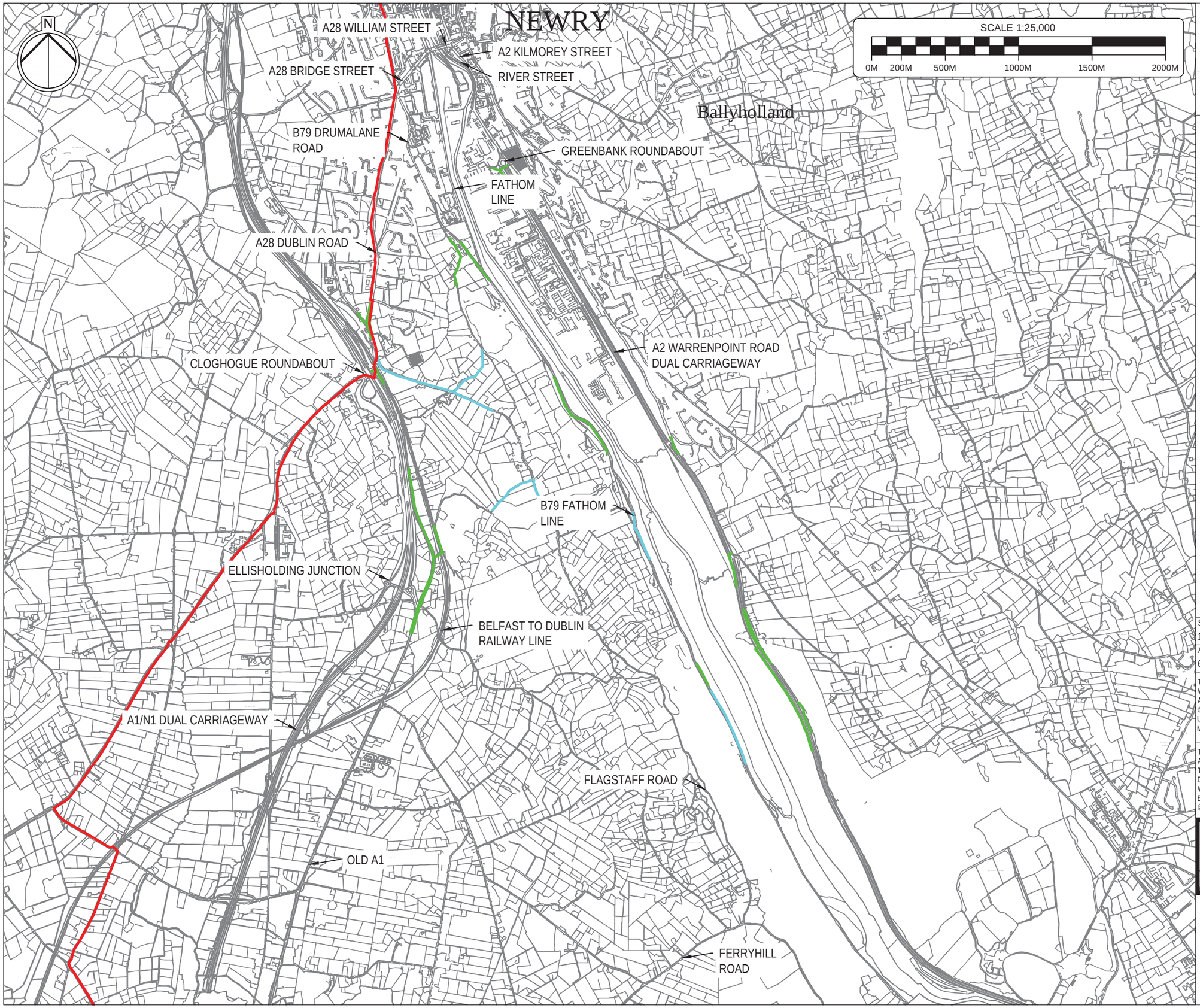

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
UTILITIES
TELECOMMUNICATIONS

KEY

- BT Overhead
- BT Underground
- Virgin Media & Eircom

Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

FIGURE 6.7.3

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
UTILITIES
FIRMUS GAS

KEY

- Distribution Pipe (Low Pressure)
- Distribution Pipe (Medium Pressure)

Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

FIGURE 6.7.4

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
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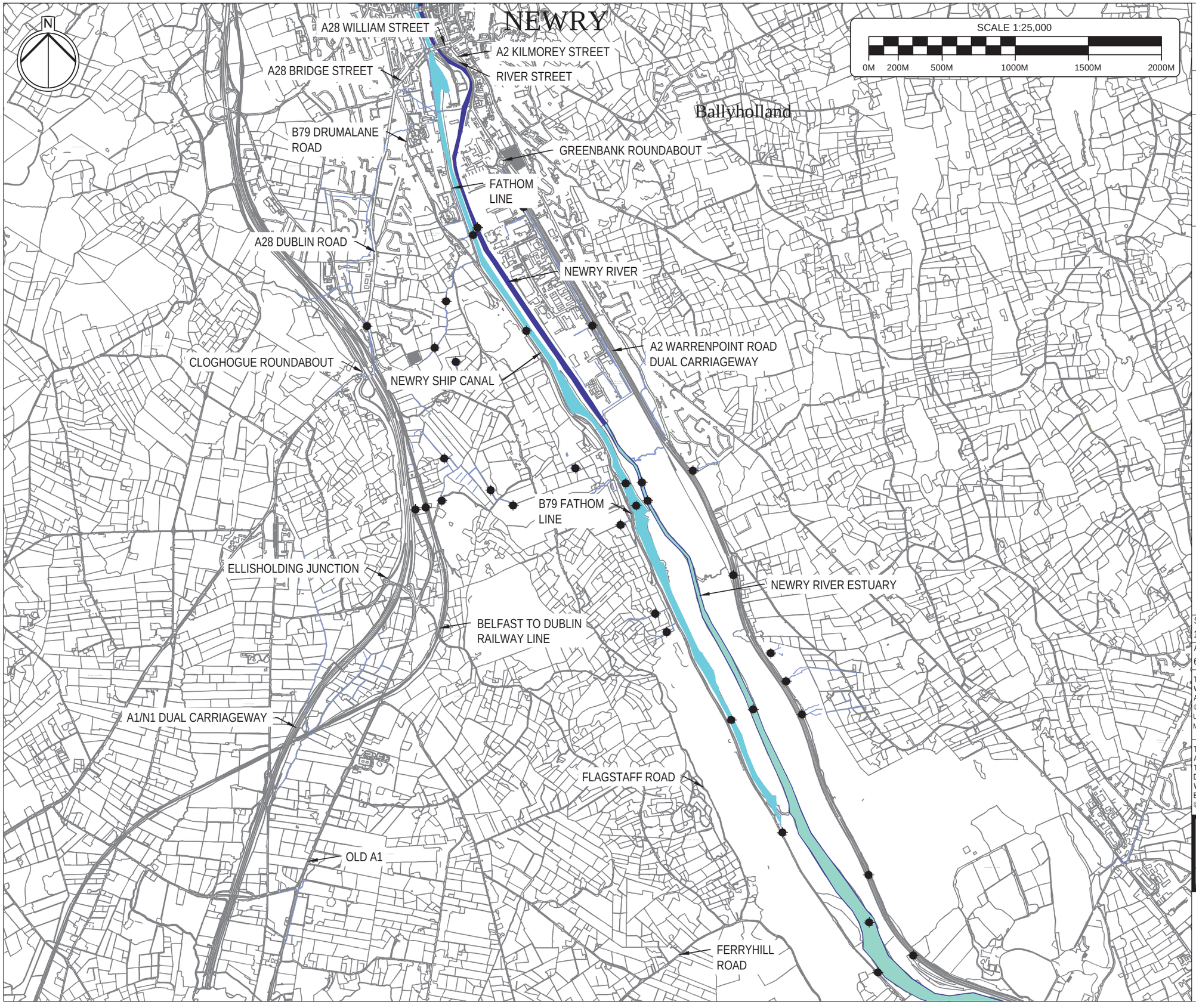

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ENGINEERING ASSESSMENT
SCHEME DRAINAGE

KEY

- Major Watercourse
- Minor Watercourse
- Culverted Minor Watercourse
- Newry Canal
- Estuarine Section of Newry River
- Potential Scheme Drainage Outfall Locations

Scale @ A3

1:25,000

AECOM Internal Project Number

60472927

FIGURE 6.7.5

REV. 0

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Beechill House
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Belfast
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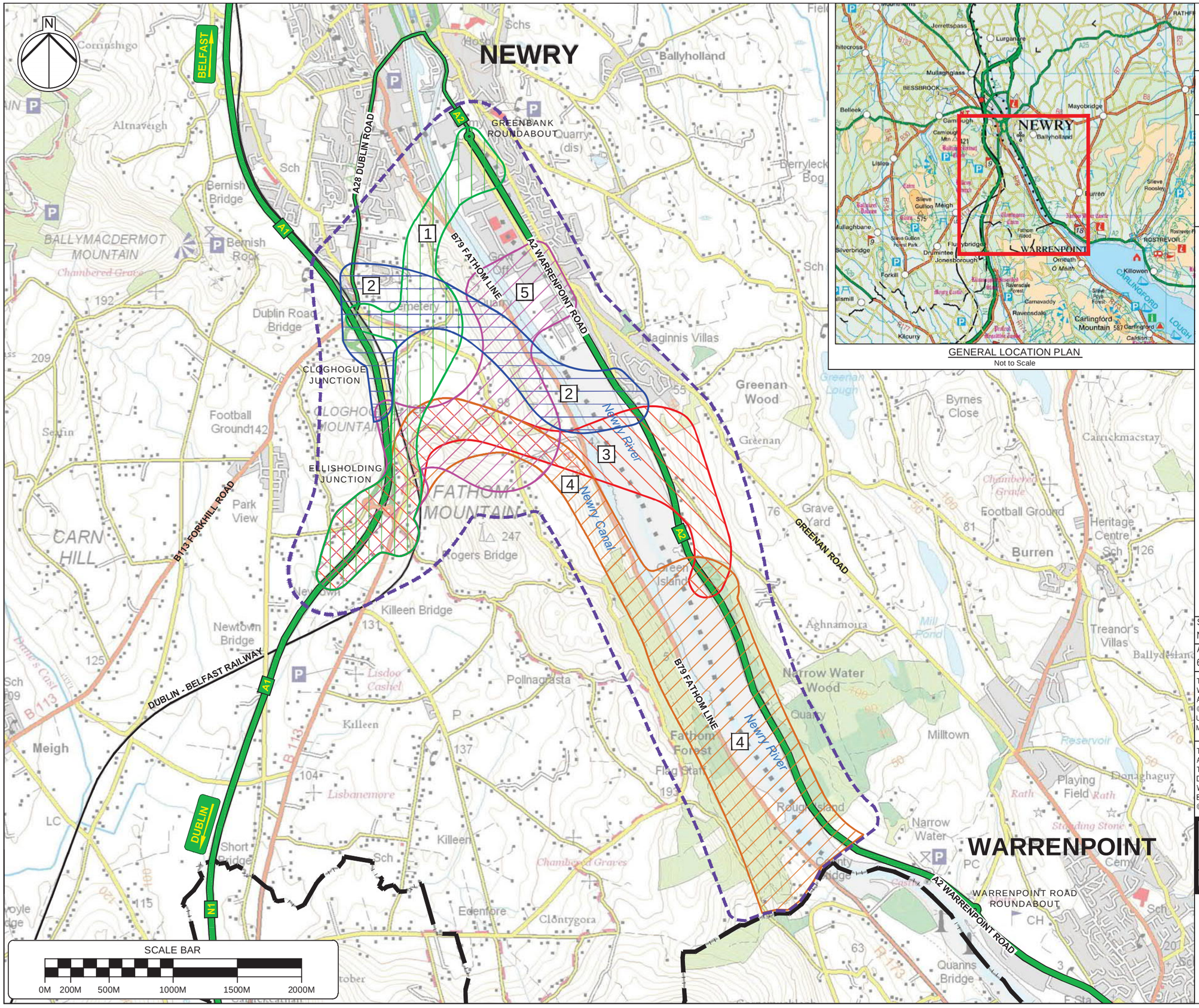

GENERAL LOCATION PLAN
Not to Scale

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

LOCATION PLAN AND GENERAL STUDY AREA

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.1.1

REV. 0

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Beechill House
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Belfast
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T: +44 (0)28 9070 5111
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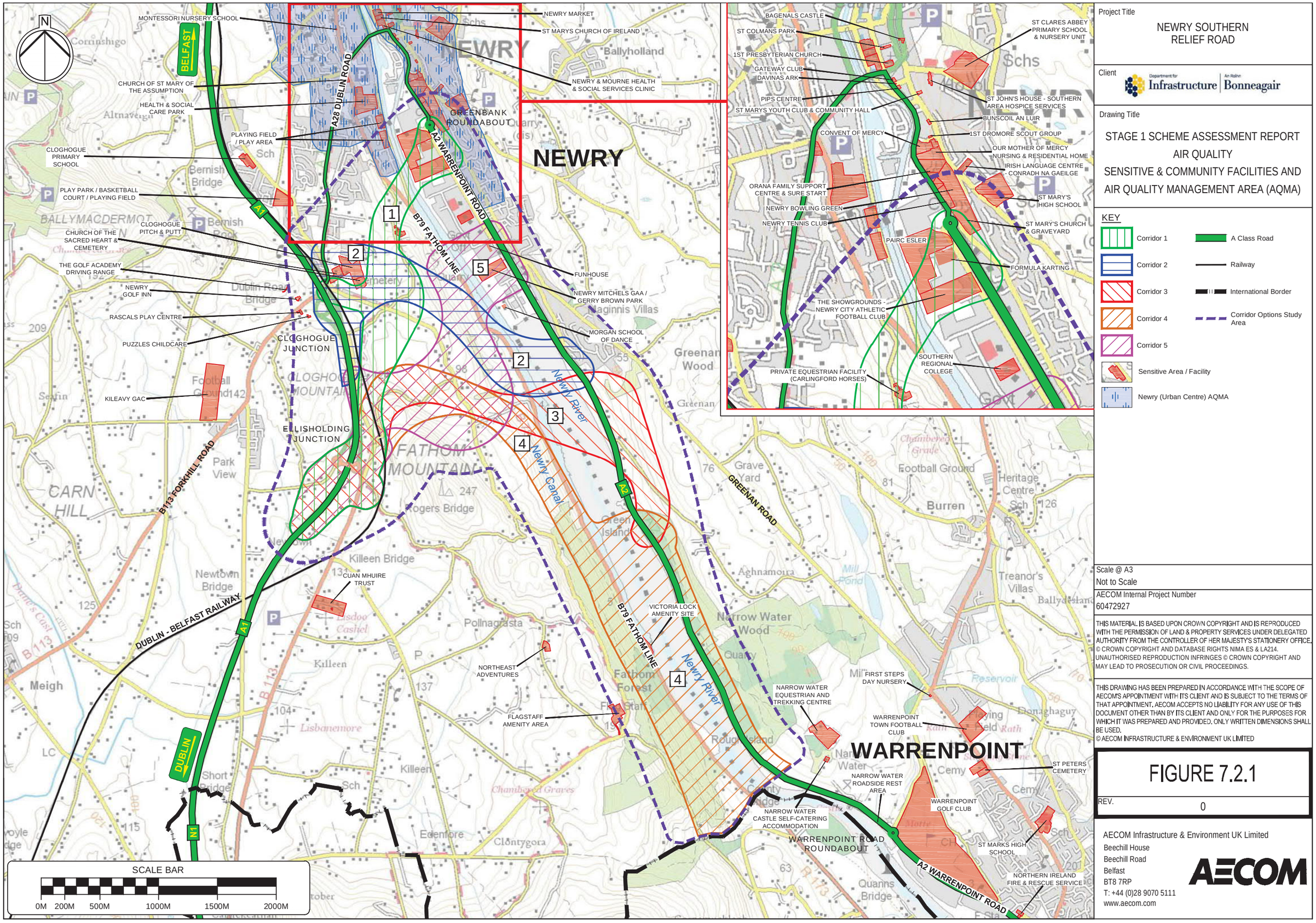


Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
AIR QUALITY
SENSITIVE & COMMUNITY FACILITIES AND AIR QUALITY MANAGEMENT AREA (AQMA)

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Sensitive Area / Facility
- Newry (Urban Centre) AQMA
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

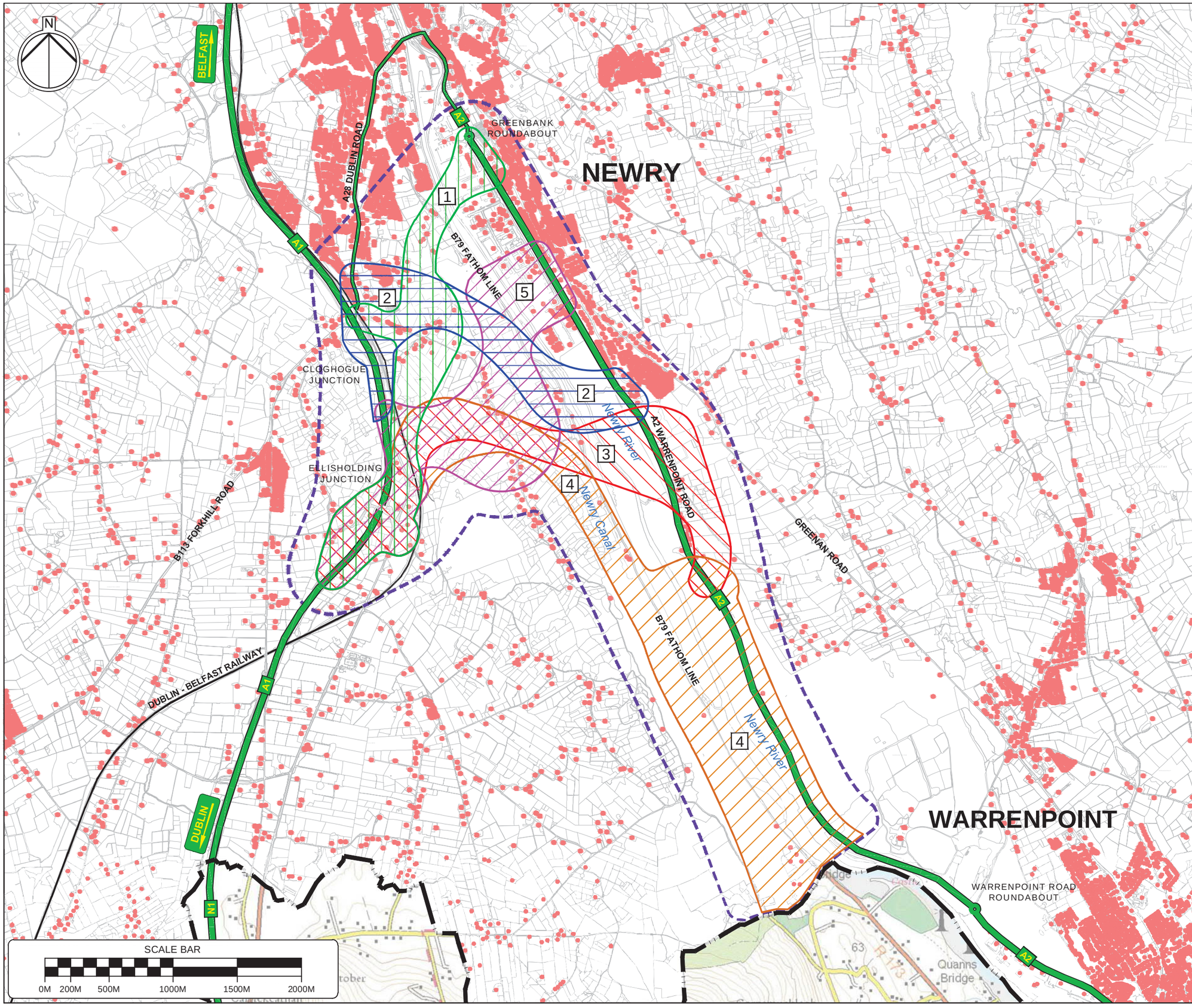
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.2.1

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

AIR QUALITY
SENSITIVE RECEPTORS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Sensitive Receptors
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

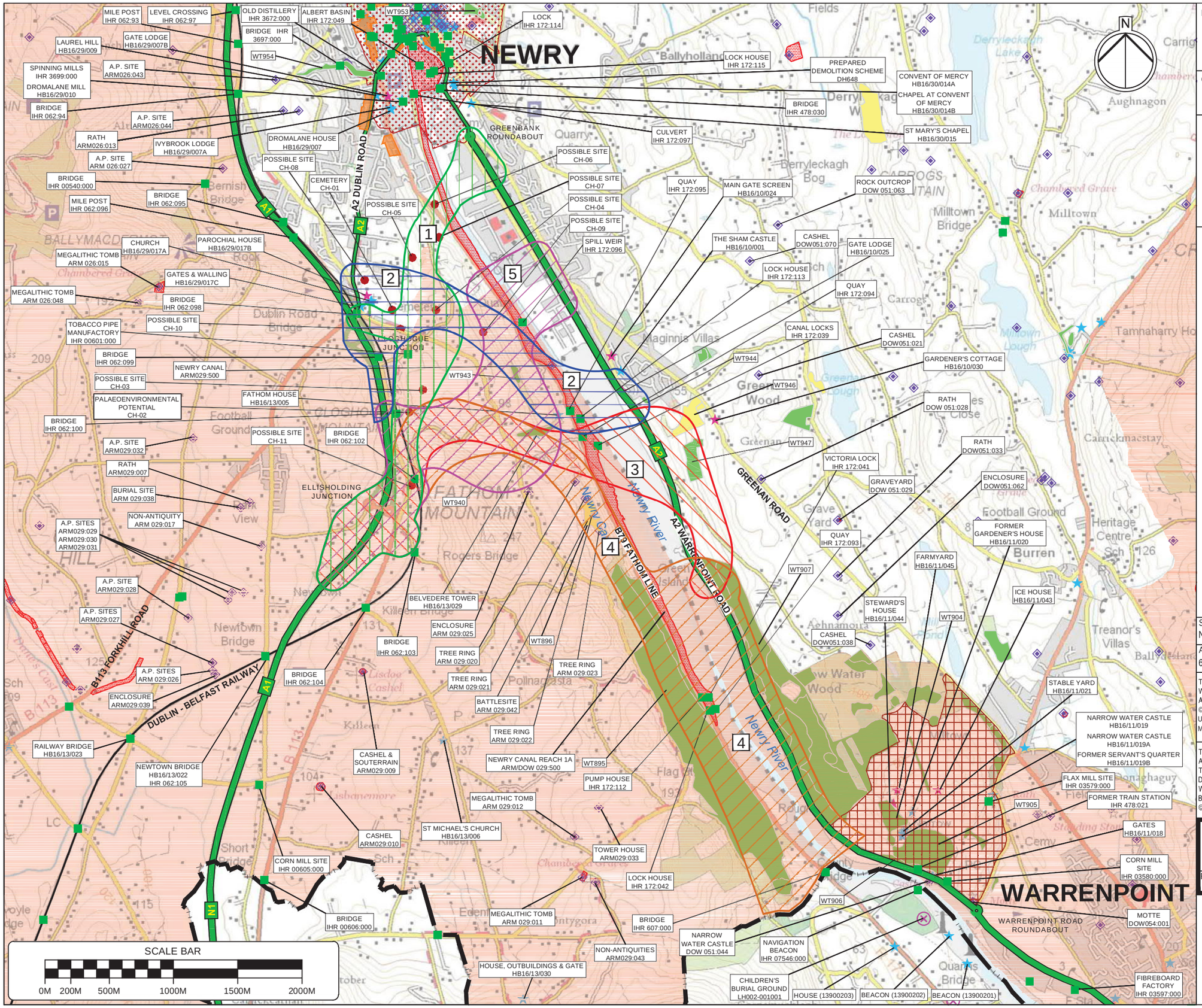
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.2.2

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

CULTURAL HERITAGE ASSETS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- National Monument
- Recorded Site (SMR)
- Industrial Heritage
- Defence Heritage
- Record Only Building (Non Listed)
- Aerial Photograph Site
- Listed Building/National Inventory of Architectural Heritage Sites
- Historic Park, Garden and Demesne
- Scheduled Monument
- Area of Archaeological Potential
- Area of Outstanding Natural Beauty (AONB)
- Conservation Area
- Areas of Townscape or Village Character (ATC)
- Woodland Trust - Long Established Woodland
- Woodland Trust - Possibly Ancient Woodland

Scale @ A3

Not to Scale

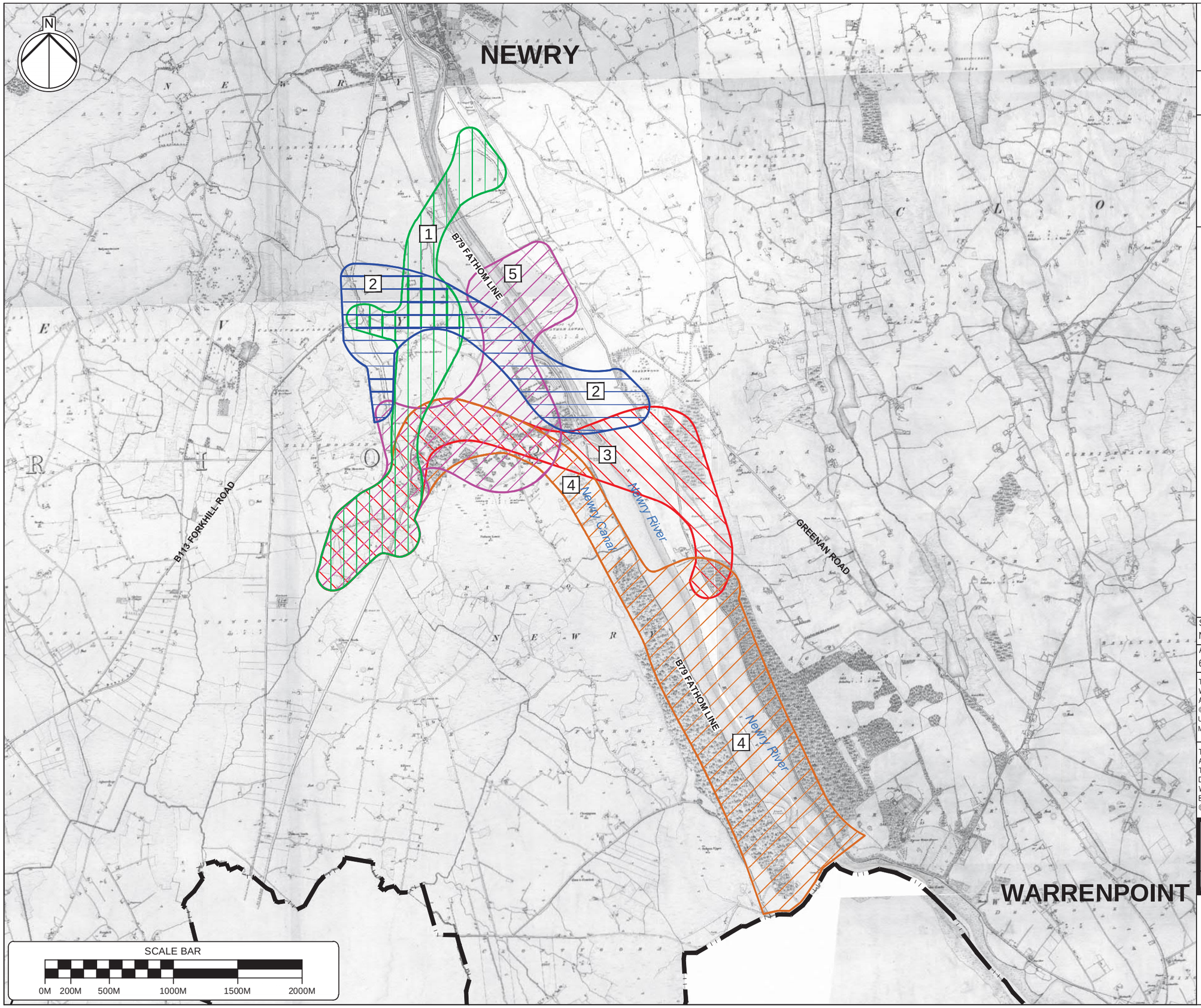
AECOM Internal Project Number

60472927

FIGURE 7.3.1

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CULTURAL HERITAGE
HISTORIC MAPPING
1:6 INCH COUNTY SERIES 1st EDITION

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- International Border

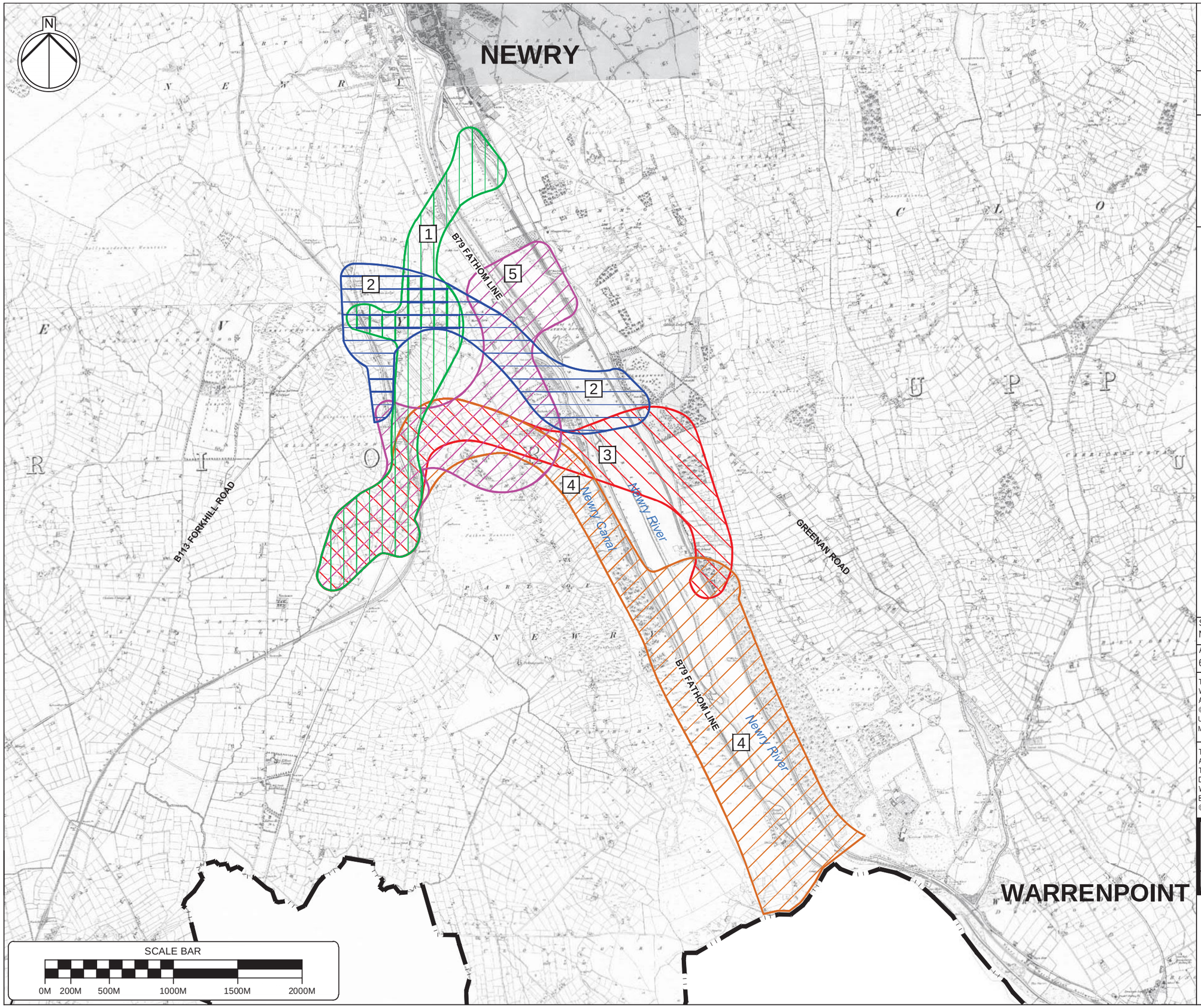
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.2

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CULTURAL HERITAGE
HISTORIC MAPPING
1:6 INCH COUNTY SERIES 2nd EDITION

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- International Border

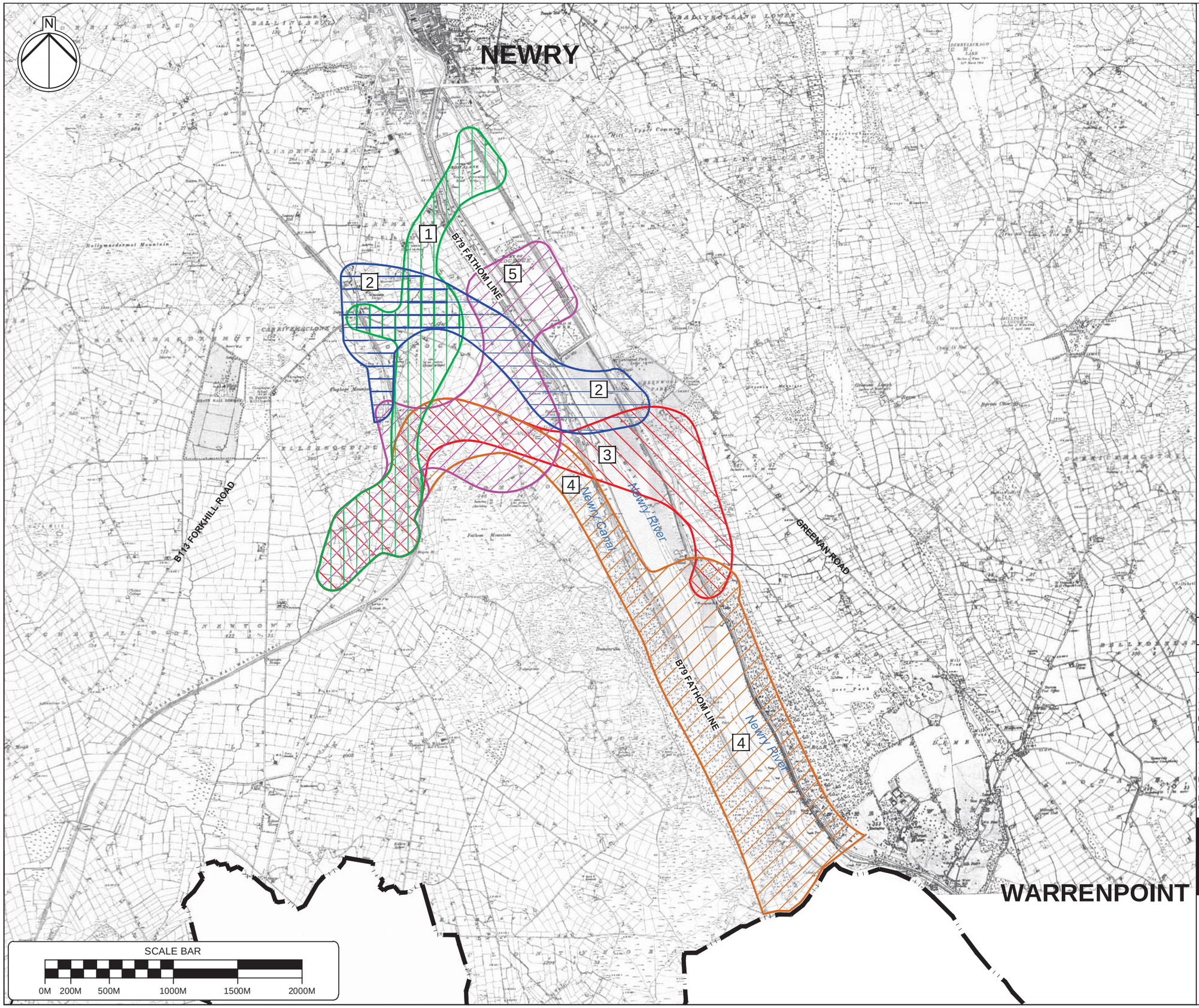
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.3

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CULTURAL HERITAGE
HISTORIC MAPPING
1:6 INCH COUNTY SERIES 3rd EDITION

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- International Border

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.4

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com

NEWRY

WARRENPOINT

1

2

2

3

4

4

5

B79 FATHOM LINE

B79 FATHOM LINE

B113 FORKHILL ROAD

GREENAN ROAD

Newry Canal

Newry River

Newry River

SCALE BAR

0M 200M 500M 1000M 1500M 2000M

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CULTURAL HERITAGE
HISTORIC MAPPING
1:6 INCH COUNTY SERIES 4th EDITION

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- International Border

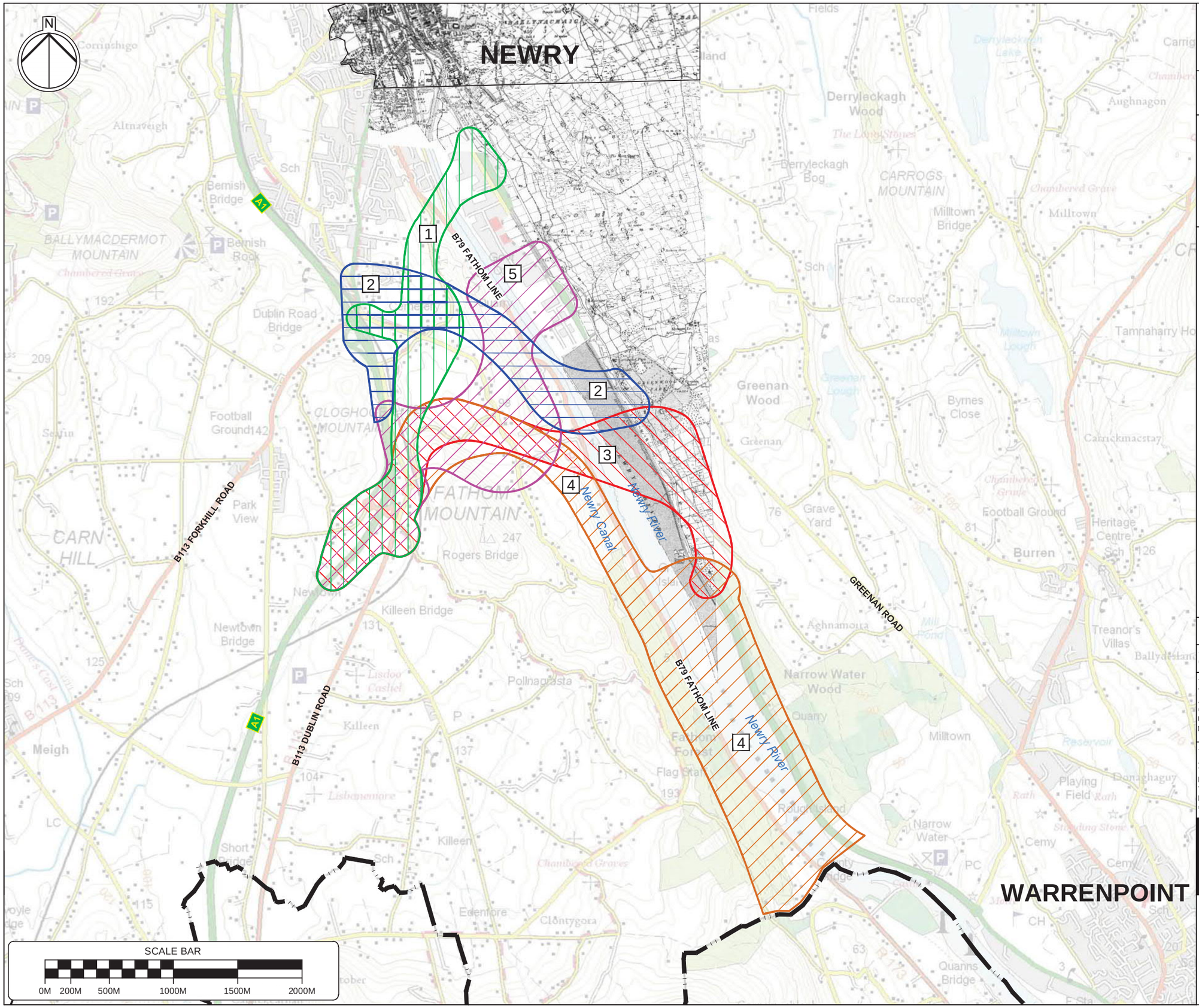
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.5

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CULTURAL HERITAGE
HISTORIC MAPPING
1:6 INCH COUNTY SERIES 5th EDITION

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- International Border

Notes

The 5th Edition Historic Mapping covered an area around Newry. The Historic Mapping is shown with a modern day mapping to provide context.

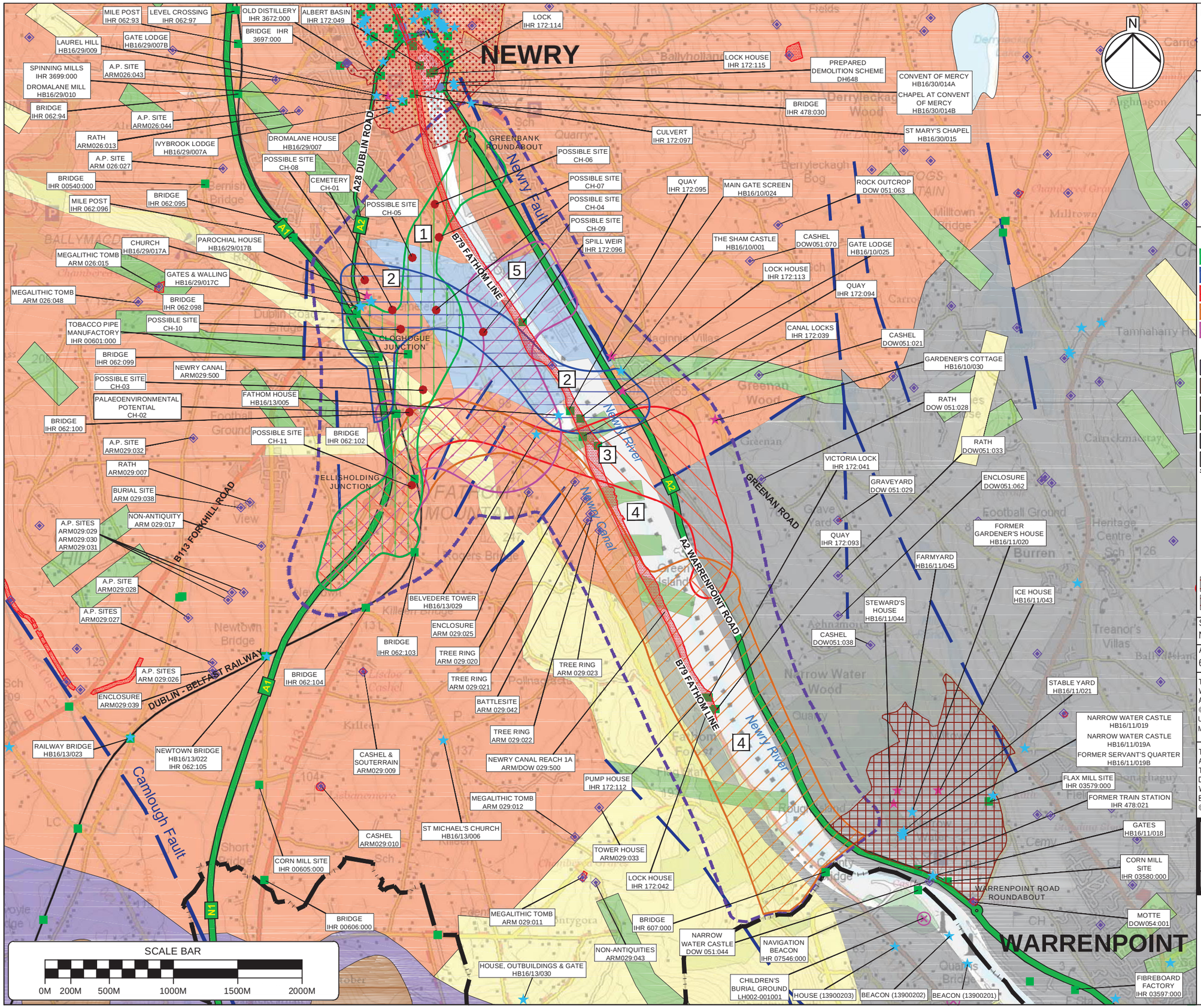
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.6

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

CULTURAL HERITAGE
SOLID GEOLOGY

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Bedrock Geology

- Granophyric Granite
- Granodiorite
- Gabbro Dyke
- Dolerite & Basalt Intrusive Dyke
- Greywacke & Shale (Gala Group)
- Greywacke & Red Shale (Hawick Group)
- Felsite
- No Feature Identified
- Fault

SOURCE: GSNI 1:250,000 SOLID GEOLOGY MAP OF NORTHERN IRELAND

Cultural Heritage

- National Monument
- Recorded Site (SMR)
- Industrial Heritage
- Listed Building/National Inventory of Architectural Heritage Sites
- Record Only Building (Non Listed)
- Historic Park, Garden and Demesne
- Area of Archaeological Potential
- Defence Heritage
- Aerial Photograph Site
- Scheduled Monument

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.7

REV. 0

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Beechill House
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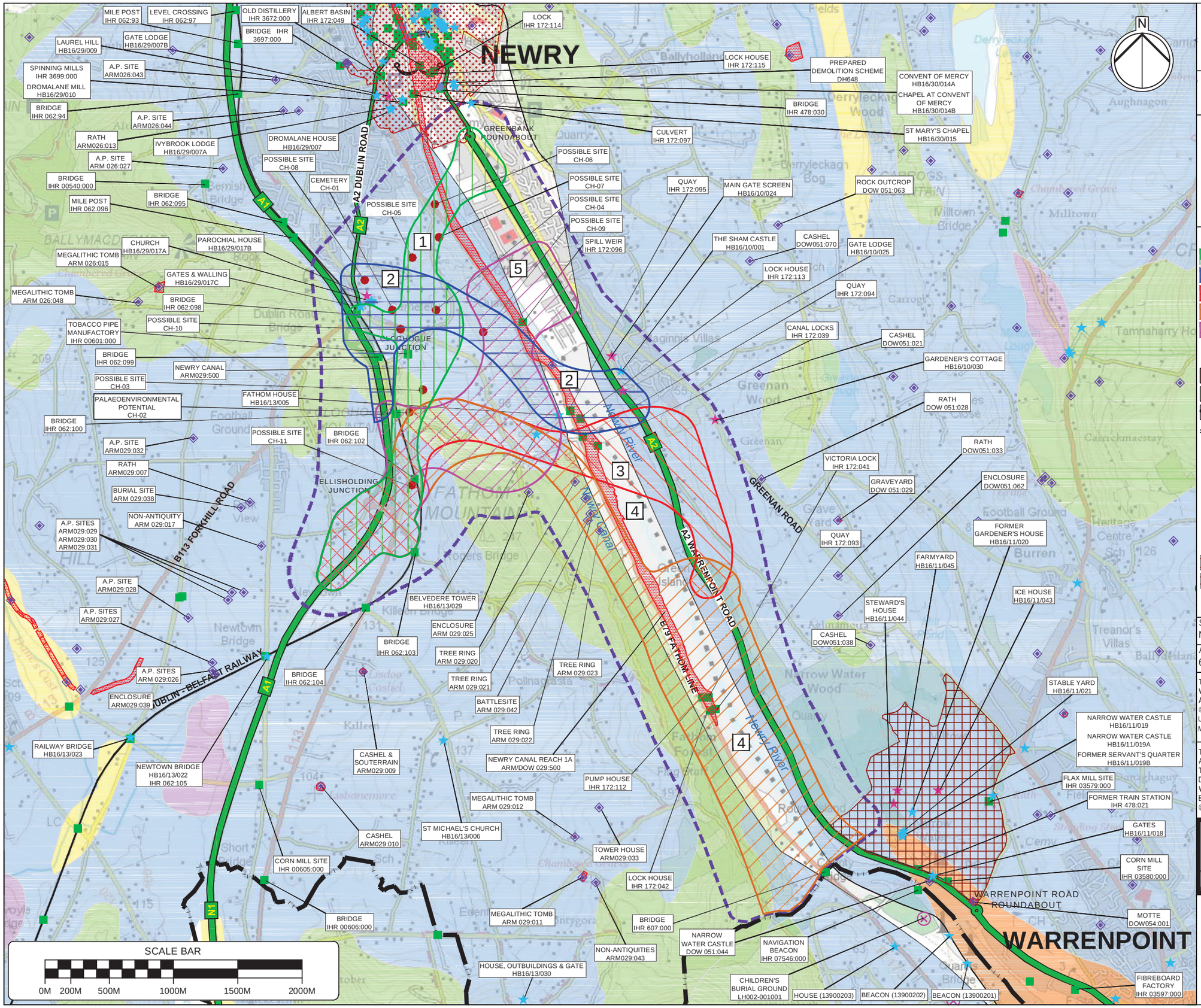

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

CULTURAL HERITAGE
DRIFT GEOLOGY

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Superficial Geology

- Raised Beach Deposits
- Bedrock at or near the surface
- Recent Marine Deposit
- Alluvium
- Peat
- Till

SOURCE: GSNI 1:250,000 DRIFT GEOLOGY MAP OF NORTHERN IRELAND

Cultural Heritage

- National Monument
- Recorded Site (SMR)
- Industrial Heritage
- Listed Building/National Inventory of Architectural Heritage Sites
- Record Only Building (Non Listed)
- Defence Heritage
- Aerial Photograph Site
- Scheduled Monument
- Historic Park, Garden and Demesne
- Area of Archaeological Potential

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.3.8

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
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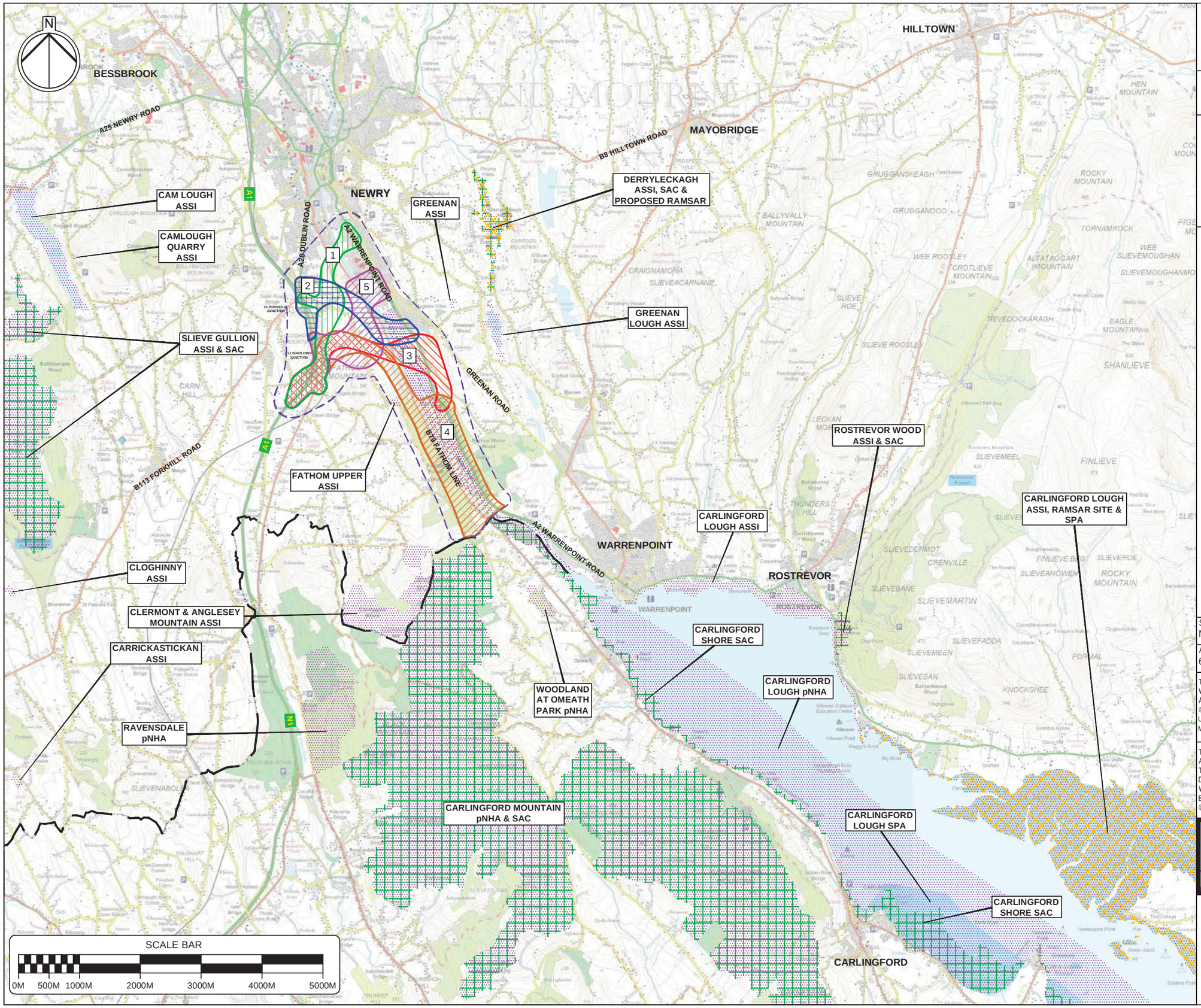
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ECOLOGY & NATURE CONSERVATION
NATIONAL & INTERNATIONAL
DESIGNATED SITES

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- International Border
- Corridor Options Study Area
- Area of Special Scientific Interest (ASSI) or proposed Natural Heritage Area (pNHA)
- Ramsar Site
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)

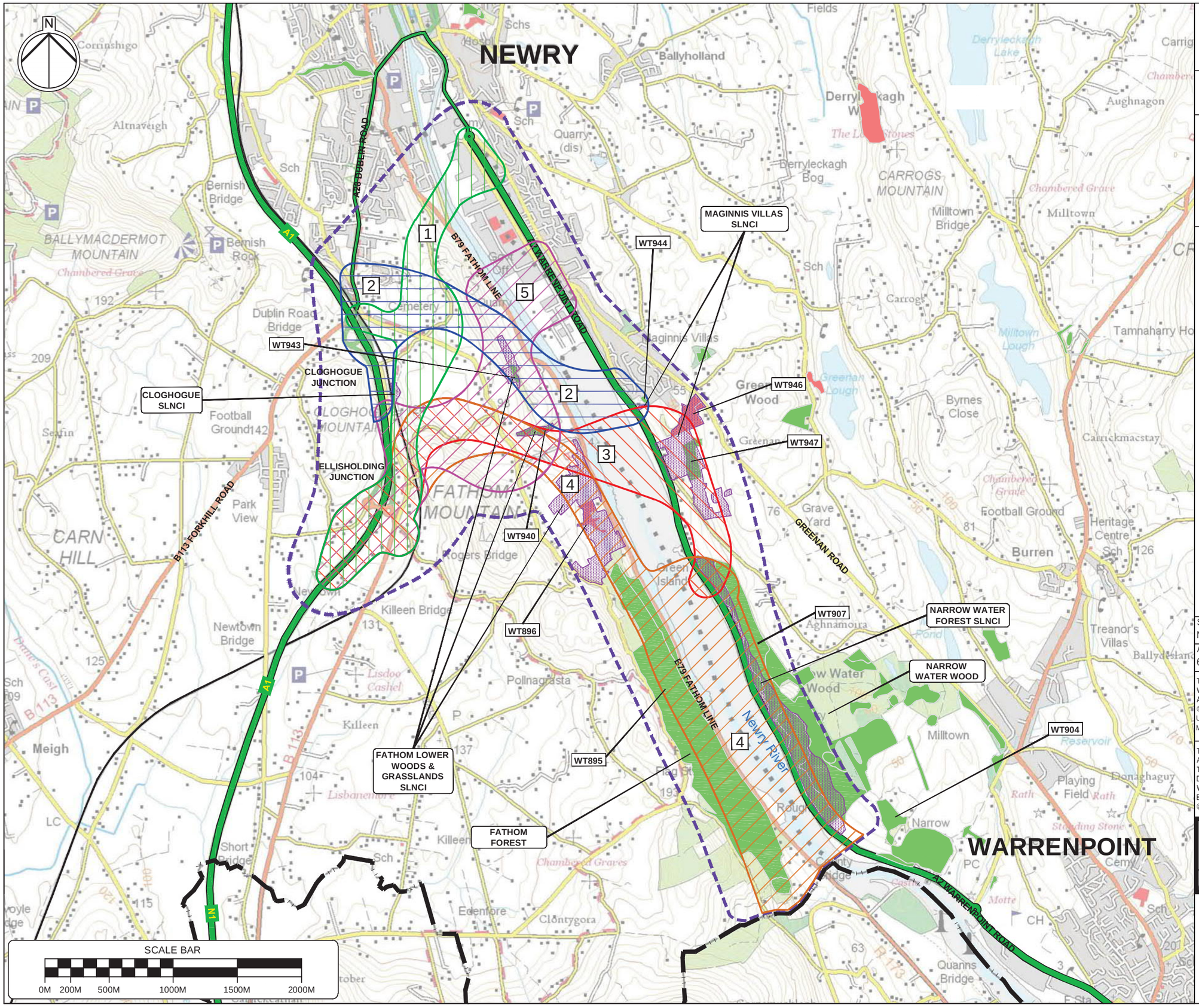
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.4.1

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

ECOLOGY & NATURE CONSERVATION
LOCAL ECOLOGICAL RECEPTORS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- Site of Local Nature Conservation Importance (SLNCI)
- Long Established Woodland
- Ancient Woodland
- WT946 Woodland Trust Reference Number

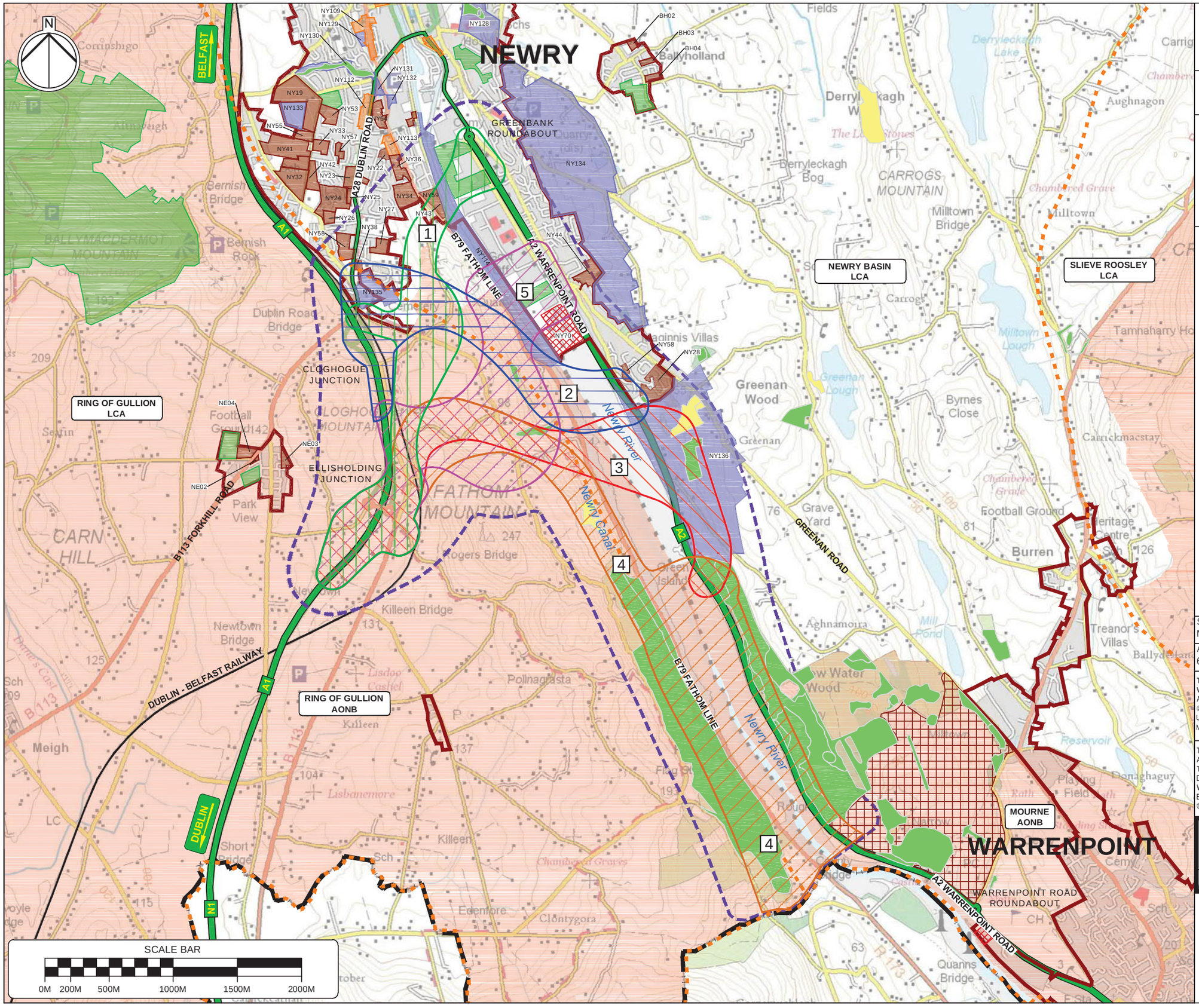
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.4.2

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
LANDSCAPE EFFECTS
LANDSCAPE CHARACTER AND DESIGNATIONS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Local Landscape Policy Area (LLPA)
- Land Zoned for Housing
- Area of Townscape Character
- Major Area of Existing Open Space
- Area of Outstanding Natural Beauty (AONB)
- Land Zoned for Economic Development
- Historic Park, Garden and Demesne
- Landscape Character Area (LCA)
- Settlement Boundary
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- Long Established Woodland
- Ancient Woodland

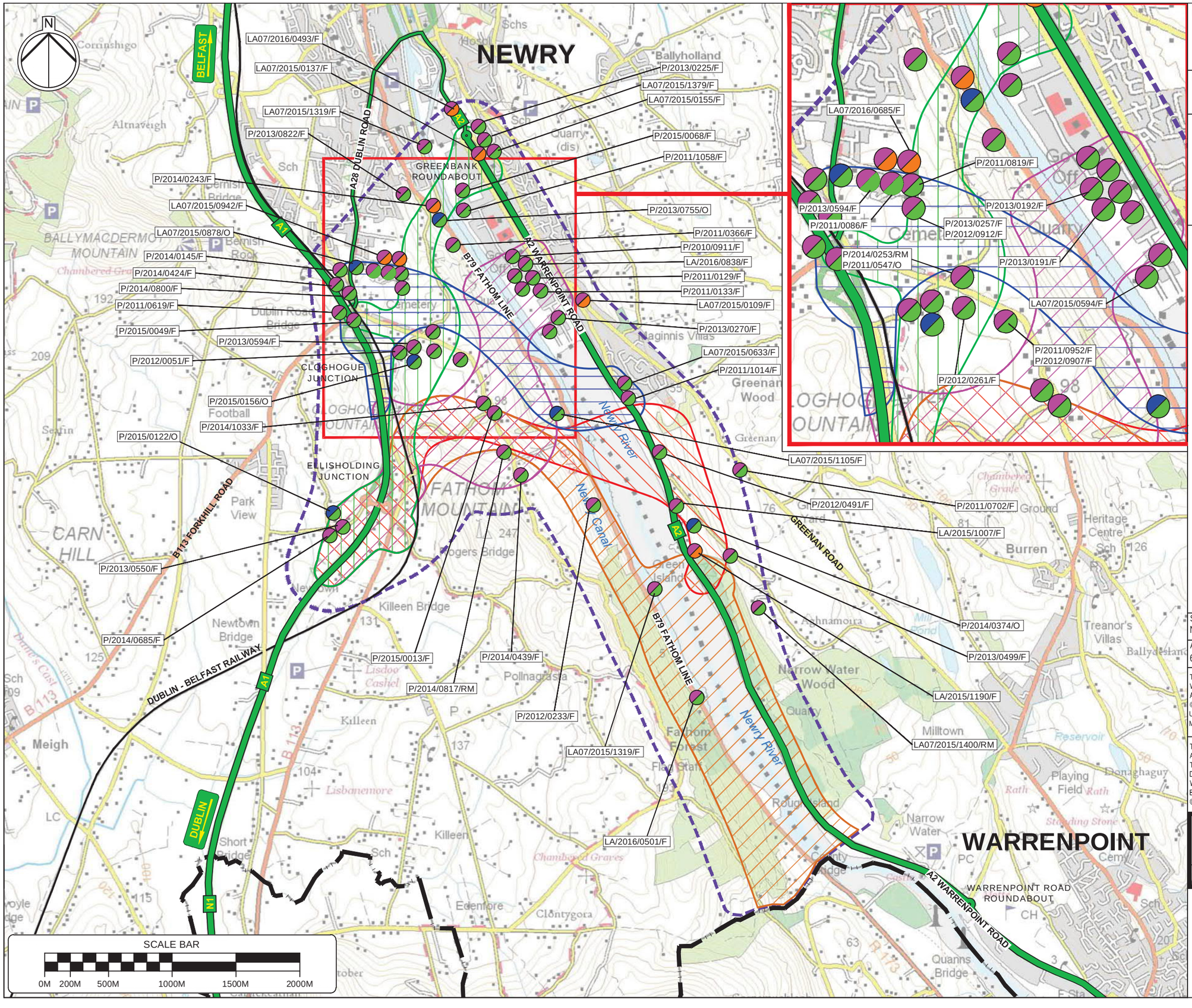
Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.5.1

REV. 0

AECOM Infrastructure & Environment UK Limited
Beechill House
Beechill Road
Belfast
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

LAND USE PLANNING APPLICATIONS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- Full / Reserved Matters
- Outline
- Approved / Granted
- Pending

YEAR No. F - Full
P/2007/0052/F Planning Reference Number

- *Above based on Planning data downloaded from 'PublicAccess for Planning' website in October 2016.*
- *Each ⊘ does not represent the full geographical extent of the application.*
- *A Full and Approved / Granted application may represent a property under construction or already built.*
- *Not all applications are necessarily shown. Reference should still be made to the 'PublicAccess for Planning' website.*

Source: 'Public Access for Planning' Website

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.6.1

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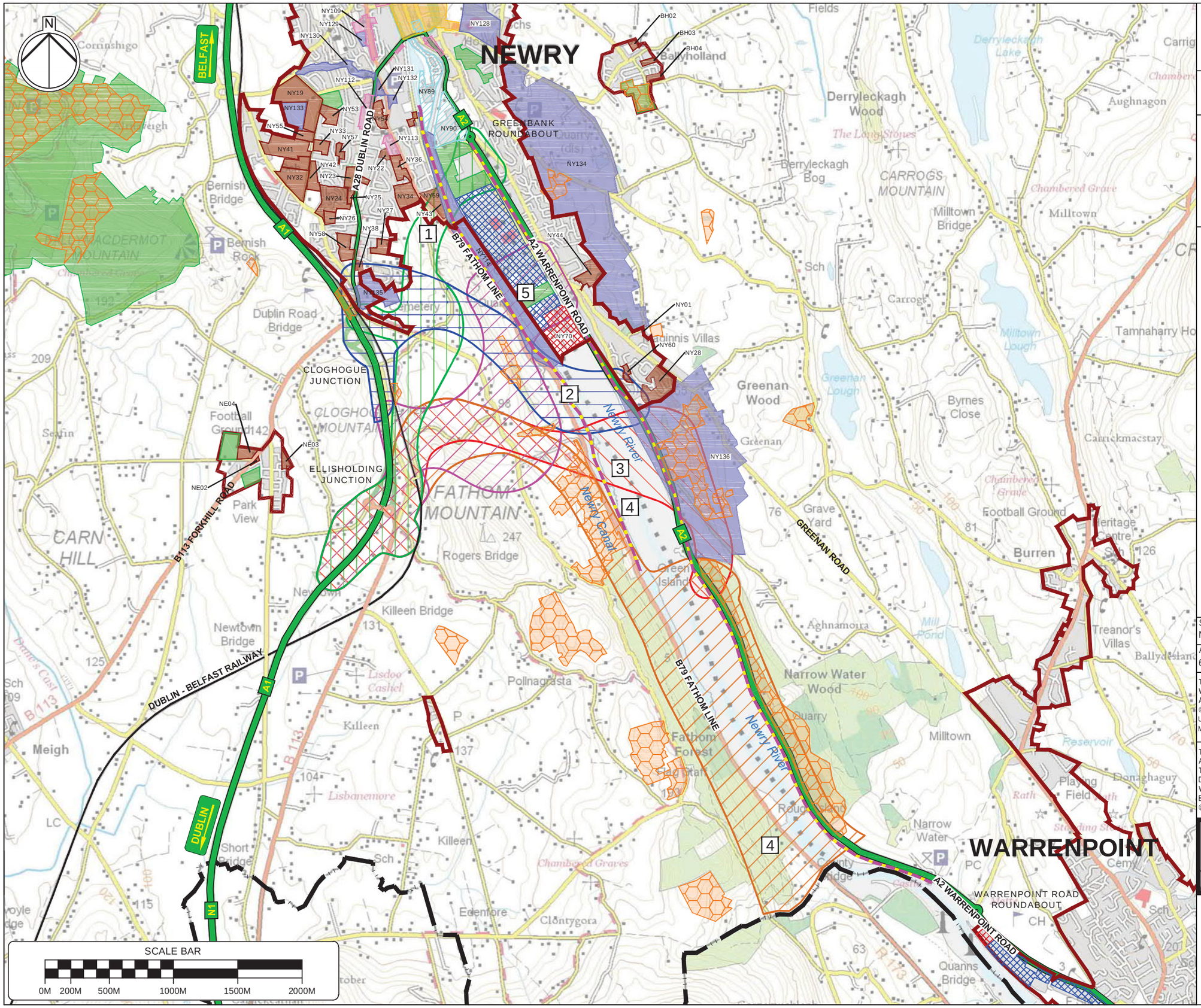

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT

LAND USE
AREA PLAN DESIGNATIONS

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Conservation Area
- Land Zoned for Housing
- Area of Townscape Character
- Major Area of Existing Open Space
- Existing Area of Economic Development
- Land Zoned for Economic Development
- Local Landscape Policy Area (LLPA)
- Development Opportunity Site
- Site of Local Nature Conservation Importance (SLNCI)
- Settlement Development Limit
- Disused Transport Route

Source: Banbridge Newry and Mourne Area Plan 2015

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.6.2

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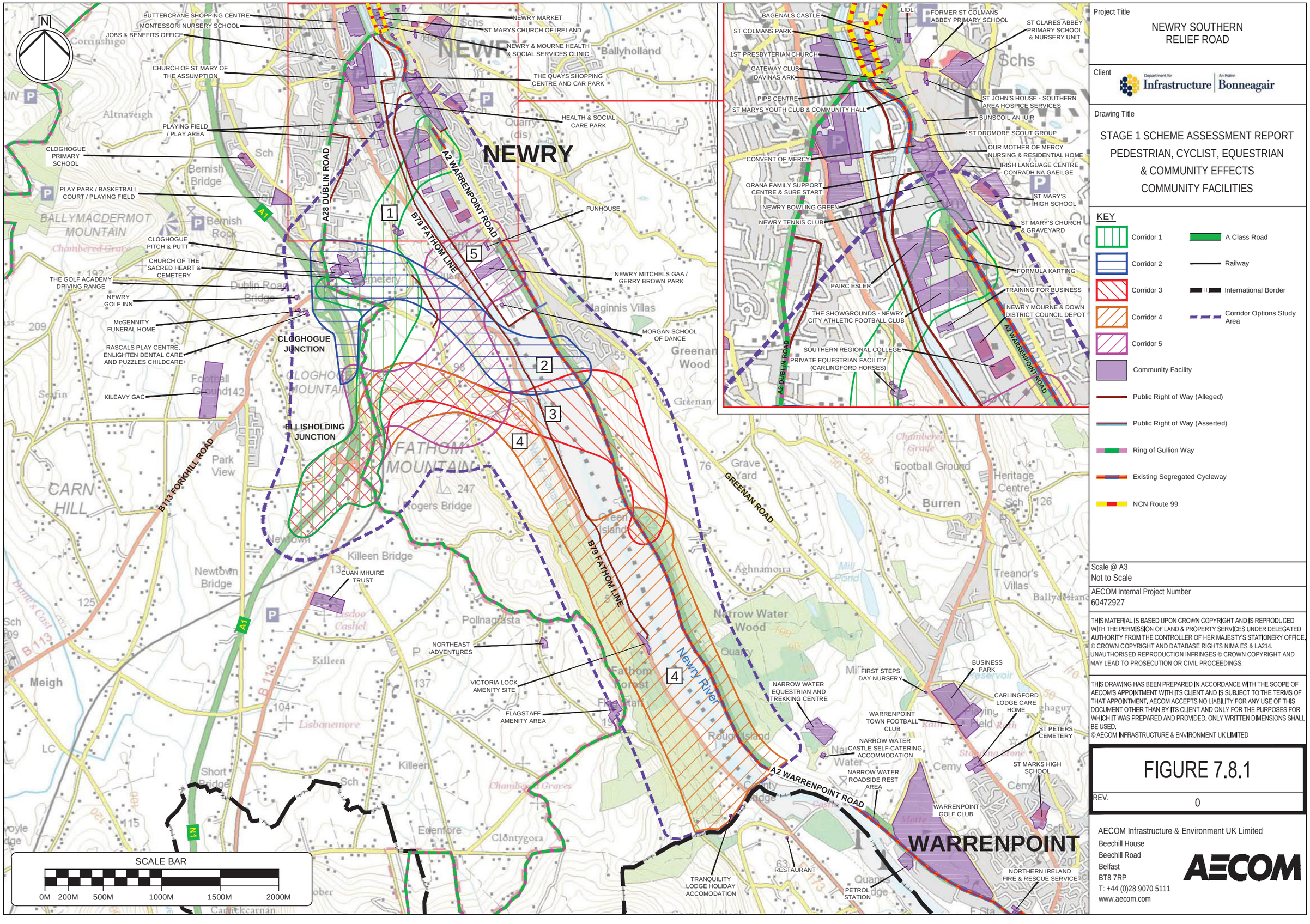

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
PEDESTRIAN, CYCLIST, EQUESTRIAN & COMMUNITY EFFECTS
COMMUNITY FACILITIES

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Community Facility
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- Public Right of Way (Alleged)
- Public Right of Way (Asserted)
- Ring of Gullion Way
- Existing Segregated Cycleway
- NCN Route 99

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.8.1

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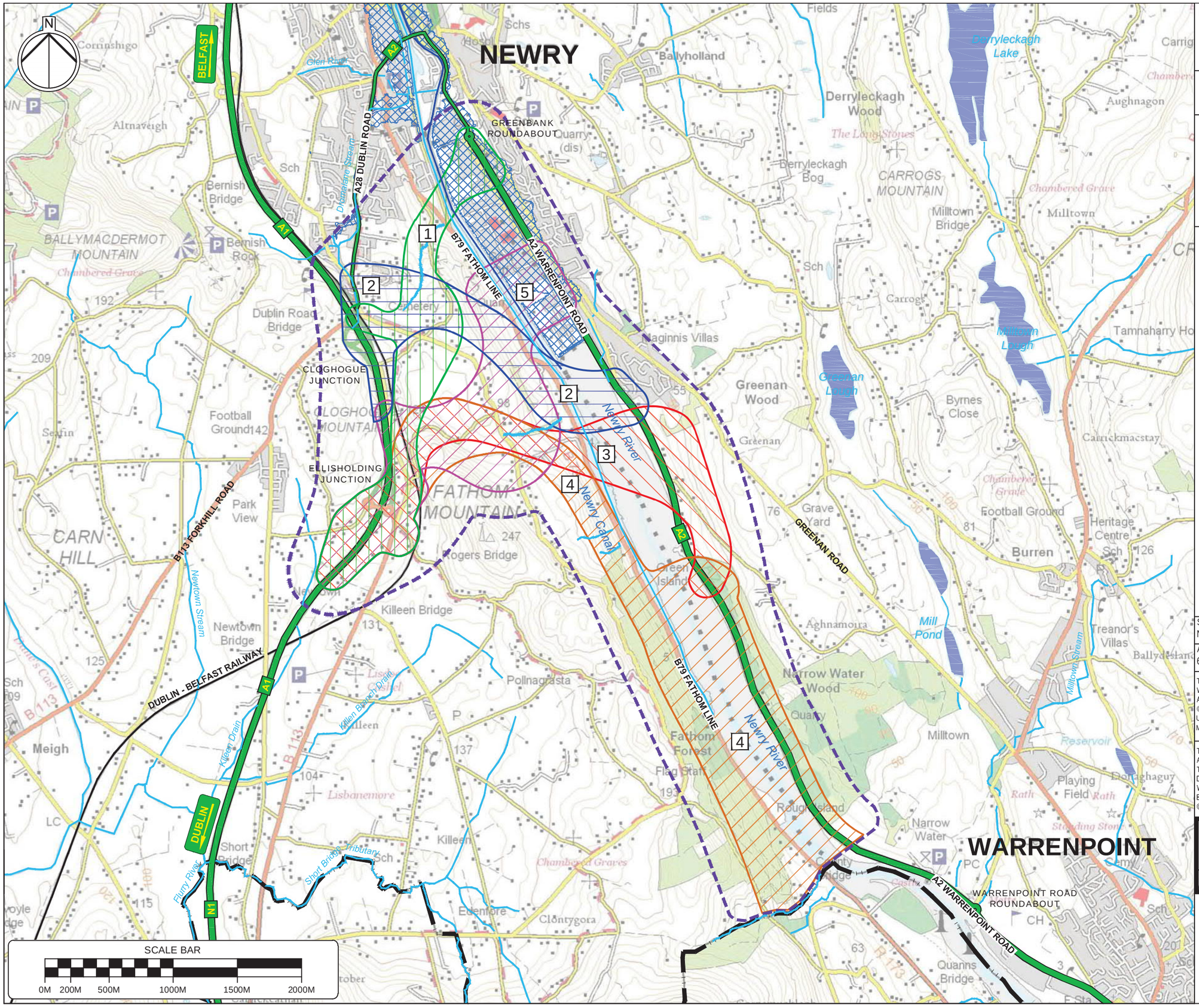

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ROAD DRAINAGE AND THE WATER ENVIRONMENT
WATERCOURSES AND FLOODPLAIN

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Watercourse
- Lake / Lough
- Extent of Q_{100} Flood Event
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.10.1

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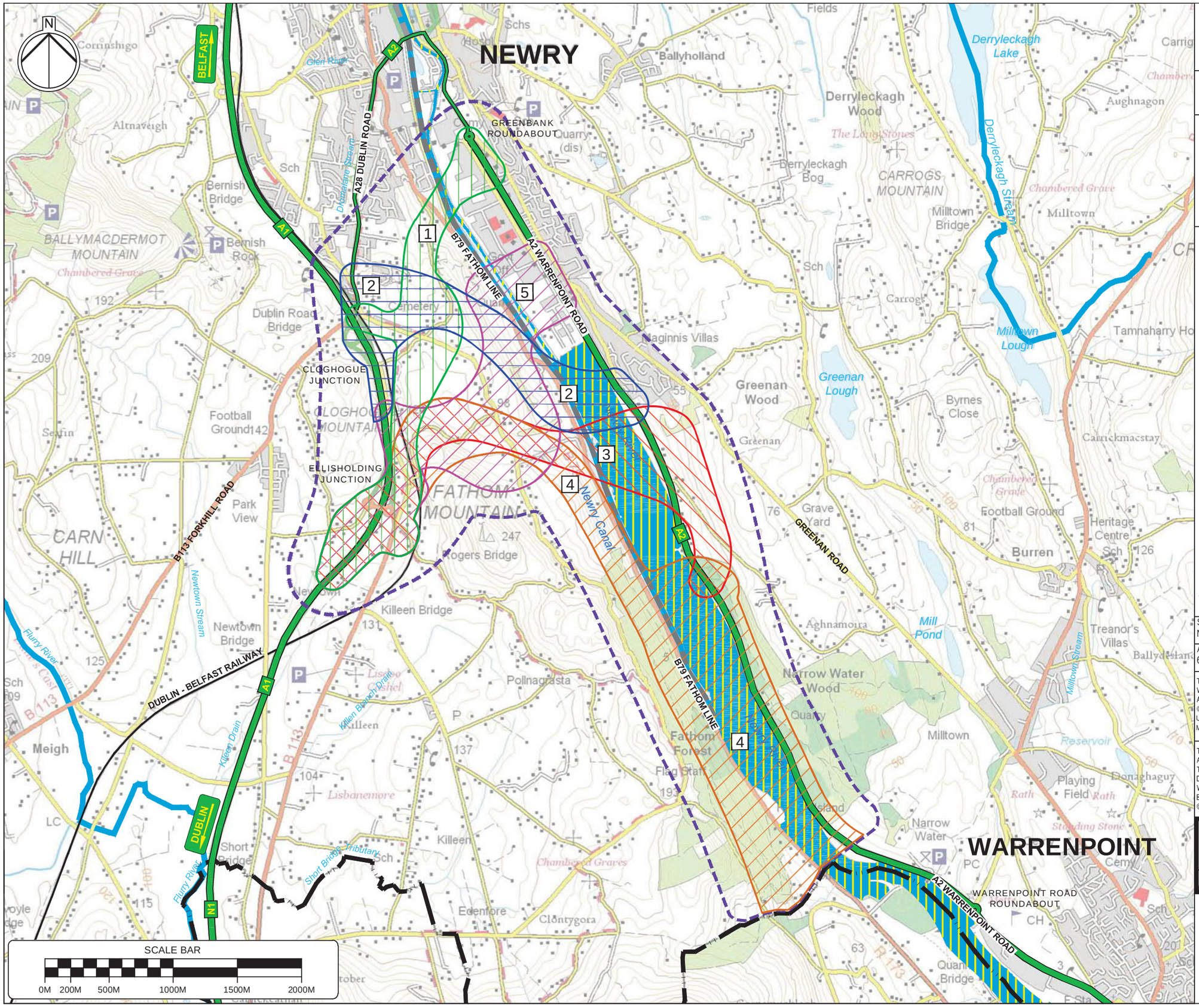

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ROAD DRAINAGE AND THE WATER ENVIRONMENT
ECOLOGICAL STATUS OF WATERBODIES

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- River / Canal - Moderate
- River / Canal - MEP (Moderate Ecological Potential)
- Transitional Water Bodies - MEP (Moderate Ecological Potential)

Source: http://appsd.daera-ni.gov.uk/RiverBasinViewer/

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.10.2

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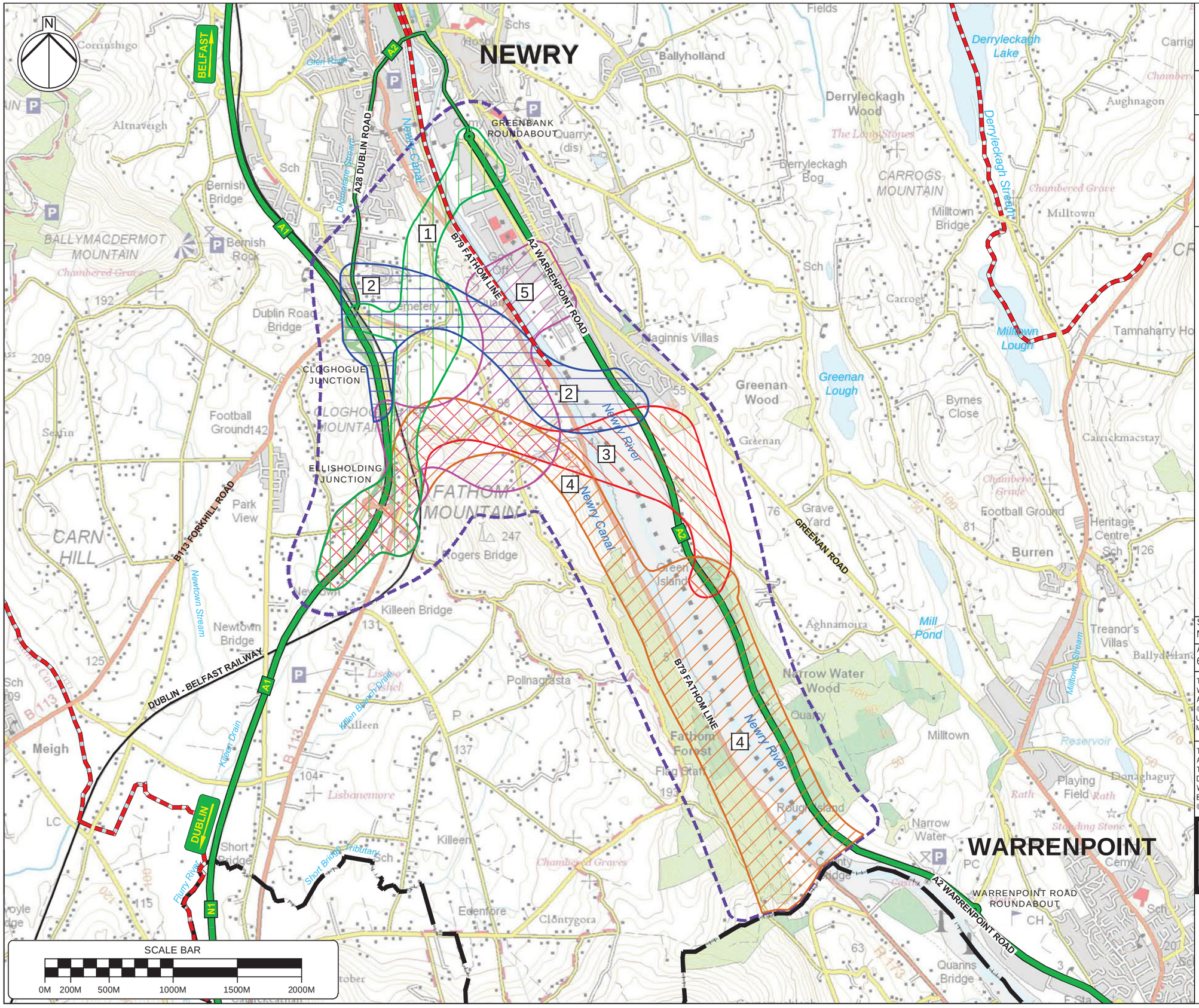

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ROAD DRAINAGE AND THE WATER ENVIRONMENT
PROTECTED WATERBODIES

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- Protected Watercourse
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Source: http://appsd.daera-ni.gov.uk/RiverBasinViewer/

Scale @ A3
Not to Scale

AECOM Internal Project Number
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FIGURE 7.10.3

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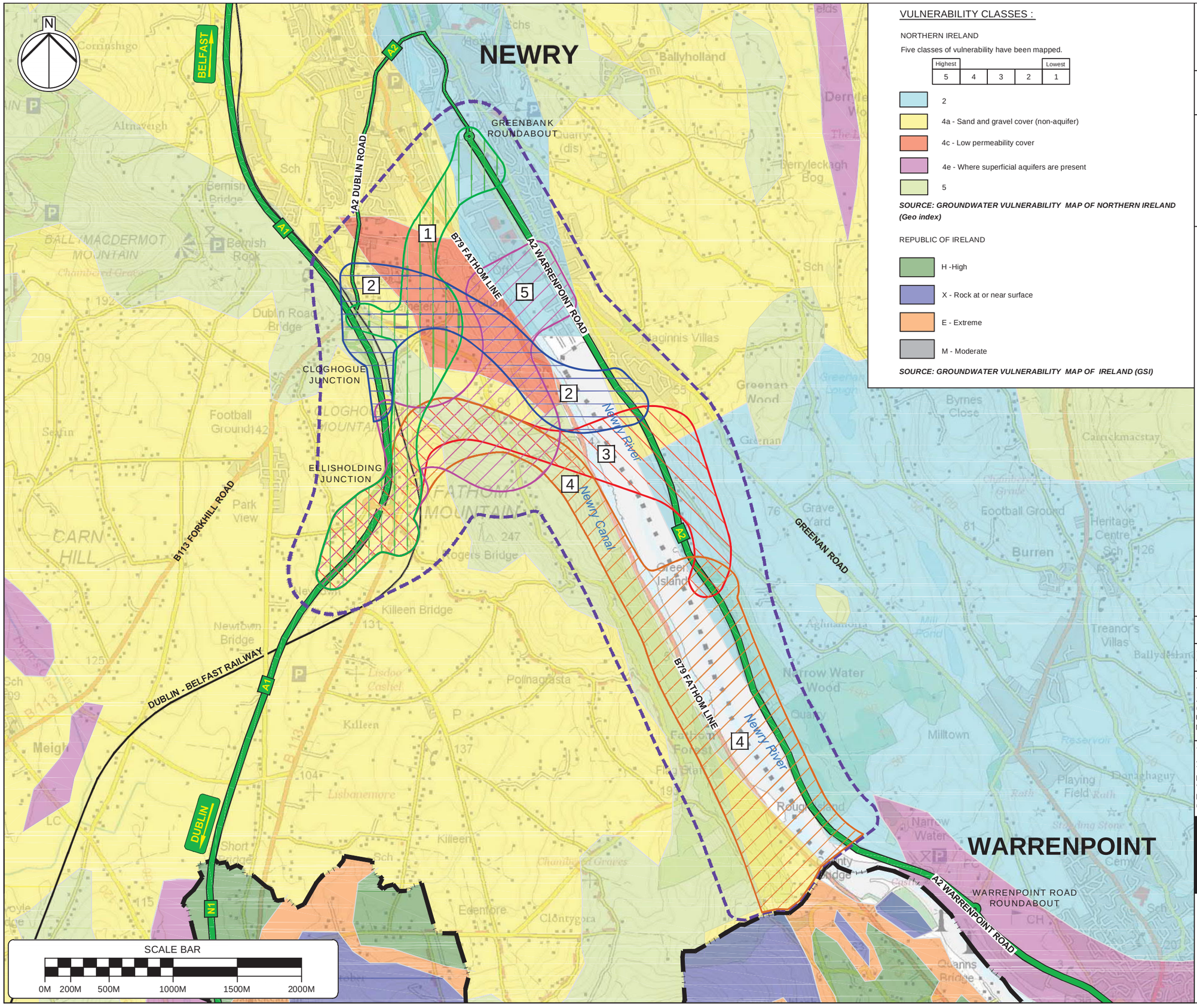

VULNERABILITY CLASSES :

NORTHERN IRELAND

Five classes of vulnerability have been mapped.

Highest				Lowest
5	4	3	2	1

- 2
- 4a - Sand and gravel cover (non-aquifer)
- 4c - Low permeability cover
- 4e - Where superficial aquifers are present
- 5

SOURCE: GROUNDWATER VULNERABILITY MAP OF NORTHERN IRELAND (Geo index)

REPUBLIC OF IRELAND

- H -High
- X - Rock at or near surface
- E - Extreme
- M - Moderate

SOURCE: GROUNDWATER VULNERABILITY MAP OF IRELAND (GSI)

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ROAD DRAINAGE & WATER ENVIRONMENT
GROUNDWATER VULNERABILITY

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.10.4

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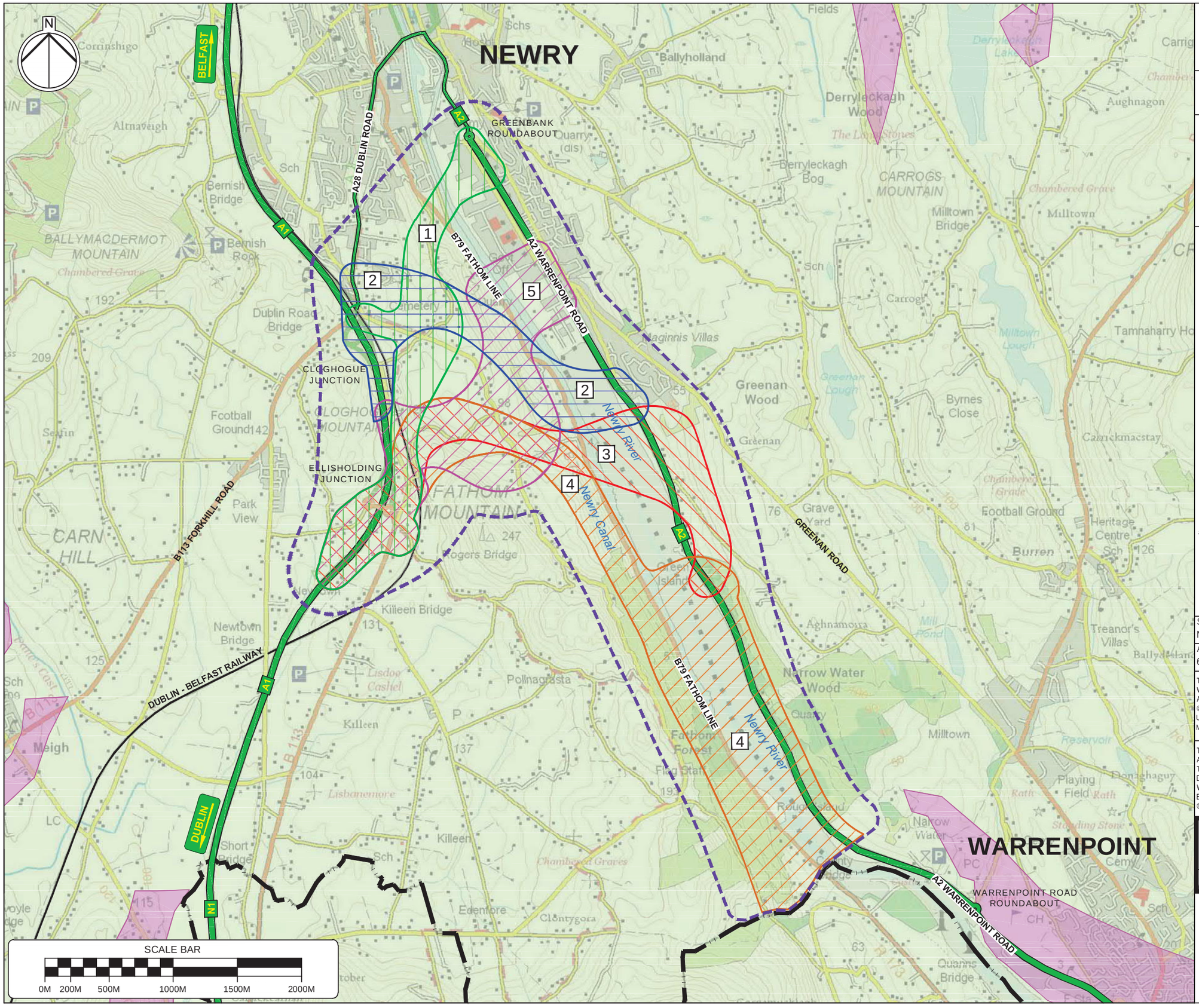

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
ROAD DRAINAGE & WATER ENVIRONMENT
HYDROGEOLOGY

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Hydrogeology

- Bedrock Aquifer - Limited potential productivity fracture flow [Moderate yields unusual. Low yields more common. Regional flow limited. Mainly shallow, local flow].
- Potential Superficial Aquifer

SOURCE: Hydro-Geology map layers from GSNI & GSI.

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.10.5

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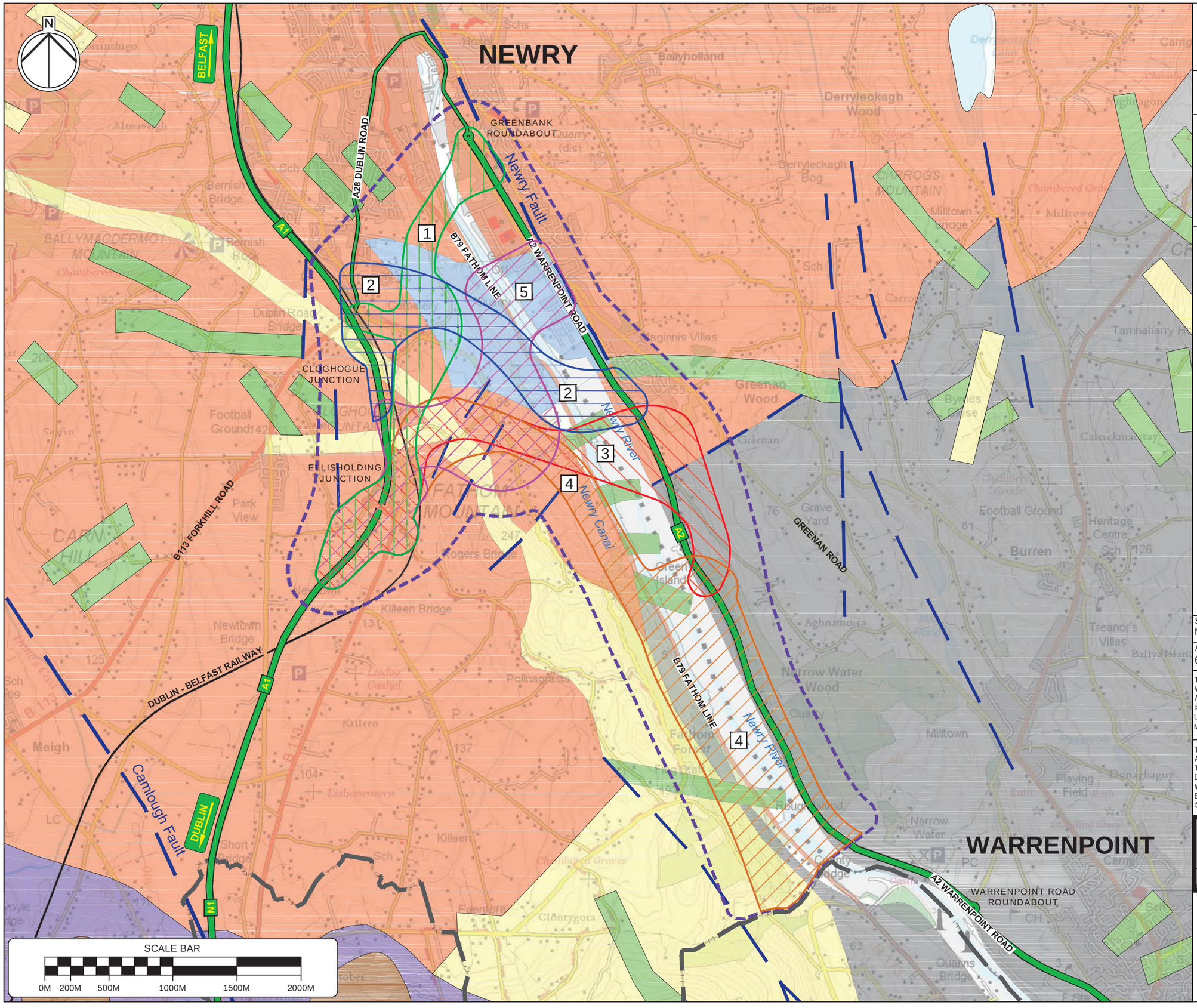

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
GEOLOGY & SOILS
SOLID GEOLOGY

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Bedrock Geology

- Felsite
- Gabbro Dyke
- Granodiorite
- Granophyric Granite
- Dolerite & Basalt Intrusive Dyke
- Greywacke & Shale (Gala Group)
- Greywacke & Red Shale (Hawick Group)
- Fault
- No Feature Identified

SOURCE: GSNI 1:250,000 SOLID GEOLOGY MAP OF NORTHERN IRELAND

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.11.1

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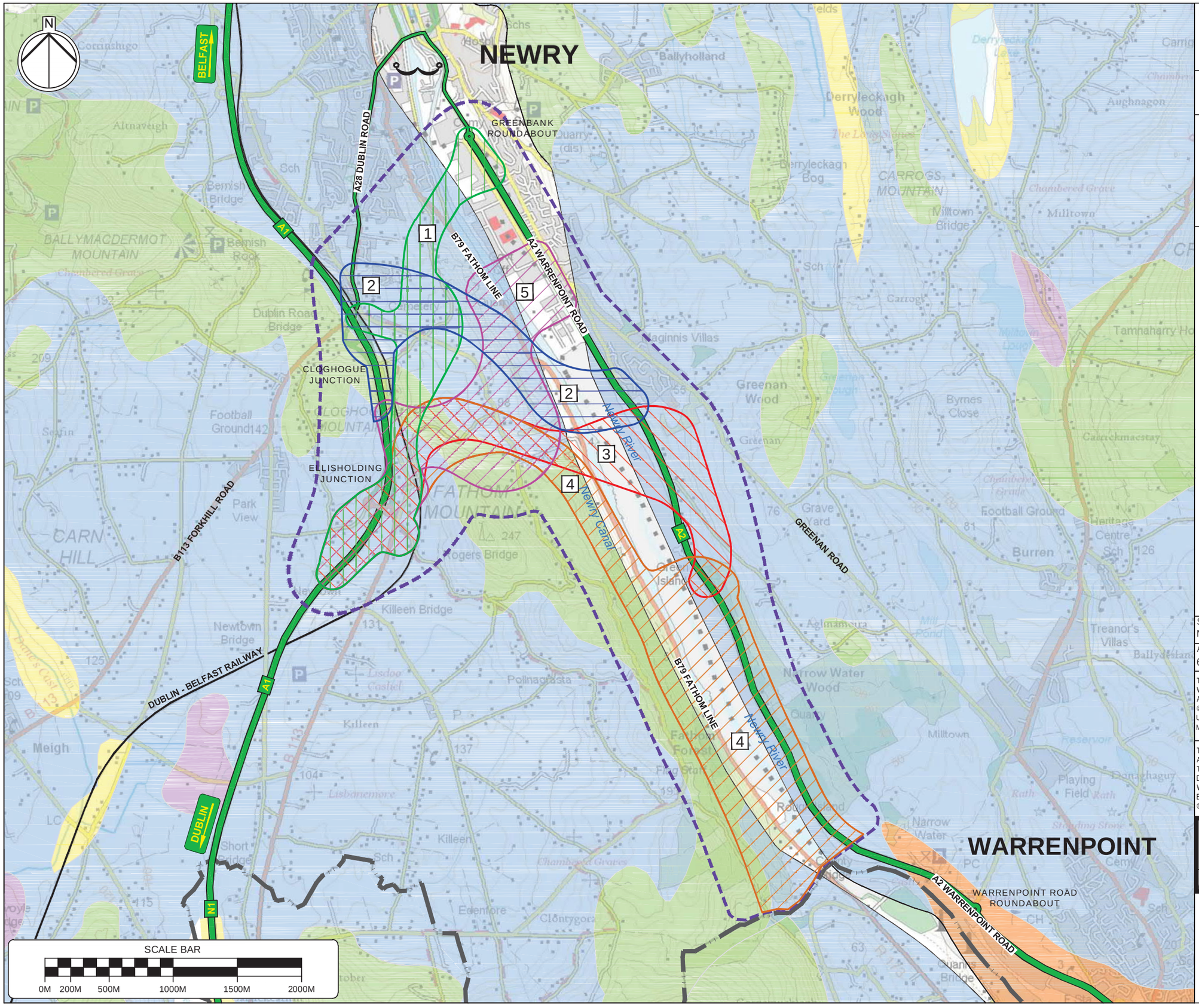

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
GEOLOGY & SOILS
DRIFT GEOLOGY

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Superficial Geology

- Alluvium
- Bedrock at or near the surface
- Peat
- Raised Beach Deposits
- Till
- No Feature Identified
- Recent Marine Deposit

SOURCE: GSNI 1:250,000 DRIFT GEOLOGY MAP OF NORTHERN IRELAND

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.11.2

REV. 0

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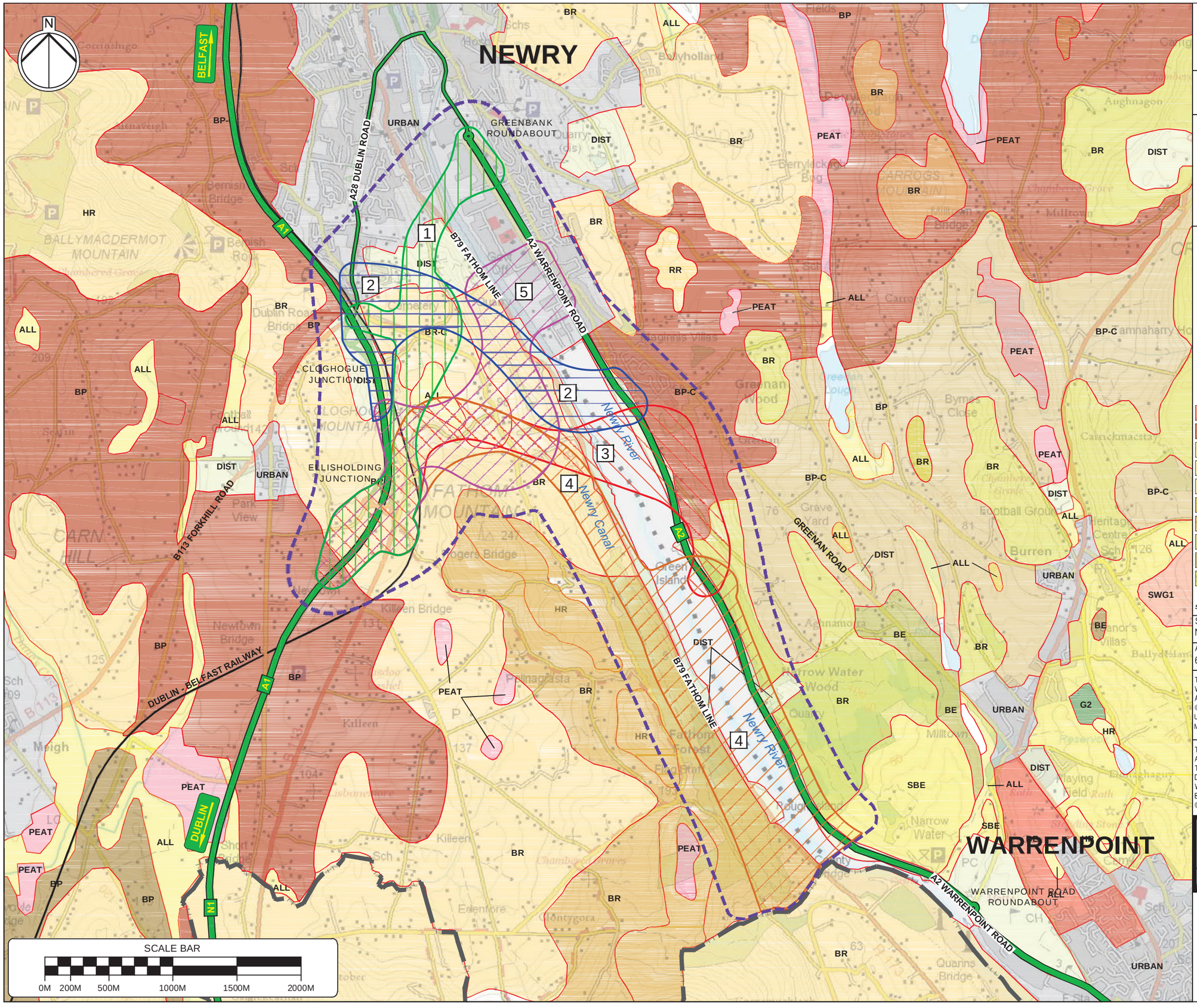
BT8 7RP
T: +44 (0)28 9070 5111
www.aecom.com



Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
GEOLOGY & SOILS
SOIL TYPES

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area

Soils

BE	Brown Earth on Granite	HR	Humic Ranker on Shale
BP	Brown Podzol on Granite	BP	Brown Podzol on Shale Till
BR	Brown Ranker on Granite	SBE	Shallow Brown Earth on Shale Till
HR	Humic Ranker on Granite	G2	Groundwater Gley
RR	Rock Ranker on Granite	SWG1	Surface Water Gley on Granite Till
BR	Brown Ranker on Felsite	URBAN	Urban
HR	Humic Ranker on Felsite	ALL	Alluvium
BE	Brown Earth on Shale	PEAT	Peat > 50cm Deep
BP	Brown Podzol on Shale	DIST	Disturbed
BR	Brown Ranker on Shale		

SOURCE:OSNI 1:50,000 SOILS SERIES MAP (SHEET 29) 1994

Scale @ A3
Not to Scale

AECOM Internal Project Number
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FIGURE 7.11.3

REV. 0

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Belfast
BT8 7RP
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Reference	Years of Operation	Information
A	1904 1982	Quarry
B	1856 1904 1982	Gravel Pit Quarry
C	1834 1856 1904 1930 1982	Quarry
D	1979 1930 1904 1856	Quarry
E	1930 1979	Quarry
F	1904 1930	Quarry
Drumalane Quarry	1990 - Present	Quarry
Bigwood Quarry	~	Quarry

NEWRY

DUBLIN ROAD BRIDGE SLNCI

CARRIVEMACLONE ASSI

A28 DUBLIN ROAD

DRUMALANE ROAD

GREENBANK ROUNDABOUT

DRUMALANE QUARRY

A2 WARRENPOINT ROAD

CLOGHOGUE JUNCTION

ELLISHOLDING JUNCTION

FATHOM MOUNTAIN

Newry River

Newry Canal

B113 FORKHILL ROAD

DUBLIN - BELFAST RAILWAY

B179 FATHOM LINE

GREENAN ROAD

BIGWOOD QUARRY

WARRENPOINT

WARRENPOINT ROAD ROUNDABOUT

A2 WARRENPOINT ROAD

SCALE BAR

0M 200M 500M 1000M 1500M 2000M

Source: GSNI Geoindex & NIEA Historic Land Use Layer

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- Mineral Extraction Site
- Historical Mineral Extraction Site
- Site of Local Nature Conservation Importance (SLNCI)
- Area of Special Scientific Interest (ASSI)

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
GEOLOGY & SOILS
LICENSED MINERAL EXTRACTION AND DESIGNATED SITES

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.11.4

REV. 0

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Source No.	Description
1	Railway land
2	Railway land
3	Mineral workings
4	Dockyards & docklands
5	Railway land
6	Mineral workings
7	Mineral workings
8	Mineral workings
9	Mineral workings
10	Gravel pit
11	Gravel pit
12	Railway land
13	Gravel pit
14	Railway land
15	Dockyards & docklands
16	Oil storage depot
17	Dockyards & docklands
18	Landing place/ docks
19	Railway land
20	Gravel pit
21	Quarry
22	Quarry
23	Factory/ works
24	Waste recycling: landfills & other waste disposal sites
25	Garage & fuel station
26	Works
27	Railway land
28	Engineering works: mechanical engineering and ordnance works
29	Quarry
30	Unspecified: industrial works
31	Unspecified: industrial works

Source No.	Description
32	Engineering works: mechanical engineering and ordnance works
33	Engineering works: mechanical engineering and ordnance works
34	Sewage works & sewage farms
35	Garage & fuel station
36	Garage & fuel station
37	Formula Karting
38	Engineering works: mechanical engineering and ordnance works
39	Electrical substation
40	Unspecified: industrial works
41	Abattoir
42	Abattoir
43	Garage & fuel station
44	Burial ground
45	Mineral workings
46	Quarry
47	Railway goods depot
48	Garage & fuel station
49	Coal yard
50	Coal yard
51	Garage & fuel station
52	Gas works
53	Dockyards & docklands
54	Garage & fuel station
55	Railway goods depot
56	Old distillery
57	Electrical substation
58	Corn & flour mills
59	Coal yard
60	Spinning mill

Source No.	Description
61	Garage & fuel station
62	Textile works
63	Garage & fuel station
64	Timber products manufacturing works
65	Railway land
66	Mineral workings
67	Waste recycling: landfills & other waste disposal sites
68	Mineral workings
69	Mineral workings
70	Cemetery
71	Smithies
72	Waste recycling: metal recycling site
73	Railway land
74	Unspecified: industrial works
75	Tobacco pipe manufacturing works
76	Quarry
77	Works
78	Filling station
79	Waste recycling: metal recycling site
80	Railway land
81	Mineral workings
82	Possible quarry
83	Mineral workings
84	Gravel pit
85	Railway land
86	Gravel pit
87	Quarry
88	Gravel pit
89	Gravel pit

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
GEOLOGY & SOILS
CONTAMINATED LAND

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4
- Corridor 5
- A Class Road
- Railway
- International Border
- Corridor Options Study Area
- Potentially Contaminated Land

SCALE BAR

0M 200M 500M 1000M 1500M 2000M

SOURCE: NIEA Land Database, OS Maps, Google Maps.

Scale @ A3
Not to Scale

AECOM Internal Project Number
60472927

FIGURE 7.11.5

REV. 0

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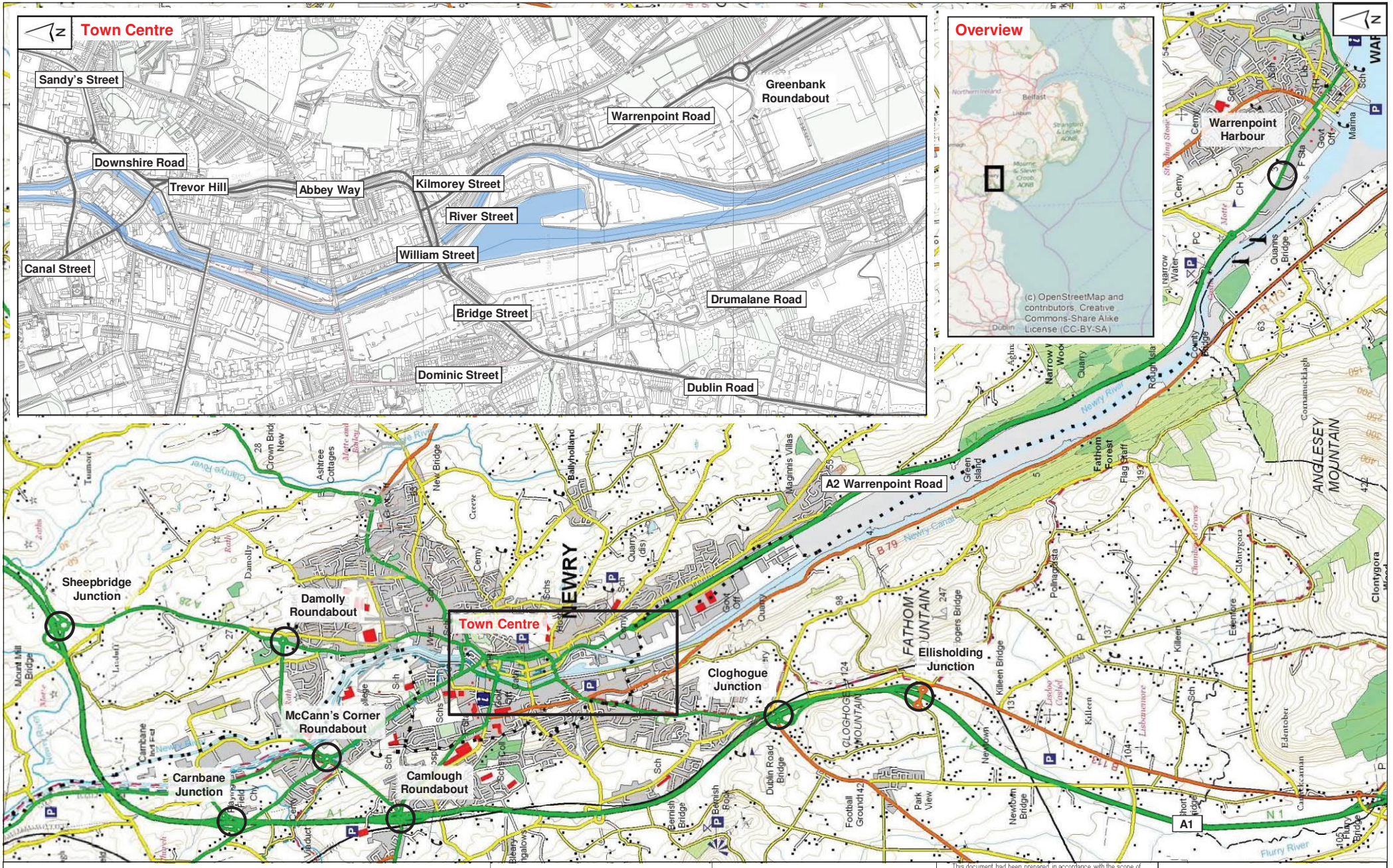

KEY

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
GENERAL LOCATION PLAN

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.1.1

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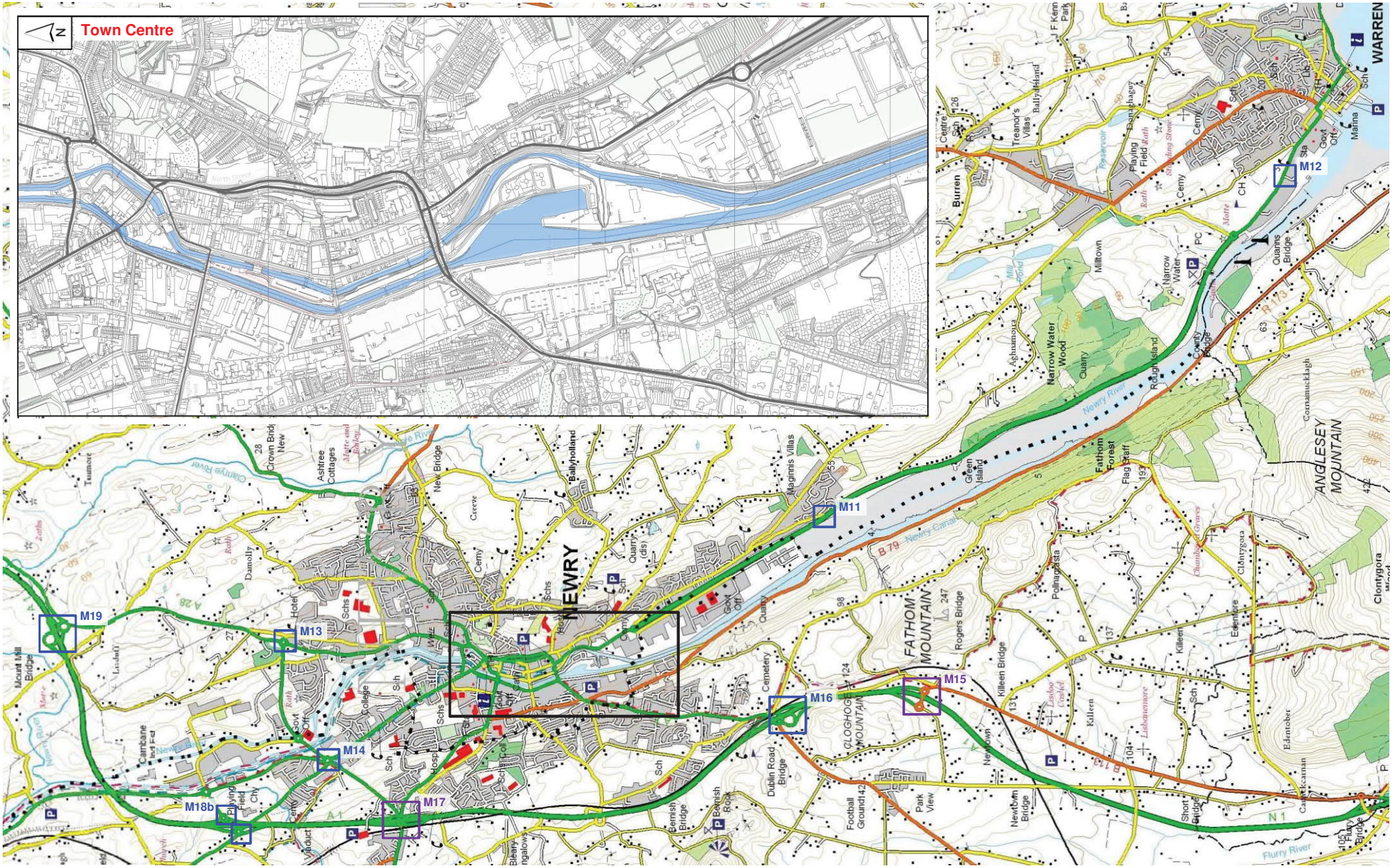
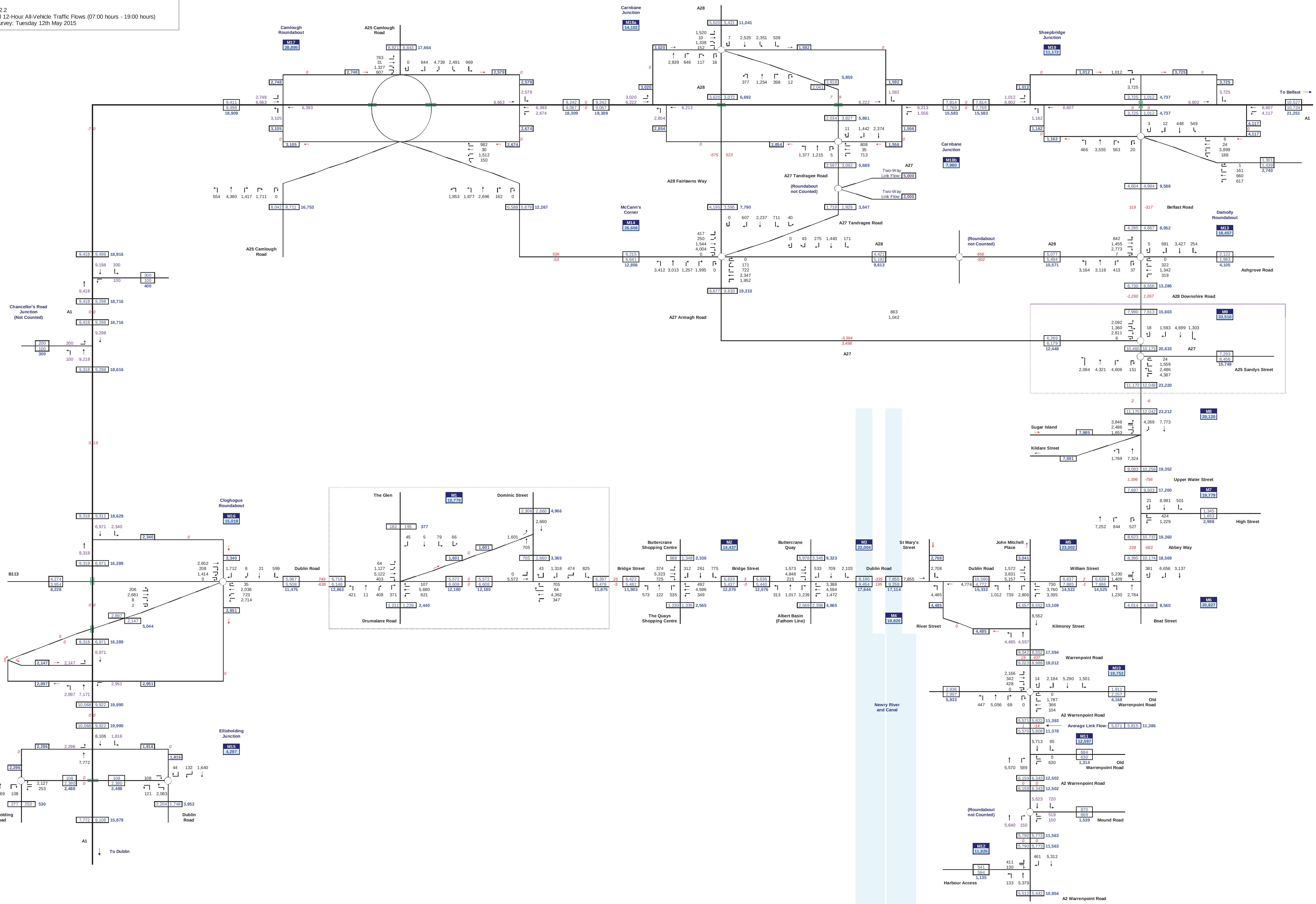
www.aecom.com


Town Centre
M11
M12
M13
M14
M15
M16
M17
M18b
M19
NEWRY
FATHOM MOUNTAIN
CLOGHOGUE MOUNTAIN
ANGLESEY MOUNTAIN
WARREN
Newry River
Newry Canal
Flurry River
A1
N1
B79
Narrow Water Wood
Fathom Forest

AECOM

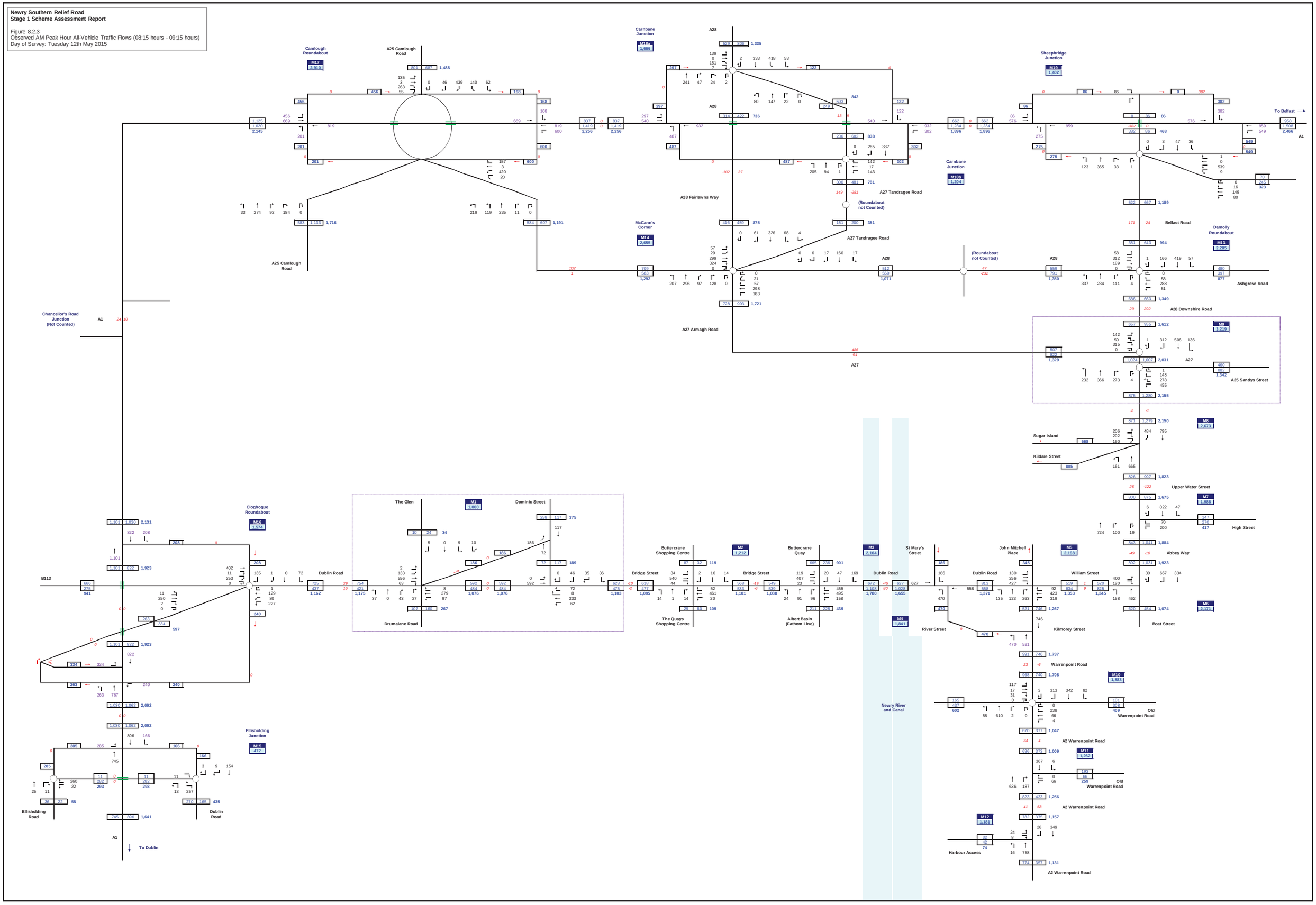
Newry Southern Relief Road
Stage 1 Scheme Assessment Report

Figure 8.2.2
Observed 12-Hour All-Vehicle Traffic Flows (07:00 hours - 19:00 hours)
Day of Survey: Tuesday 12th May 2015



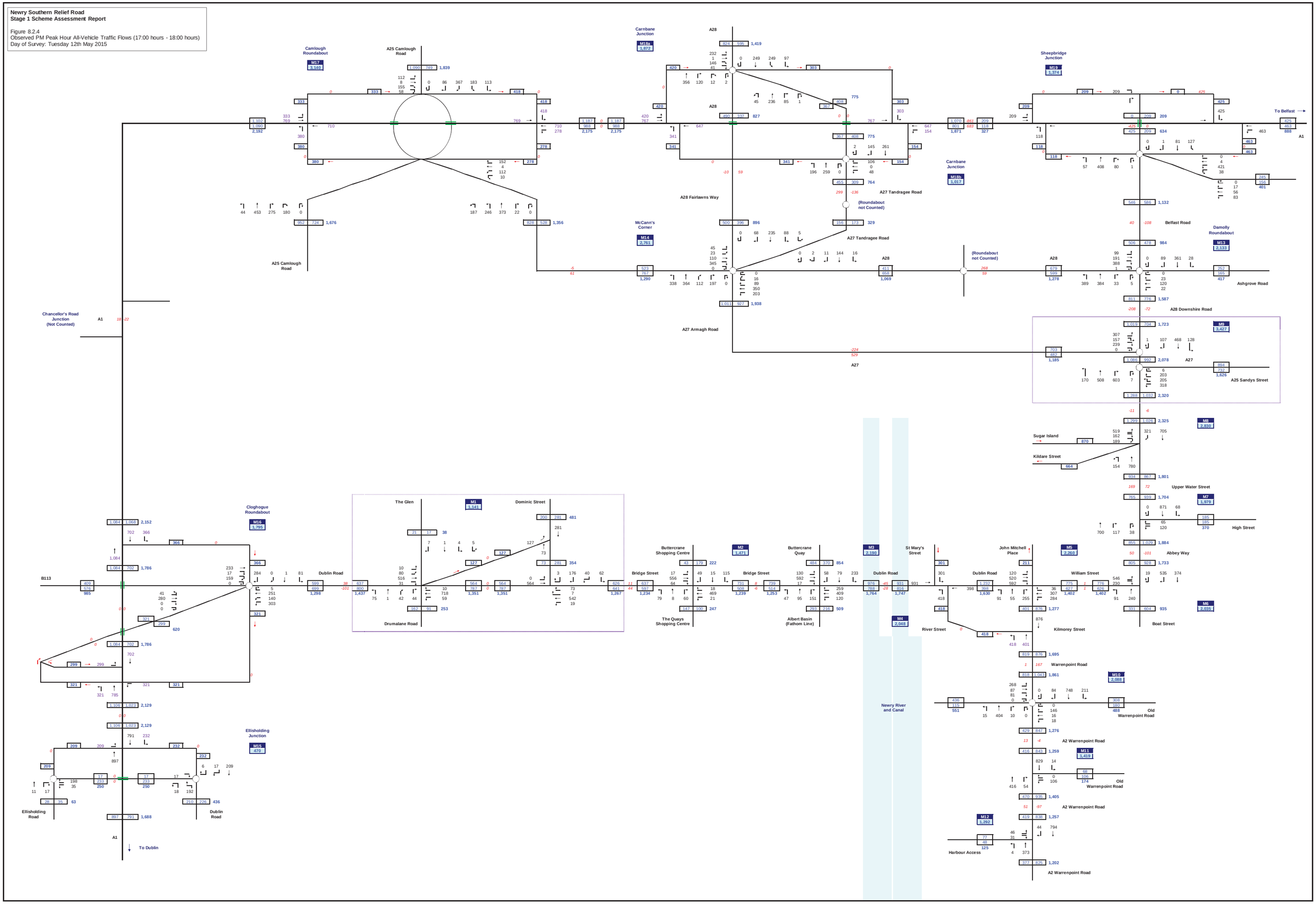
Newry Southern Relief Road
Stage 1 Scheme Assessment Report

Figure 8.2.3
Observed AM Peak Hour All-Vehicle Traffic Flows (08:15 hours - 09:15 hours)
Day of Survey: Tuesday 12th May 2015



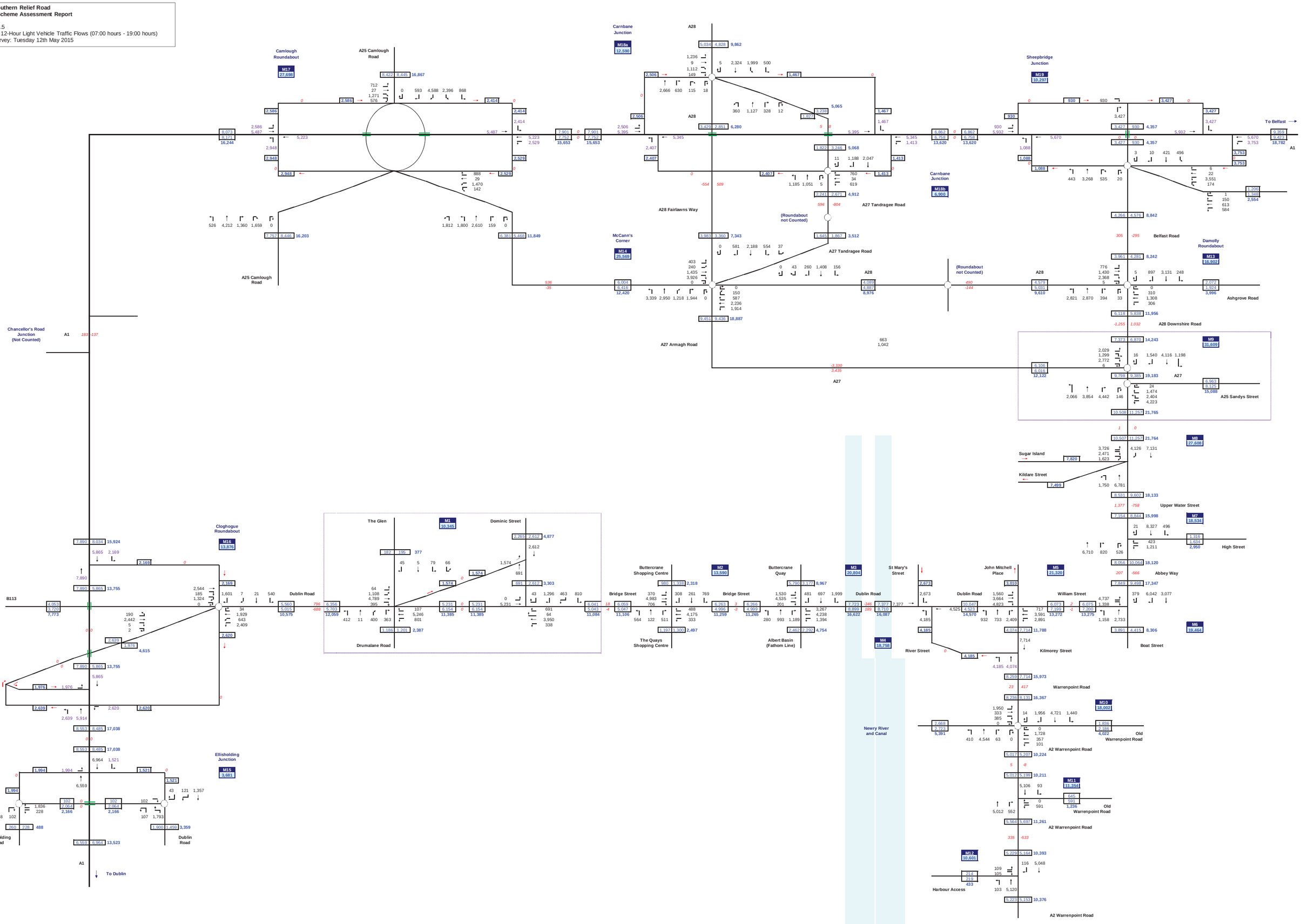
Newry Southern Relief Road
Stage 1 Scheme Assessment Report

Figure 8.2.4
Observed PM Peak Hour All-Vehicle Traffic Flows (17:00 hours - 18:00 hours)
Day of Survey: Tuesday 12th May 2015



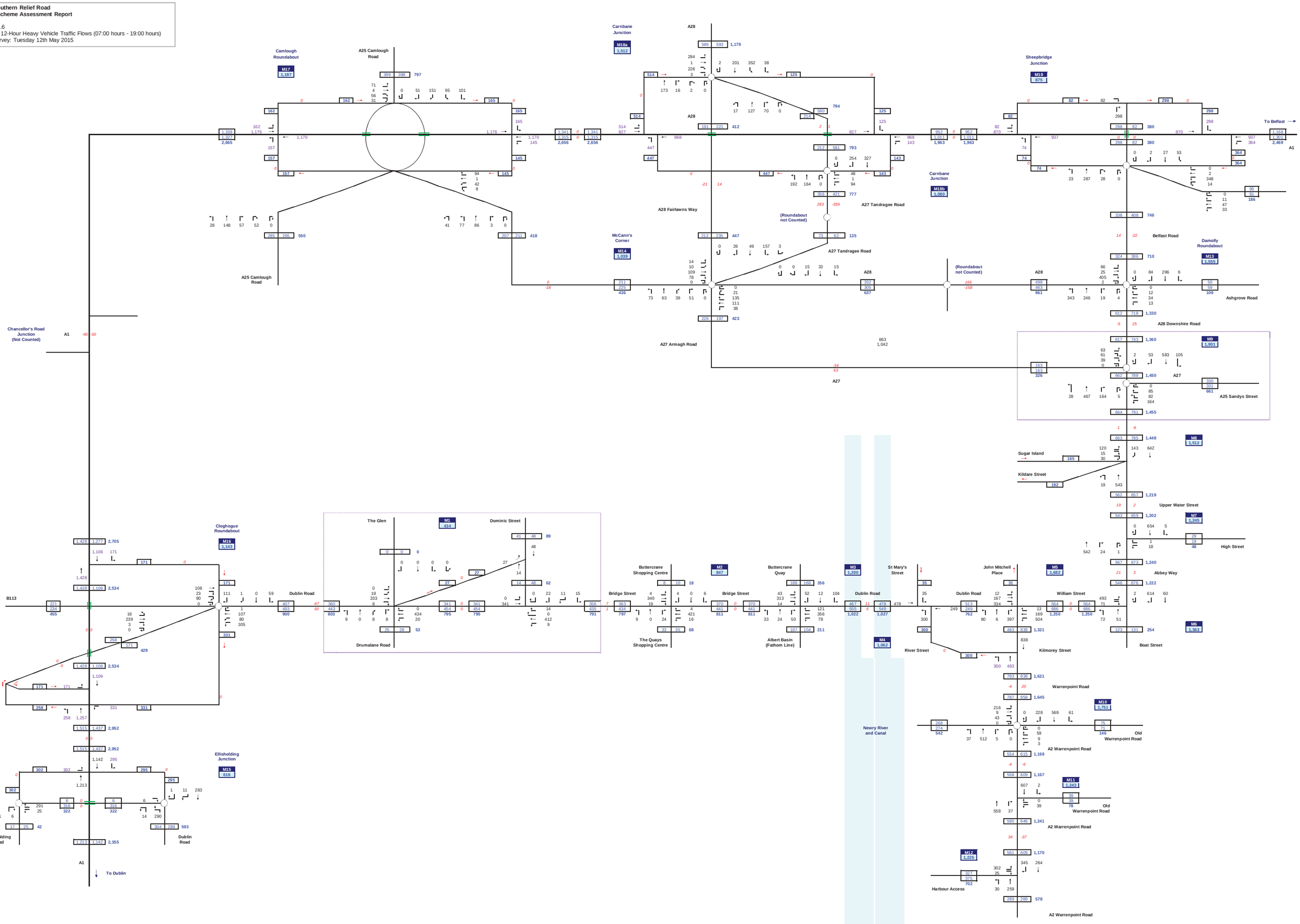
Newry Southern Relief Road
Stage 1 Scheme Assessment Report

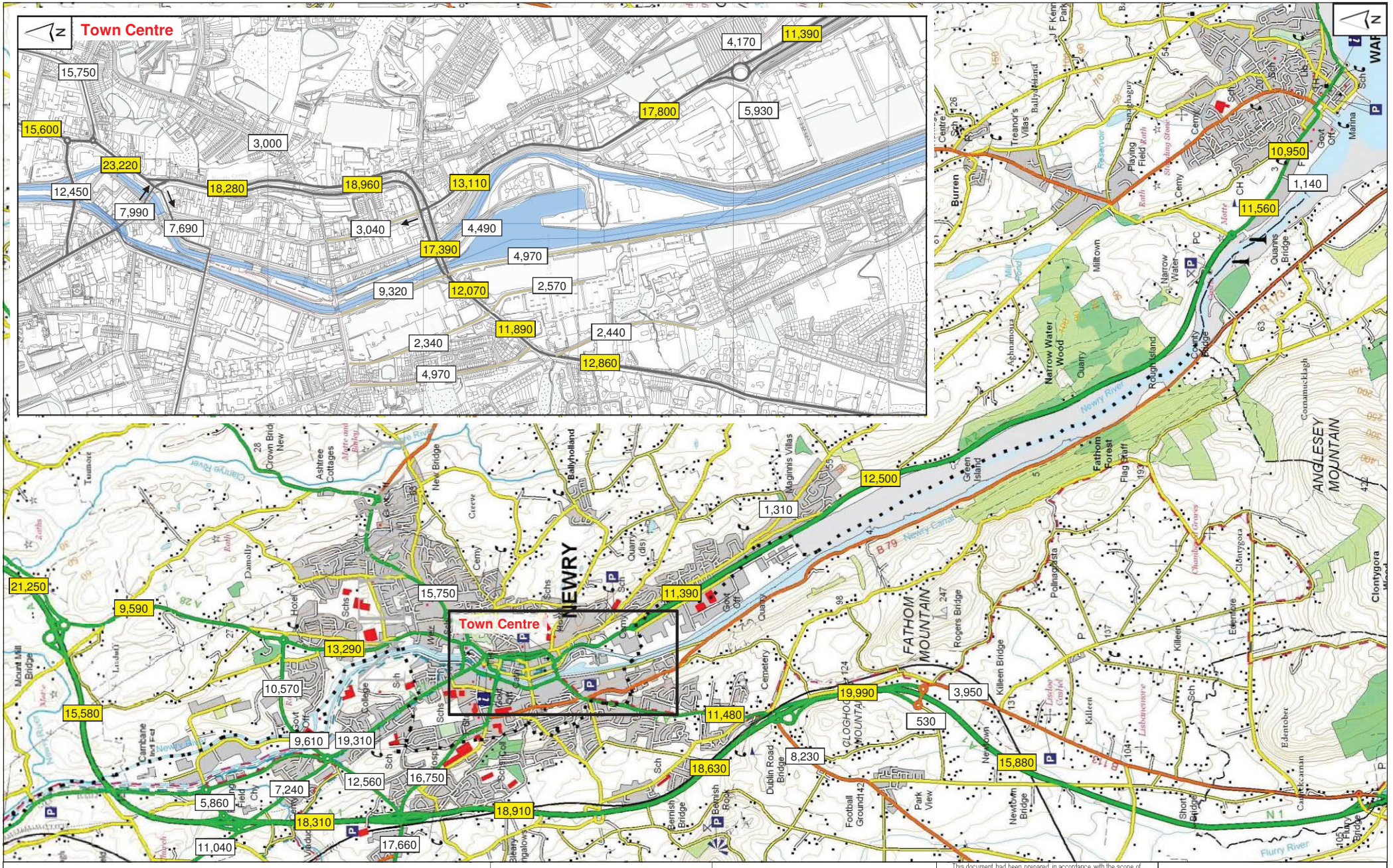
Figure 8.2.5
Observed 12-Hour Light Vehicle Traffic Flows (07:00 hours - 19:00 hours)
Day of Survey: Tuesday 12th May 2015



Newry Southern Relief Road
Stage 1 Scheme Assessment Report

Figure 8.2.6
Observed 12-Hour Heavy Vehicle Traffic Flows (07:00 hours - 19:00 hours)
Day of Survey: Tuesday 12th May 2015





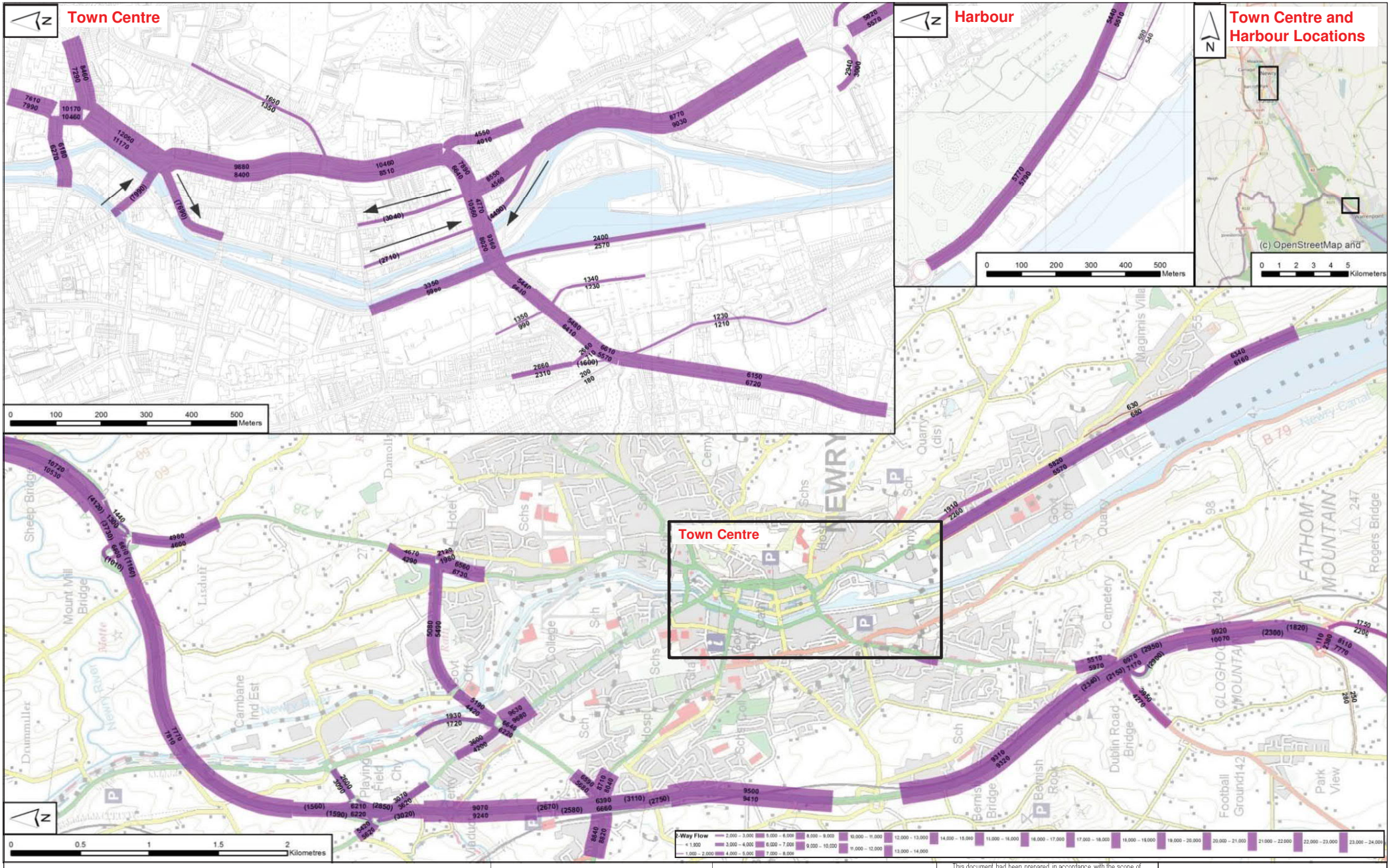
KEY

Day of Survey: Tuesday 12th May 2015

10,000 Main Road Traffic Flow

10,000 Side Road Traffic Flow

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: MANUAL CLASSIFIED COUNTS OBSERVED WEEKDAY TWO-WAY 12-HOUR LINK FLOWS	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used. © AECOM Infrastructure & Environment UK Limited. Crown Copyright, All Rights Reserved. License number – NIMA ES&LA214.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
Client: Department for Infrastructure | An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.7



KEY

Day of Survey: Tuesday 12th May 2015

MCC flows have been rounded to the nearest 10.

Motorcycles and Pedal Cycles have been excluded

One-way flows are shown in brackets.

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

MANUAL CLASSIFIED COUNTS
12-HOUR TWO-WAY BANDWIDTH PLOT

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.8

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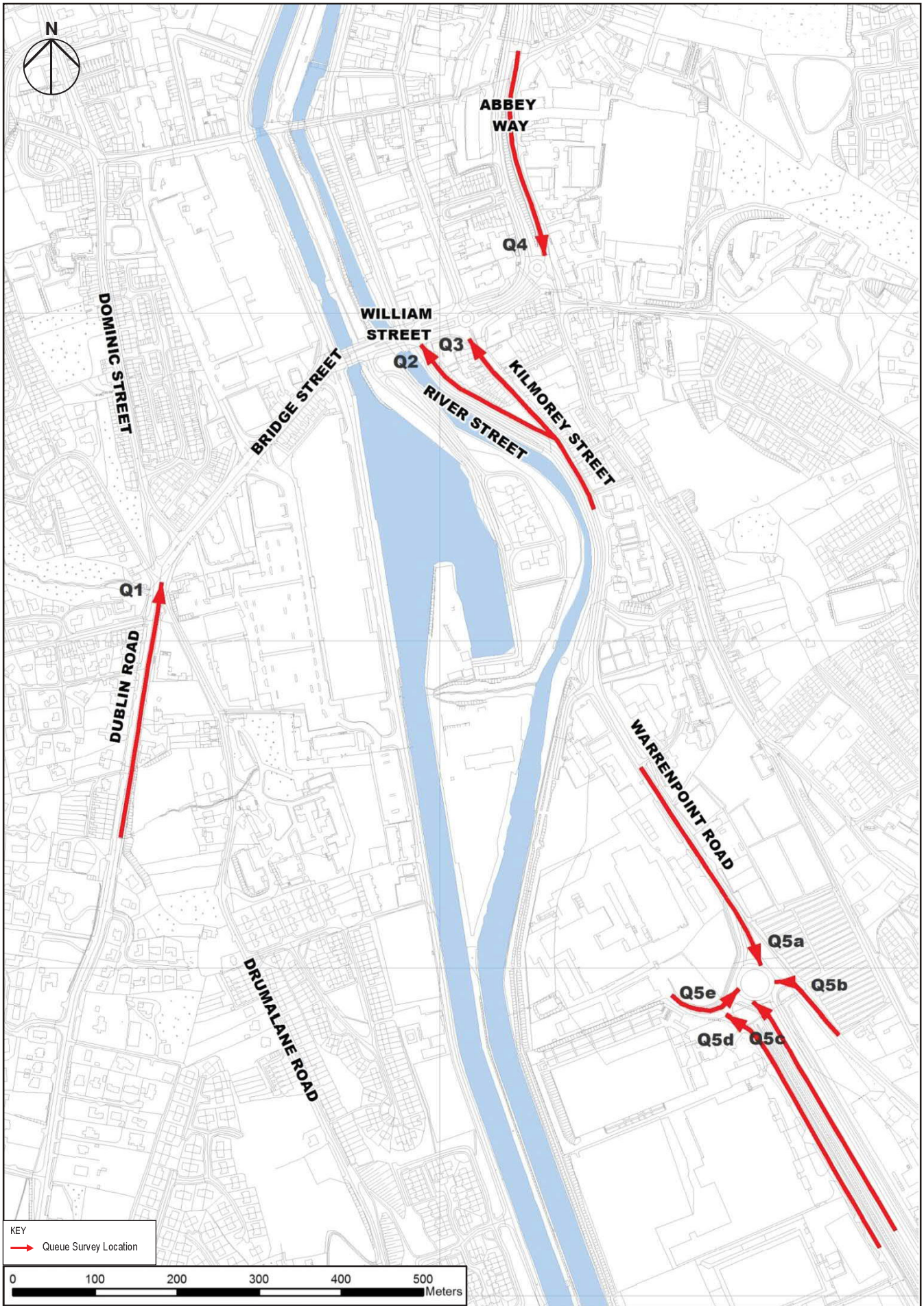
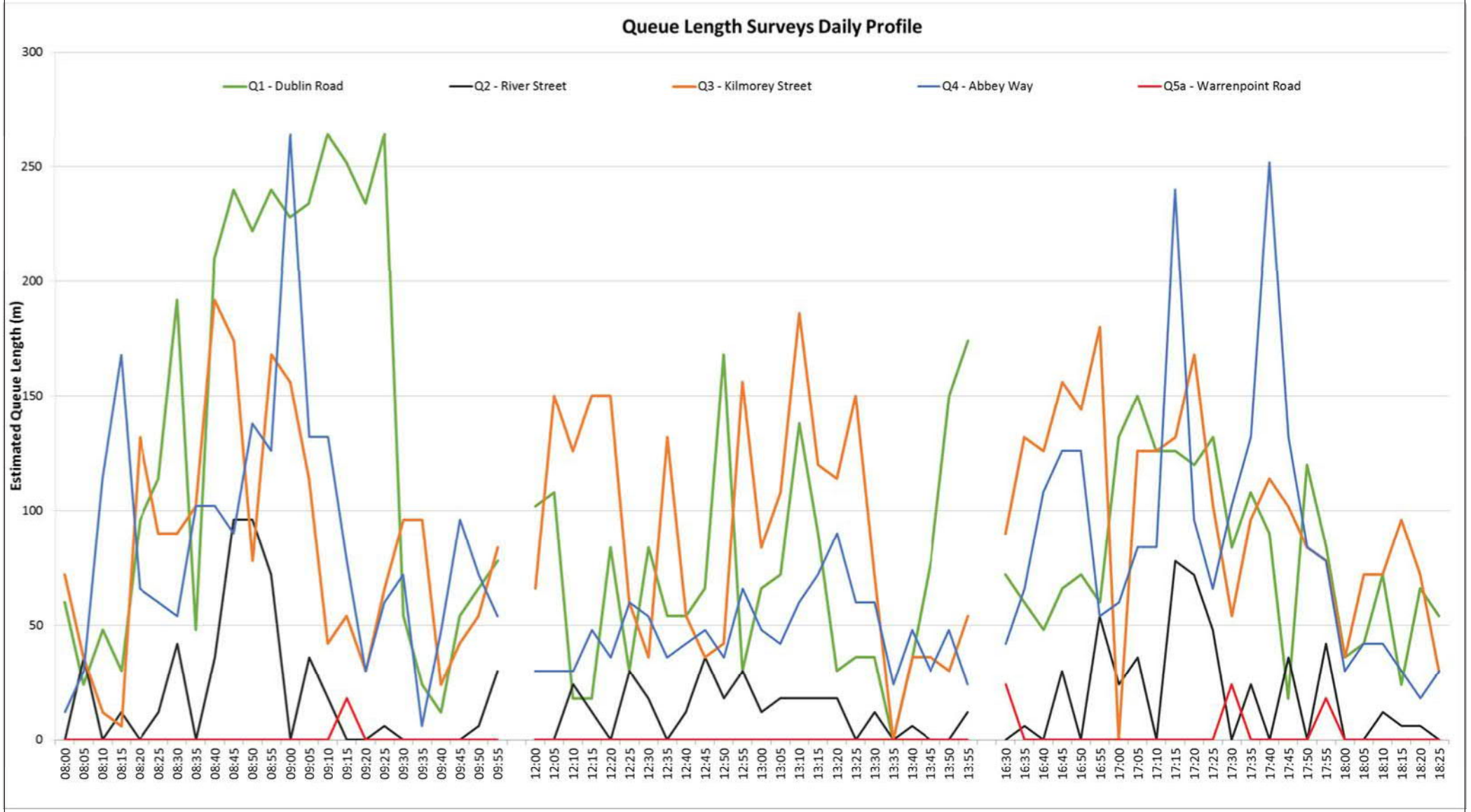


Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: QUEUE SURVEY LOCATIONS		This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use d this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used. © AECOM Infrastructure & Environment UK Limited. Crown Copyright, All Rights Reserved. License number – NIMAES&LA214	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
Client: Department for Infrastructure / An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.9	



KEY

Three individual time periods of 2-hours have been surveyed. Only Q5a at Greenbank Roundabout is shown due to low counts.

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: QUEUE SURVEYS QUEUE SURVEY PROFILE

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.10

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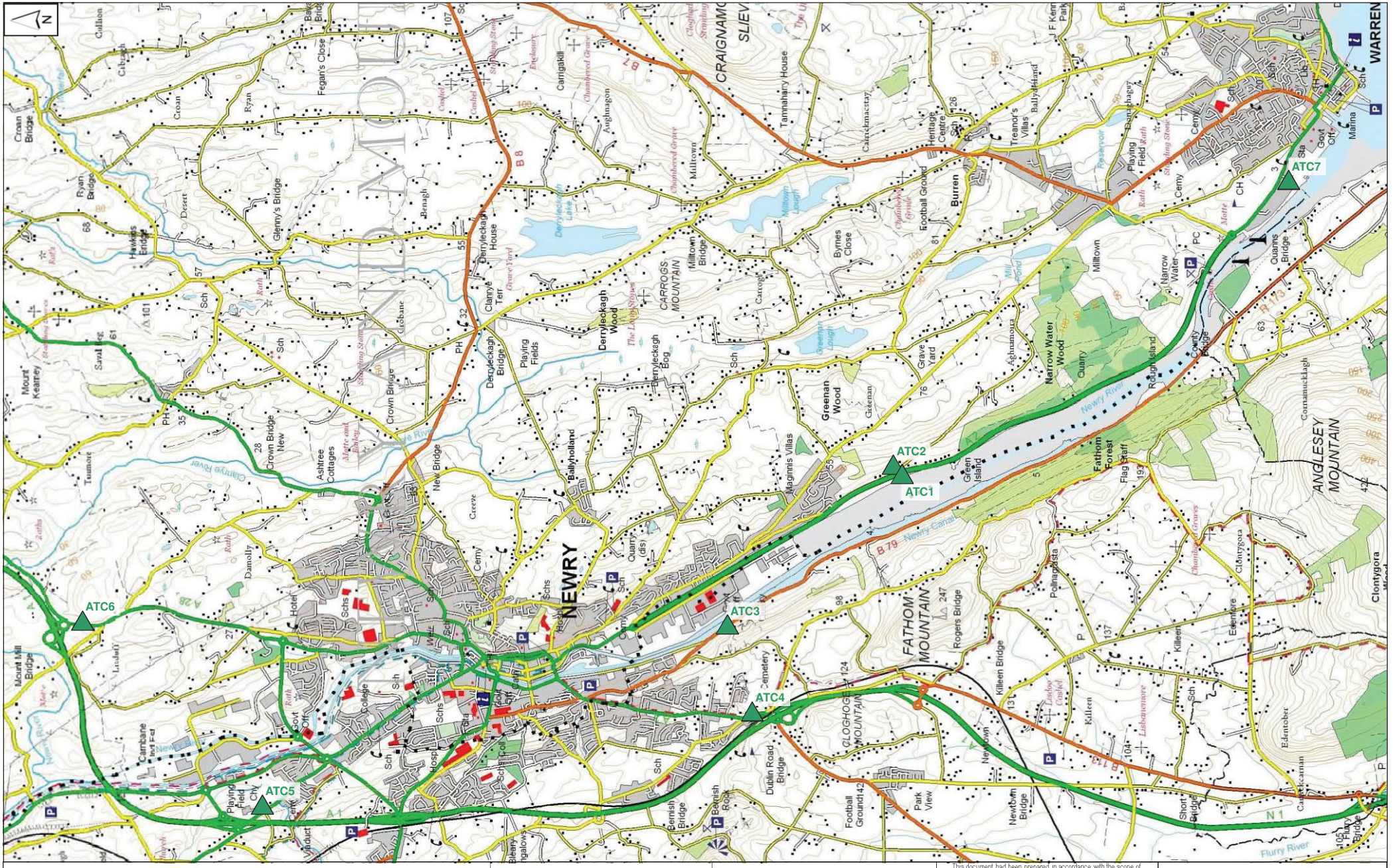

KEY

▲ Temporary Automatic Traffic Count Location

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: TEMPORARY AUTOMATIC TRAFFIC COUNT LOCATIONS MAY 2015		
Client: Department for Infrastructure / An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.11

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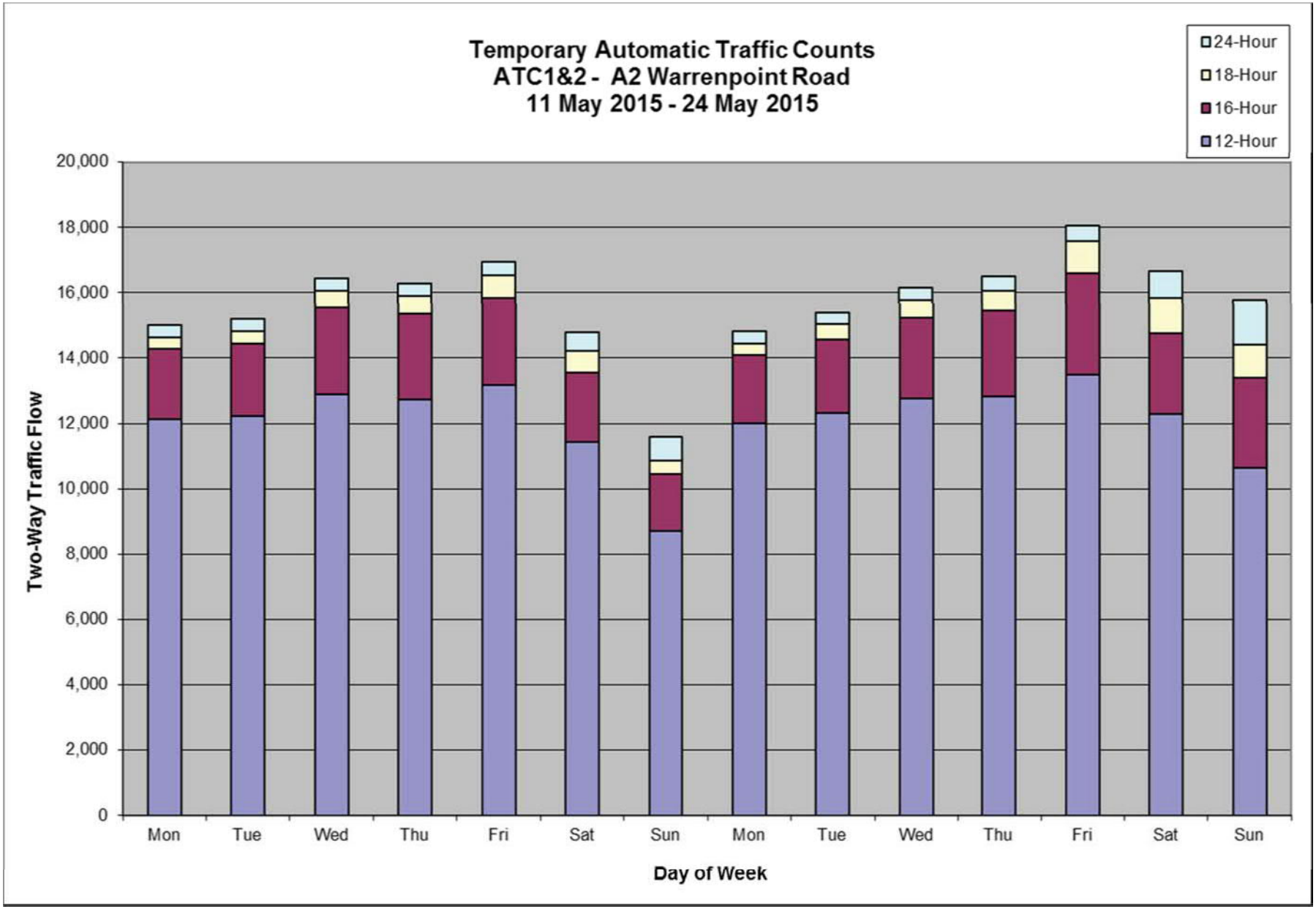

KEY

ATC2 has been infilled for all of Monday 11th May 2015 and part of Tuesday 12th May 2015.
Also, Sunday 17th May 2015 has been partly infilled.

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
TEMPORARY AUTOMATIC TRAFFIC COUNTS
ATC SITES 1 & 2
MAY 2015 DAILY TRAFFIC FLOWS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
NTS

AECOM Internal Project Number: 60472927

Figure 8.2.12

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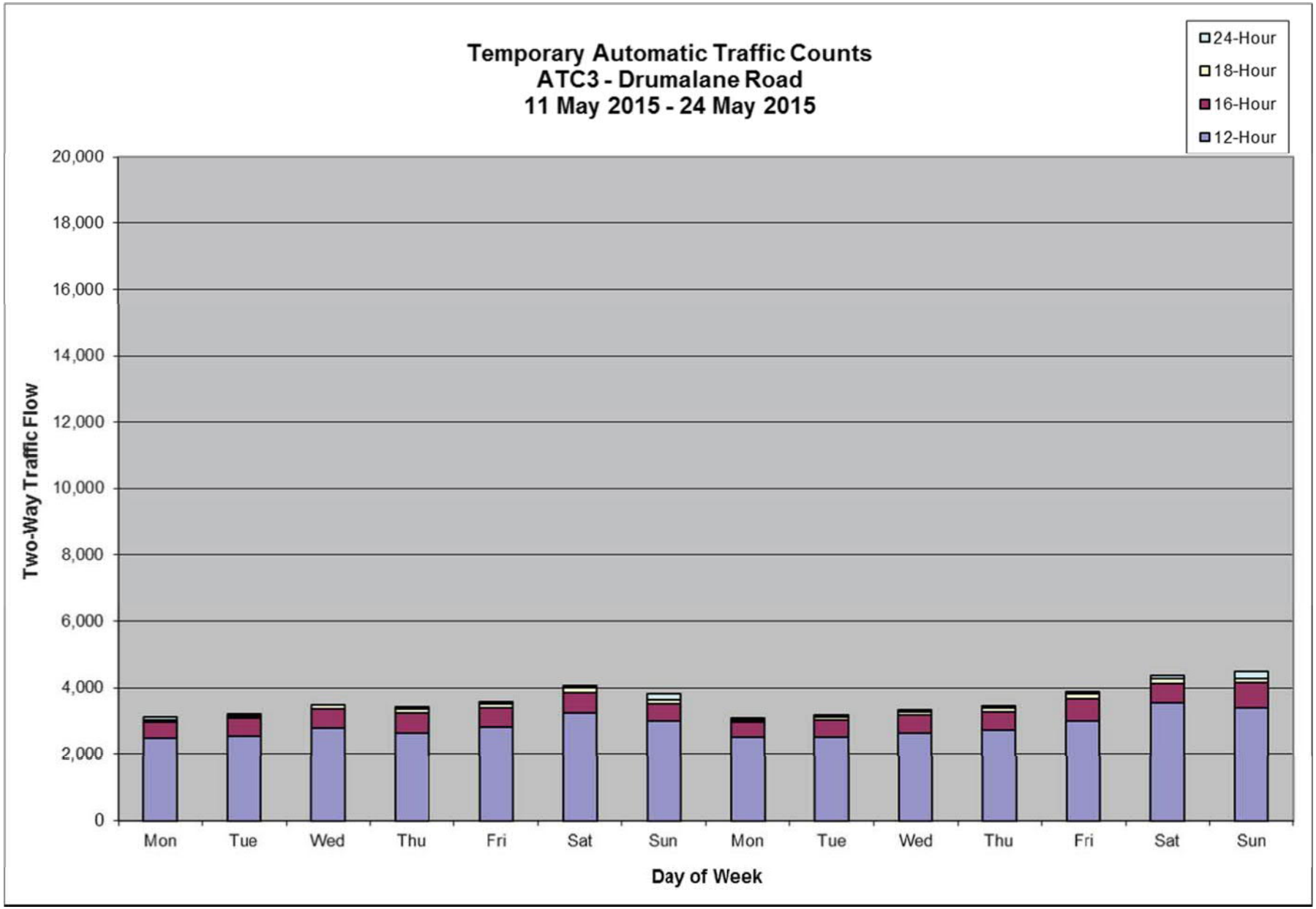

KEY

ATC3 has been infilled for part of Monday 11th May 2015 and part of Tuesday 12th May 2015.

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: TEMPORARY AUTOMATIC TRAFFIC COUNTS ATC SITE 3 MAY 2015 DAILY TRAFFIC FLOWS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.13

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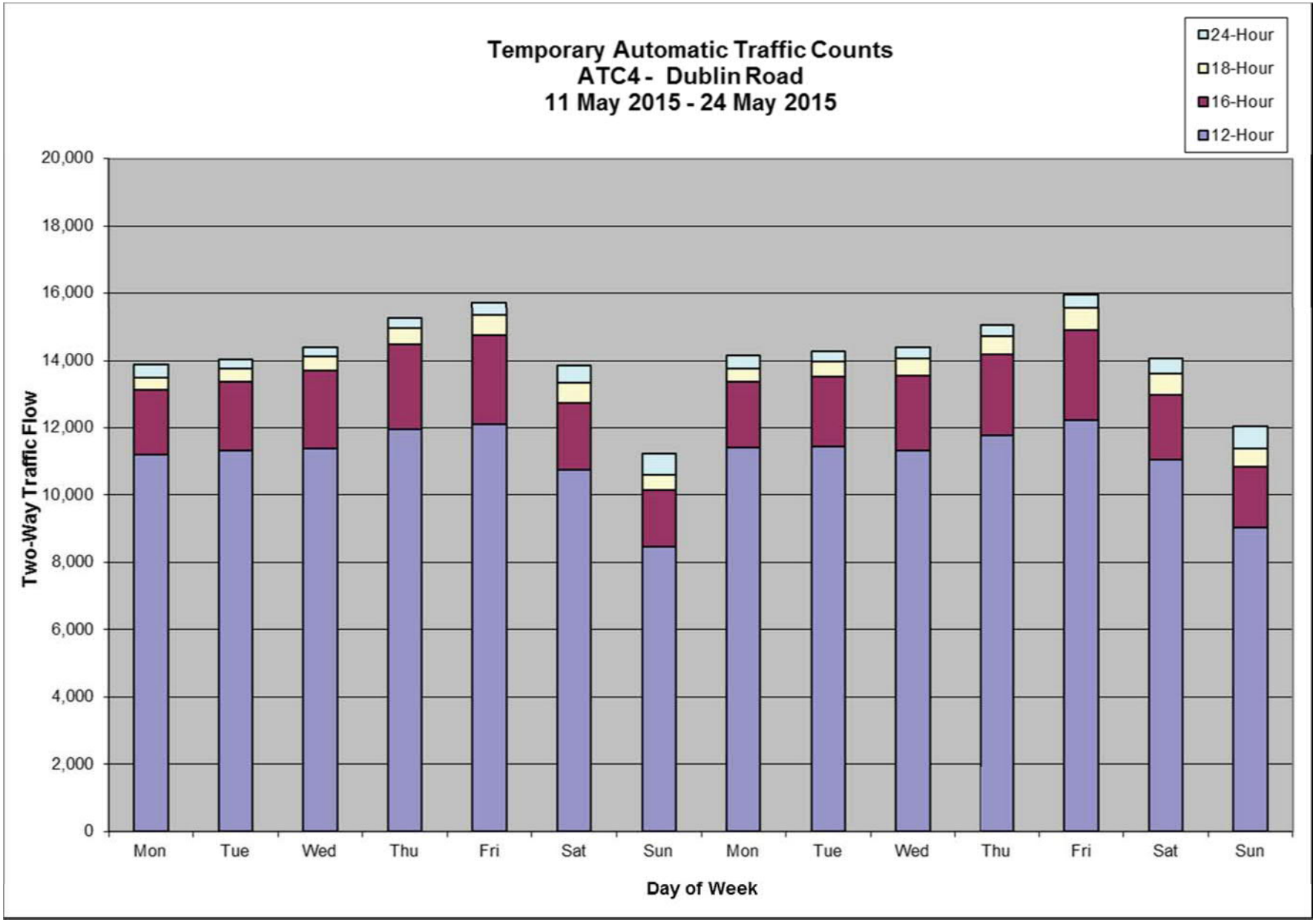

KEY

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
TEMPORARY AUTOMATIC TRAFFIC COUNTS
ATC SITE 4
MAY 2015 DAILY TRAFFIC FLOWS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
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AECOM Internal Project Number: 60472927

Figure 8.2.14

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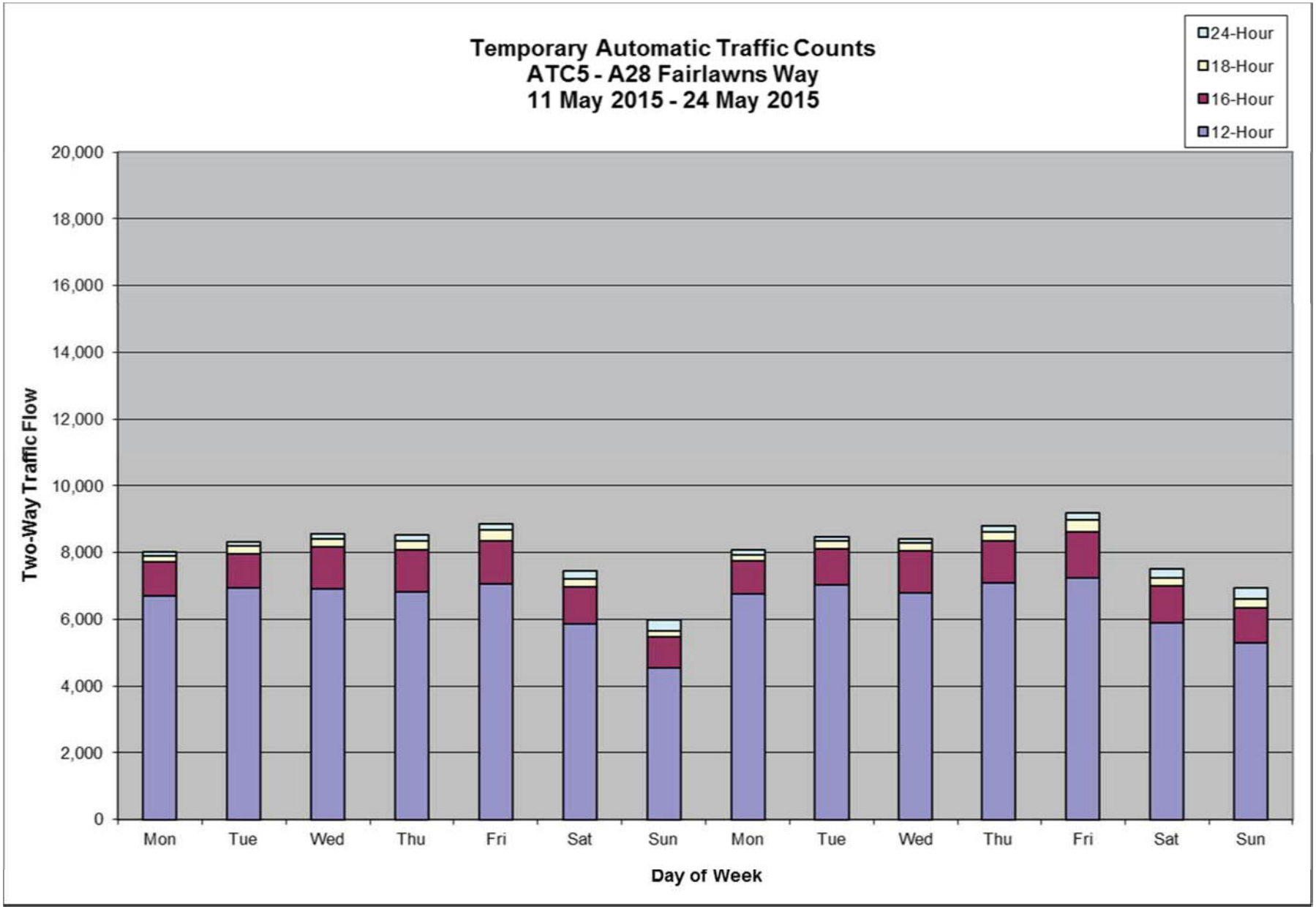

KEY

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
TEMPORARY AUTOMATIC TRAFFIC COUNTS
ATC SITE 5
MAY 2015 DAILY TRAFFIC FLOWS

Client Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
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AECOM Internal Project Number: 60472927

Figure 8.2.15

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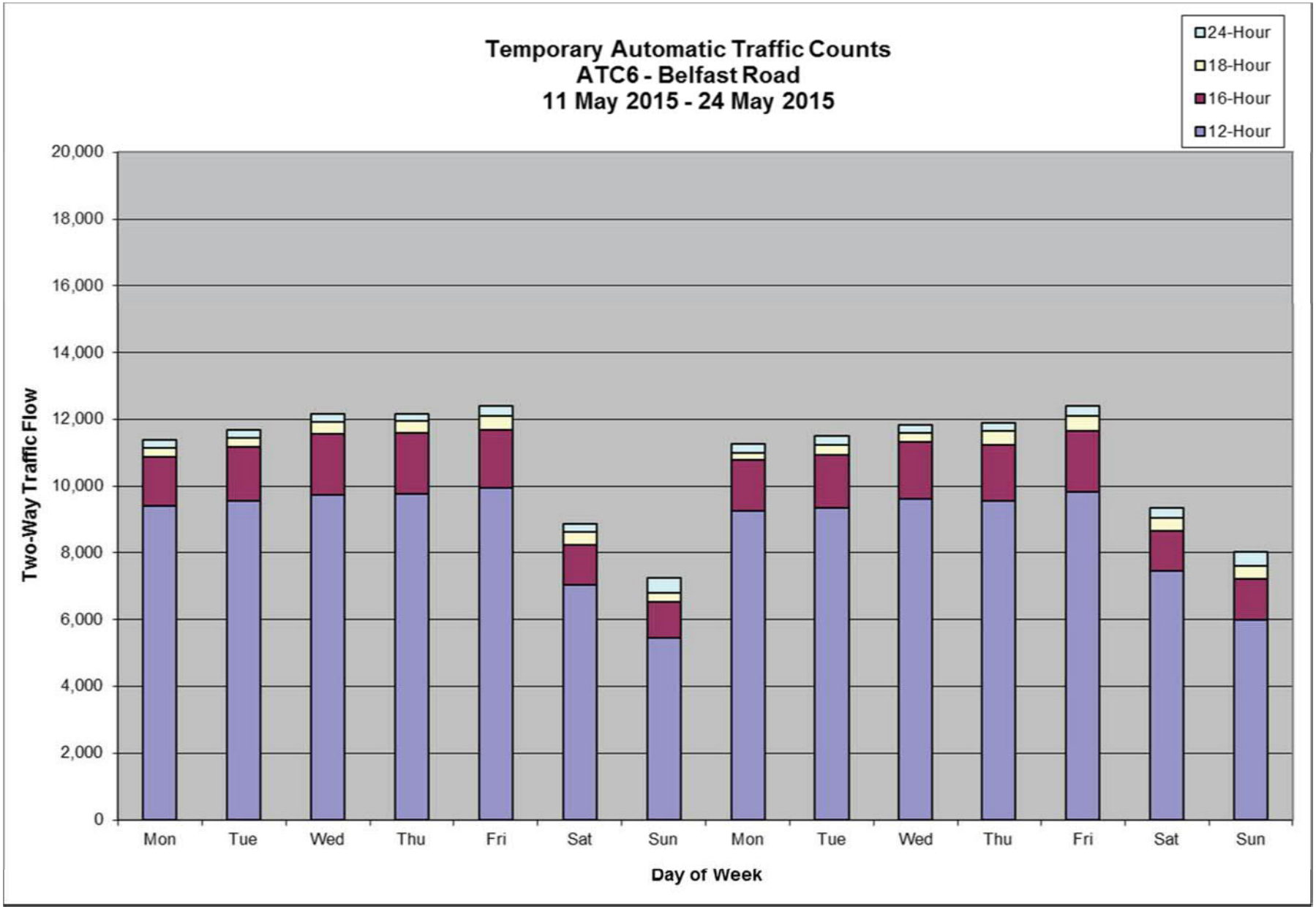

KEY

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
TEMPORARY AUTOMATIC TRAFFIC COUNTS
ATC SITE 6
MAY 2015 DAILY TRAFFIC FLOWS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
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AECOM Internal Project Number: 60472927

Figure 8.2.16

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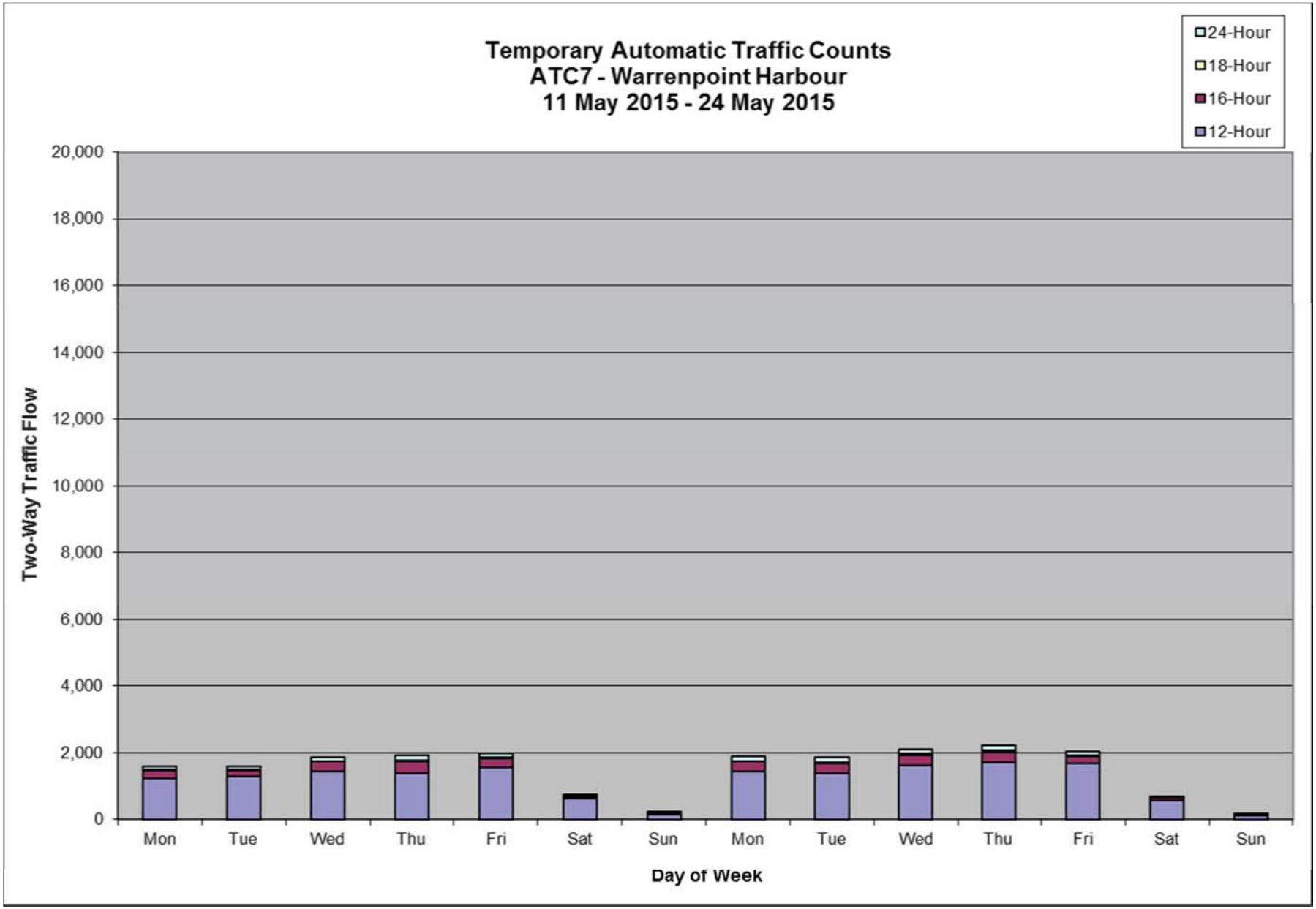

KEY

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
TEMPORARY AUTOMATIC TRAFFIC COUNTS
ATC SITE 7
MAY 2015 DAILY TRAFFIC FLOWS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
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AECOM Internal Project Number: 60472927

Figure 8.2.17

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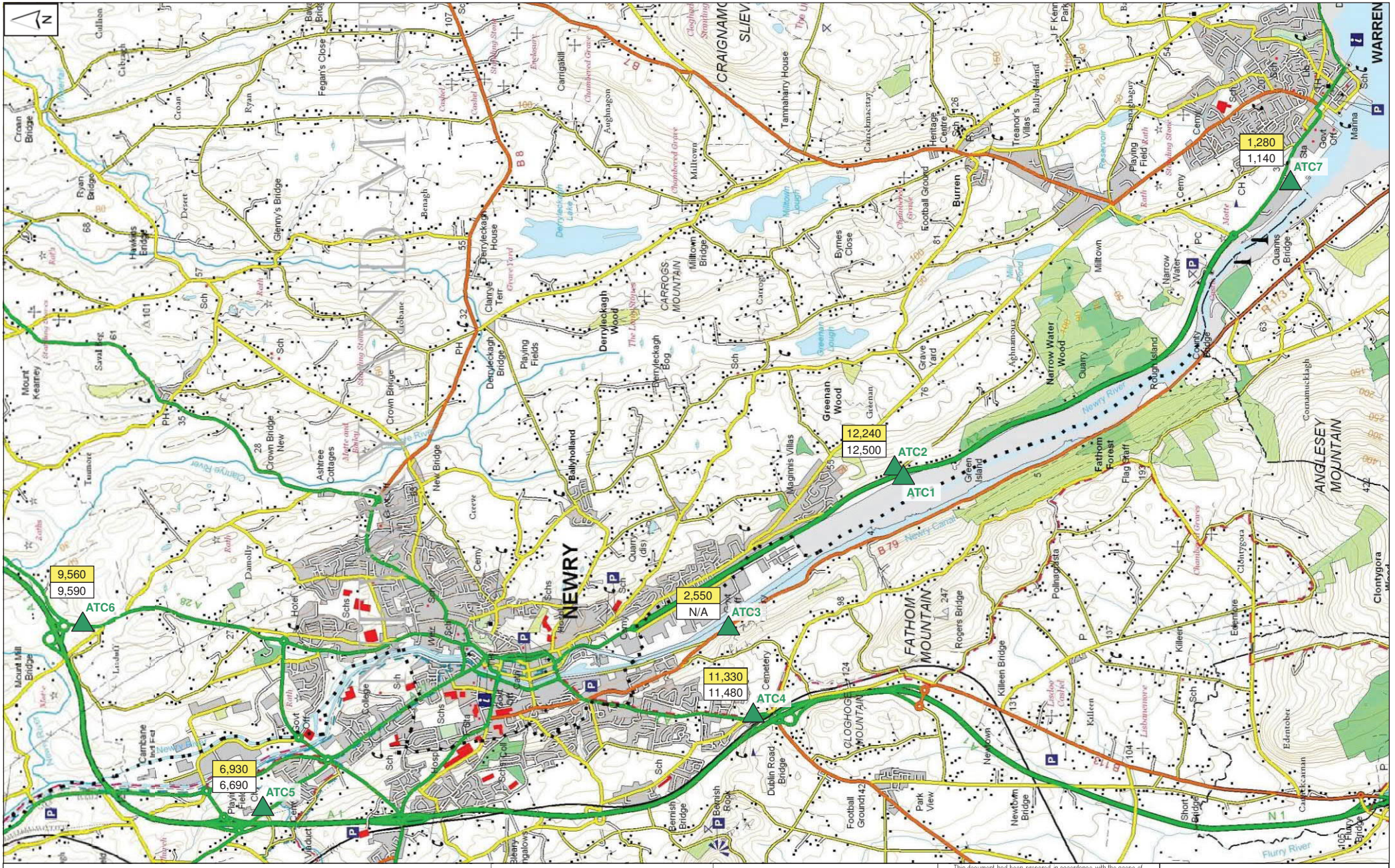

KEY

Day of Survey: Tuesday 12th May 2015

ATC3 (Fathom Line) does not have a directly comparable MCC Site.

It should also be noted that ATC3 has been infilled for part of the main survey day using data from Tues 19th May.

Both data-sets exclude Motorcycles and Pedal Cycles.

10,000 ATC 12-Hour Traffic Flow

10,000 MCC 12-Hour Traffic Flow

Project Title

NEWRY SOUTHERN RELIEF ROAD

Client: Department for Infrastructure | An Roinn Bonneagair

Drawing Title

TEMPORARY AUTOMATIC TRAFFIC COUNTS
COMPARISON OF ATC & MCC TRAFFIC FLOWS
07:00 HOURS – 19:00 HOURS

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.18

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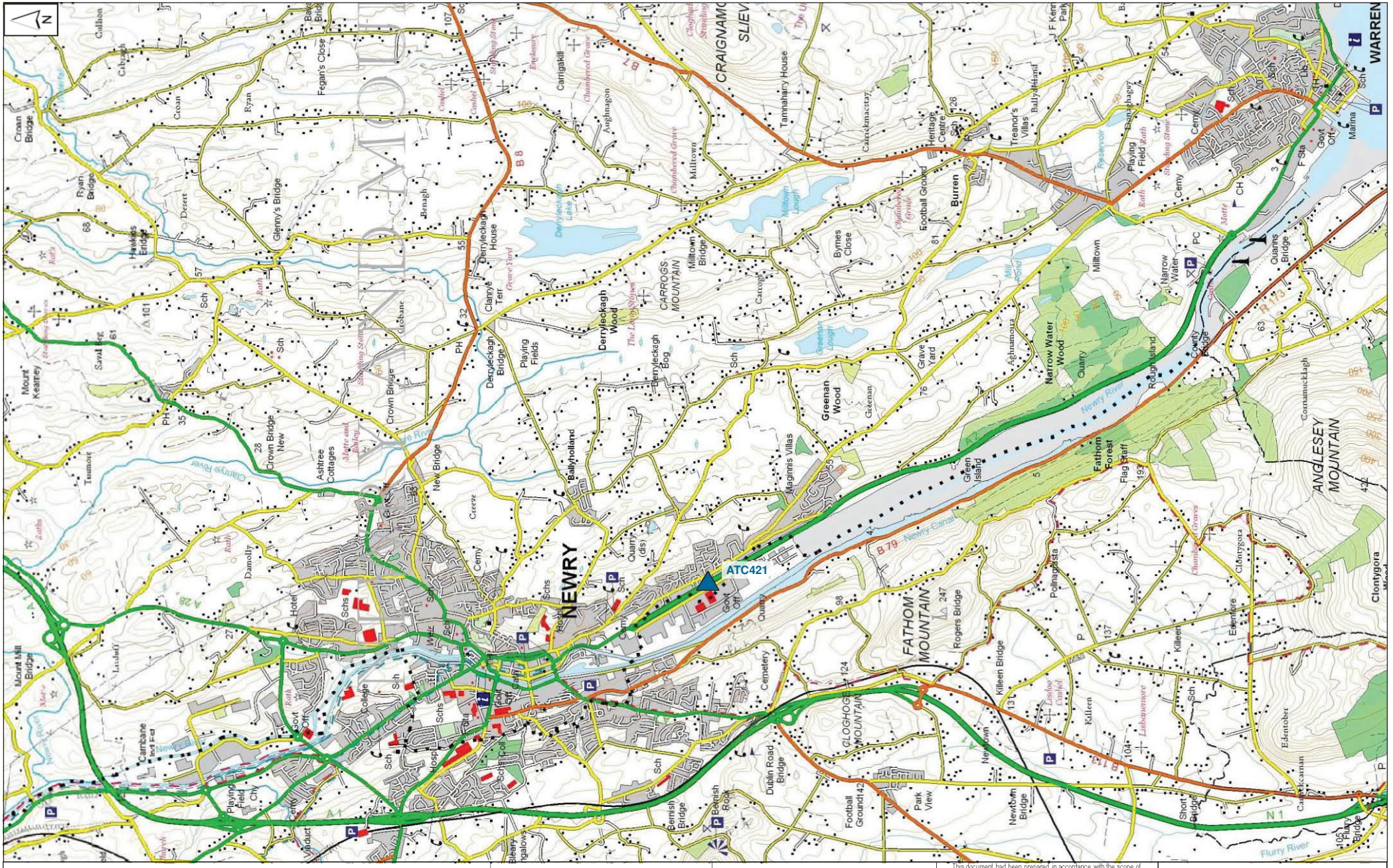

KEY

▲ Permanent Automatic Traffic Count Location

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

PERMANENT AUTOMATIC TRAFFIC COUNT LOCATION
ATC 421 – A2 WARRENPOINT ROAD

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.19

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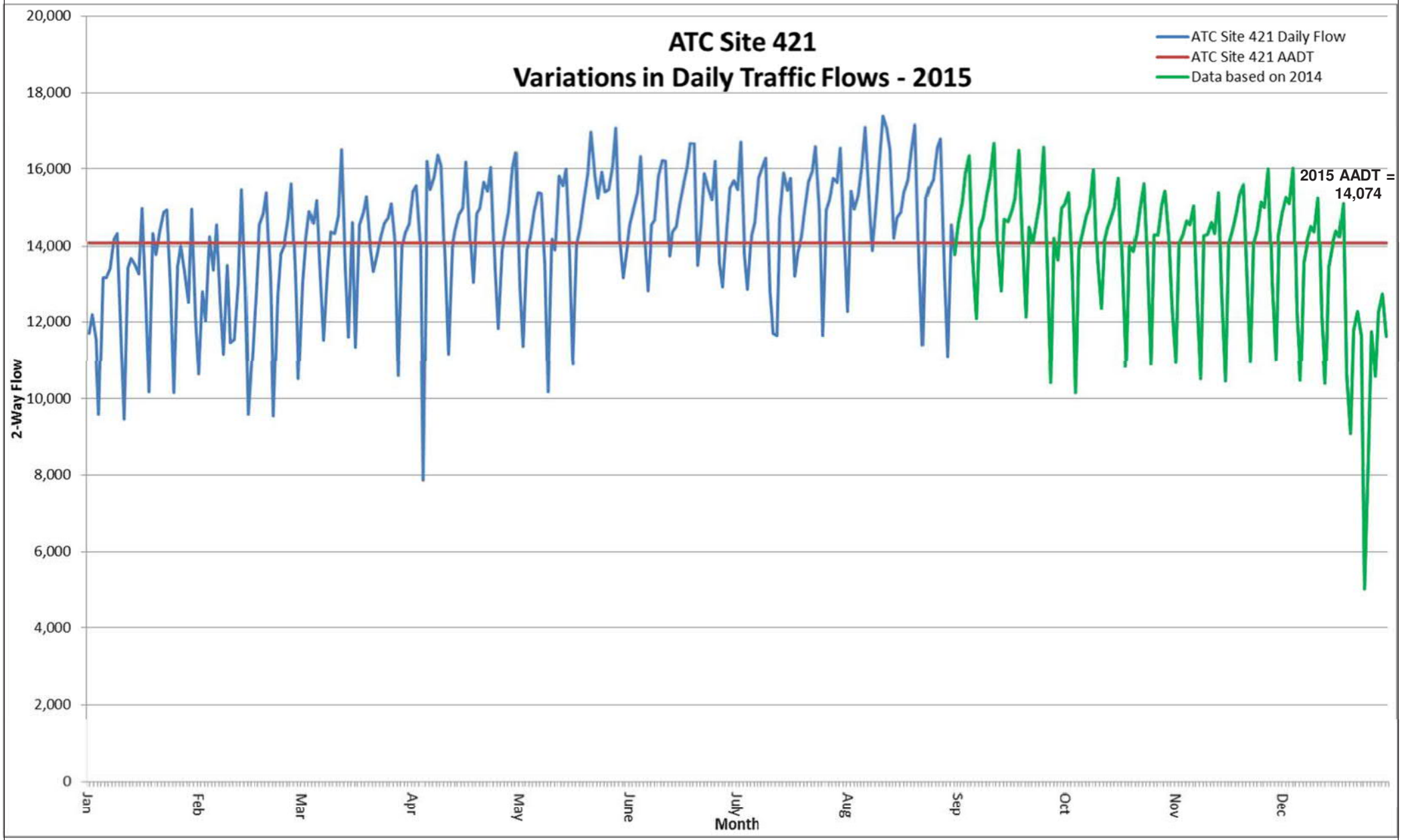

KEY

Due to missing ATC data, September 2015 to December 2015 flows are based upon the equivalent 2014 flows and application of a growth factor.

Project Title: NEWRY SOUTHERN RELIEF ROAD

Client: Department for Infrastructure | An Roinn Bonneagair

Drawing Title: PERMANENT AUTOMATIC TRAFFIC COUNT ATC SITE 421 VARIATIONS IN DAILY TRAFFIC FLOWS 2015

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.20

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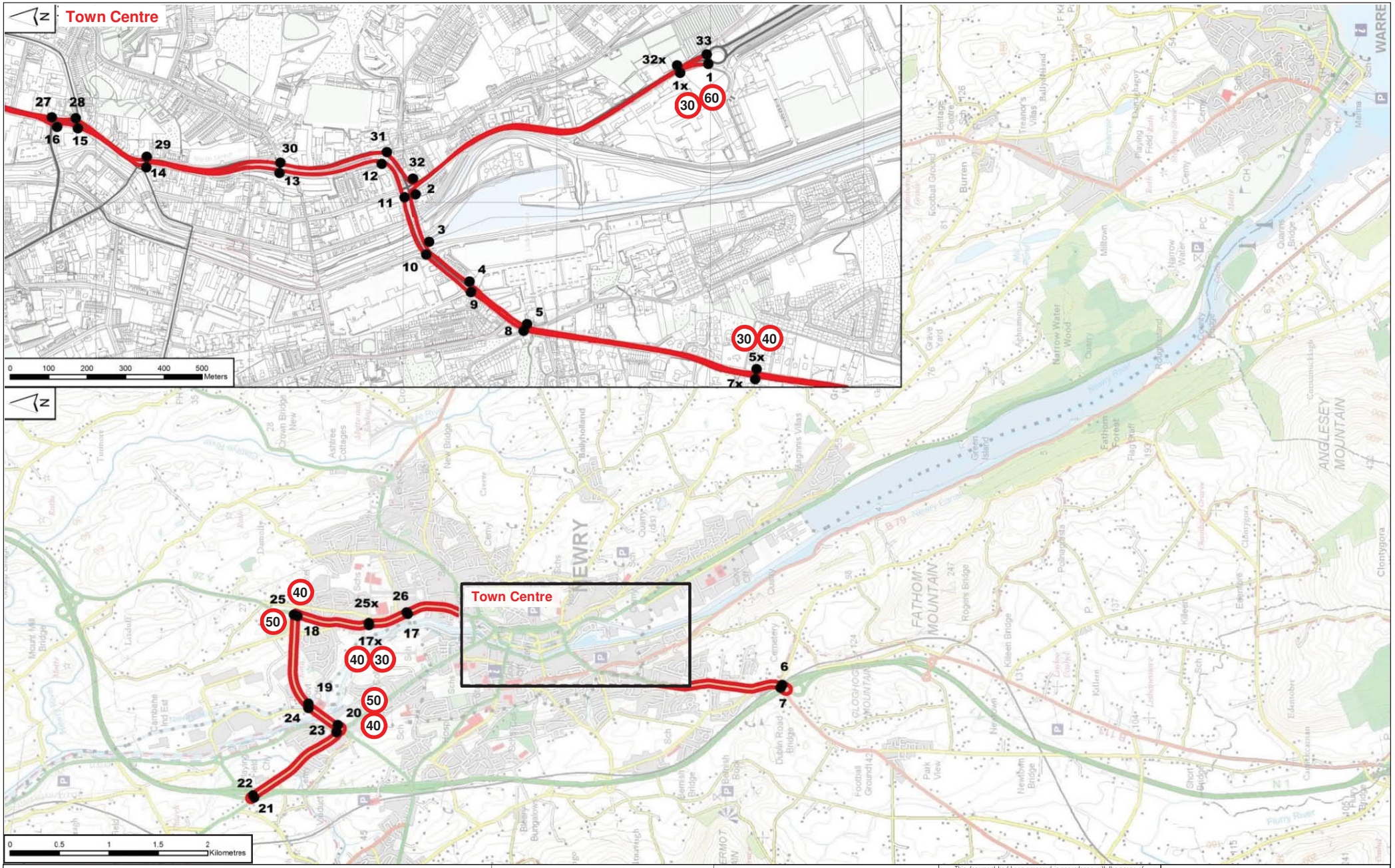

KEY

- Journey Time Survey Measurement Point
- (33) Speed Limit (mph)

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
JOURNEY TIME SURVEY LOCATION RED ROUTE

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.21

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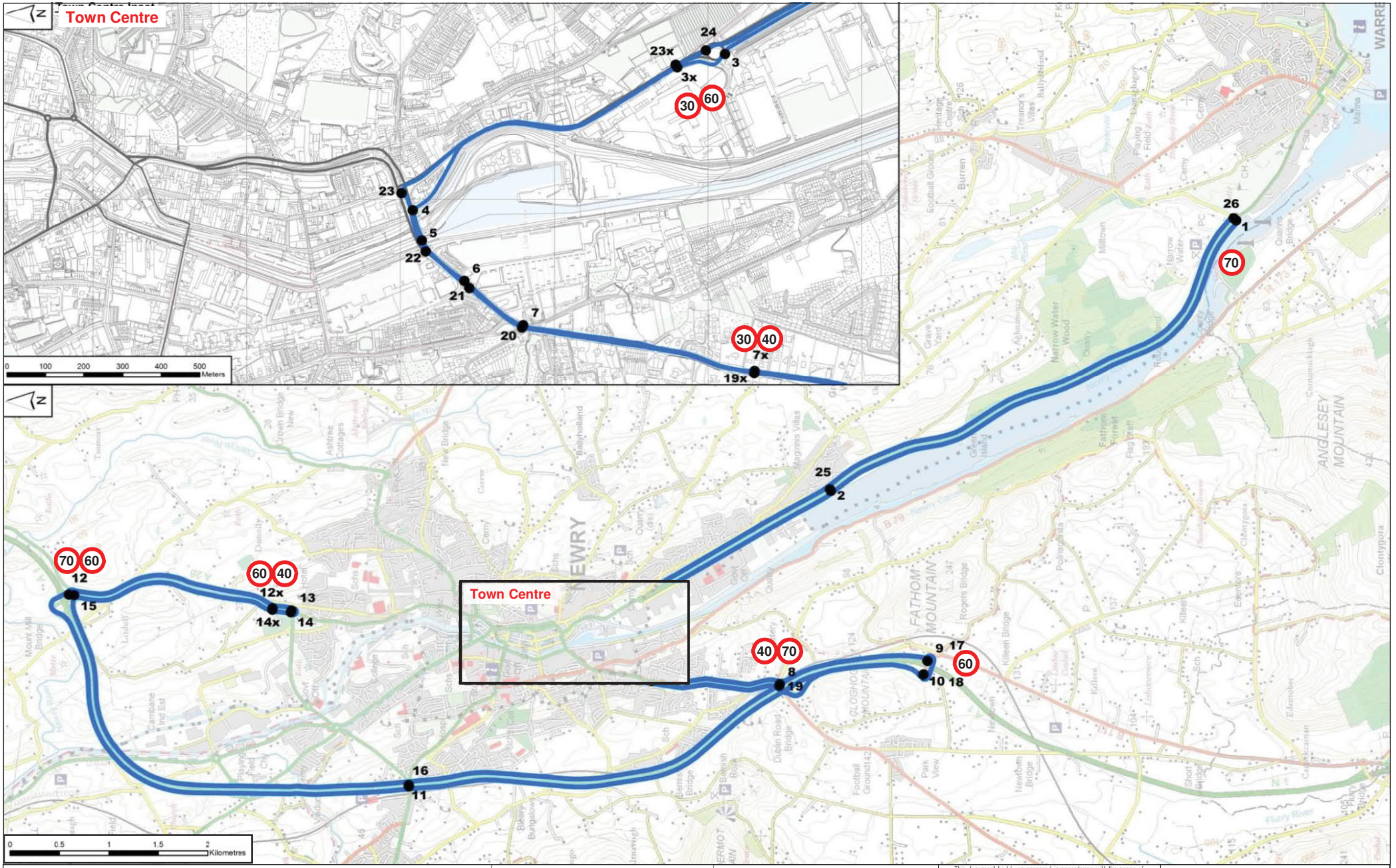

KEY

- Journey Time Survey Measurement Point
- (33) Speed Limit (mph)

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: JOURNEY TIME SURVEY LOCATION BLUE ROUTE

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.22

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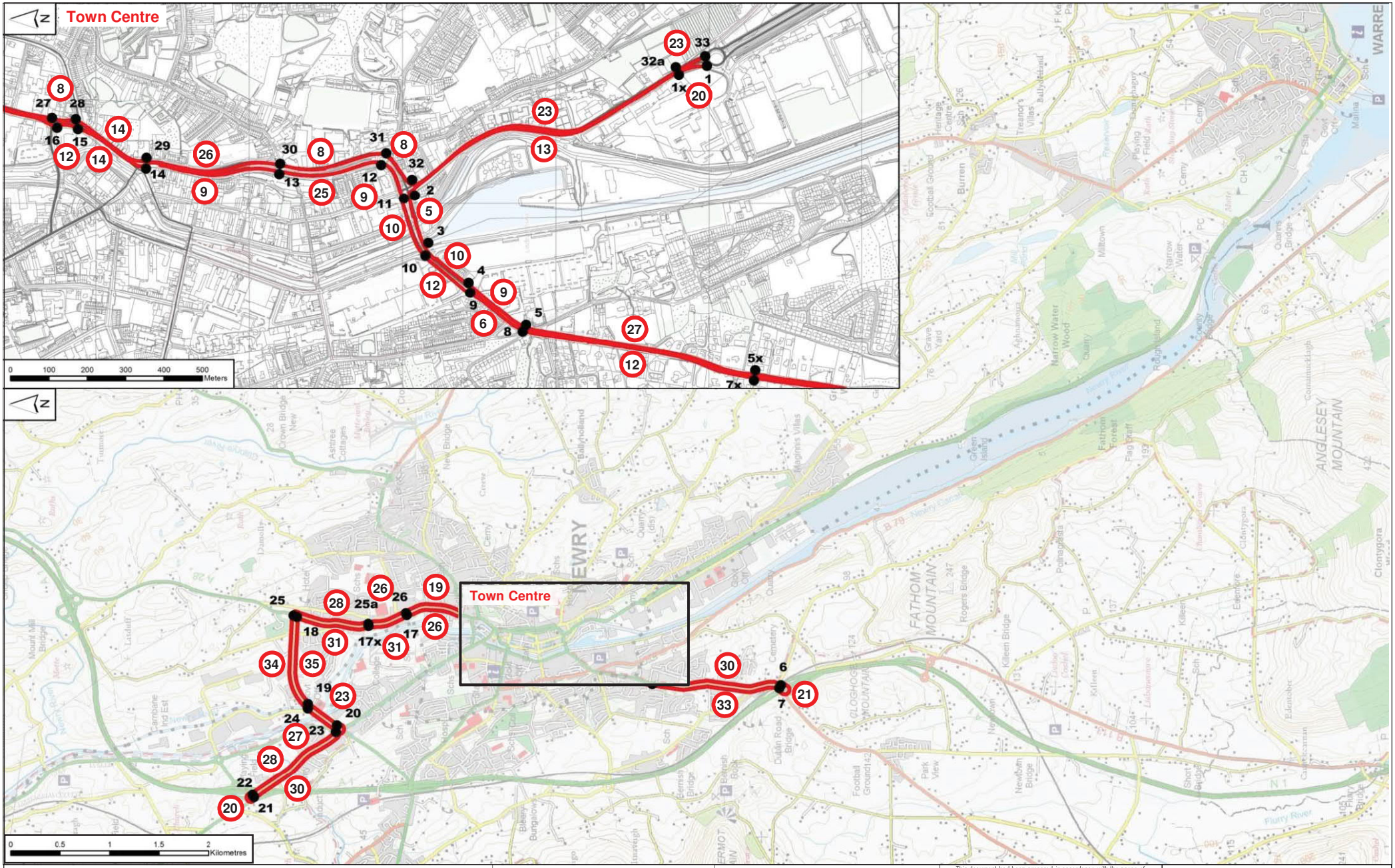

KEY

TP1 – TP33 was surveyed on Tuesday 12th May and Wednesday 13th May 2015

TP1 – TP38 was surveyed on Thursday 28th May 2015. The results of these runs are not shown here.

● Journey Time Survey Measurement Point

(33) Average 12-Hour Speed (mph)

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

JOURNEY TIME SURVEY – RED ROUTE
AVERAGE DIRECTIONAL SPEEDS
07:00 HOURS – 19:00 HOURS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.23

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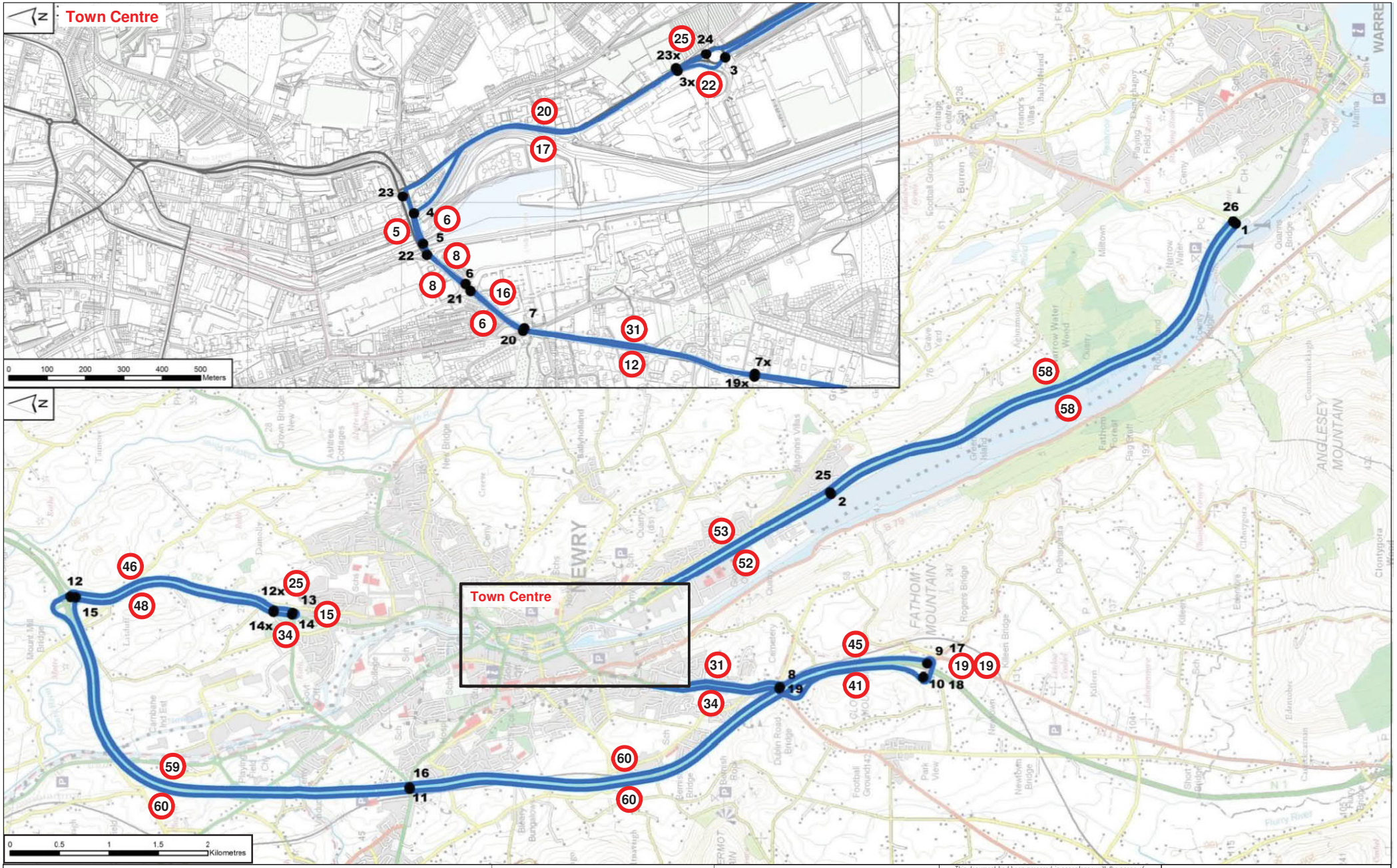

KEY

- Journey Time Survey Measurement Point
- (33) Average 12-Hour Speed (mph)

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
JOURNEY TIME SURVEY – BLUE ROUTE
AVERAGE DIRECTIONAL SPEEDS
07:00 HOURS – 19:00 HOURS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.24

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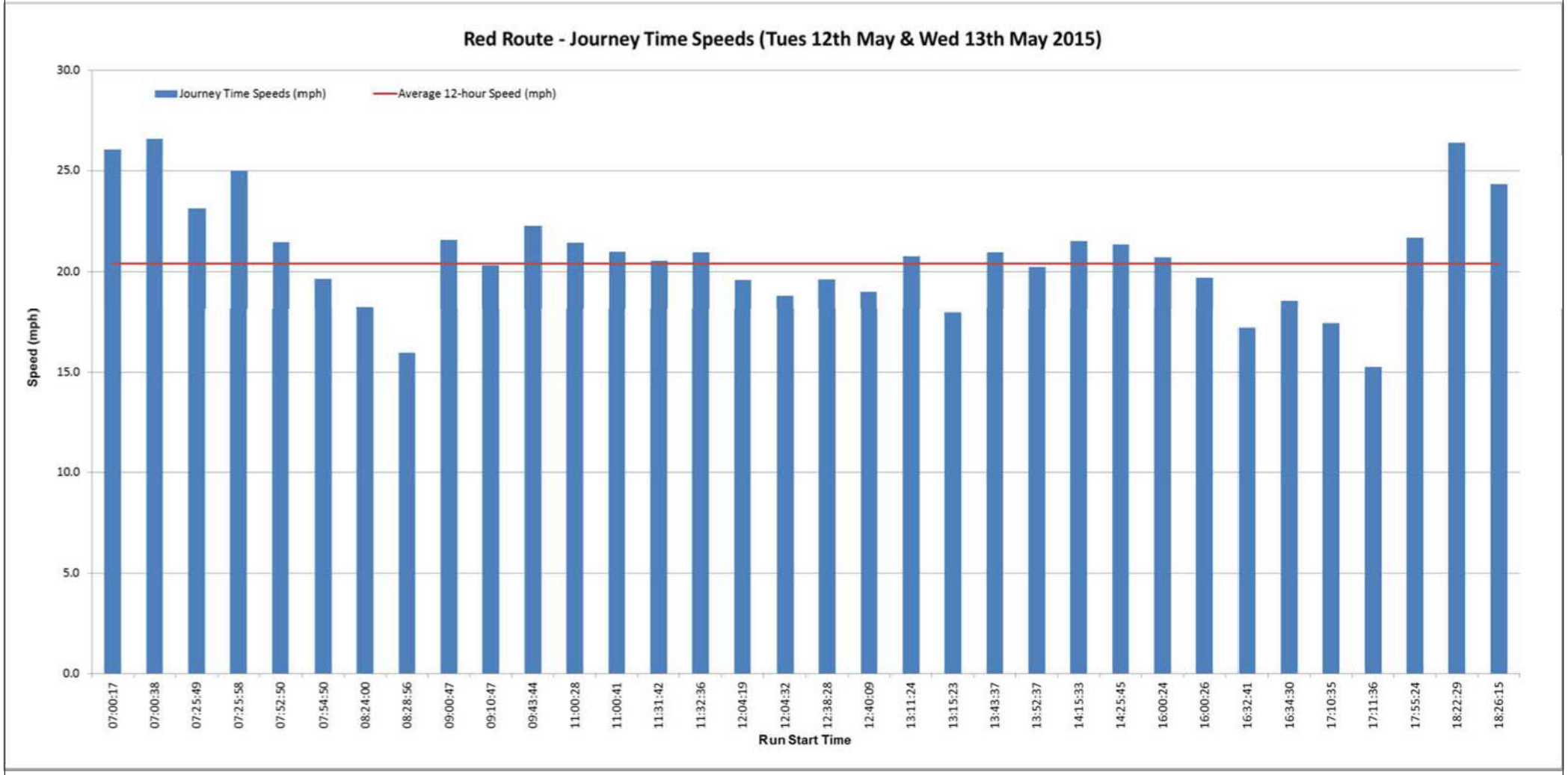

KEY

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
JOURNEY TIME SURVEY – RED ROUTE
JOURNEY TIME SPEEDS (MPH)
07:00 HOURS – 19:00 HOURS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
NTS

AECOM Internal Project Number: 60472927

Figure 8.2.25

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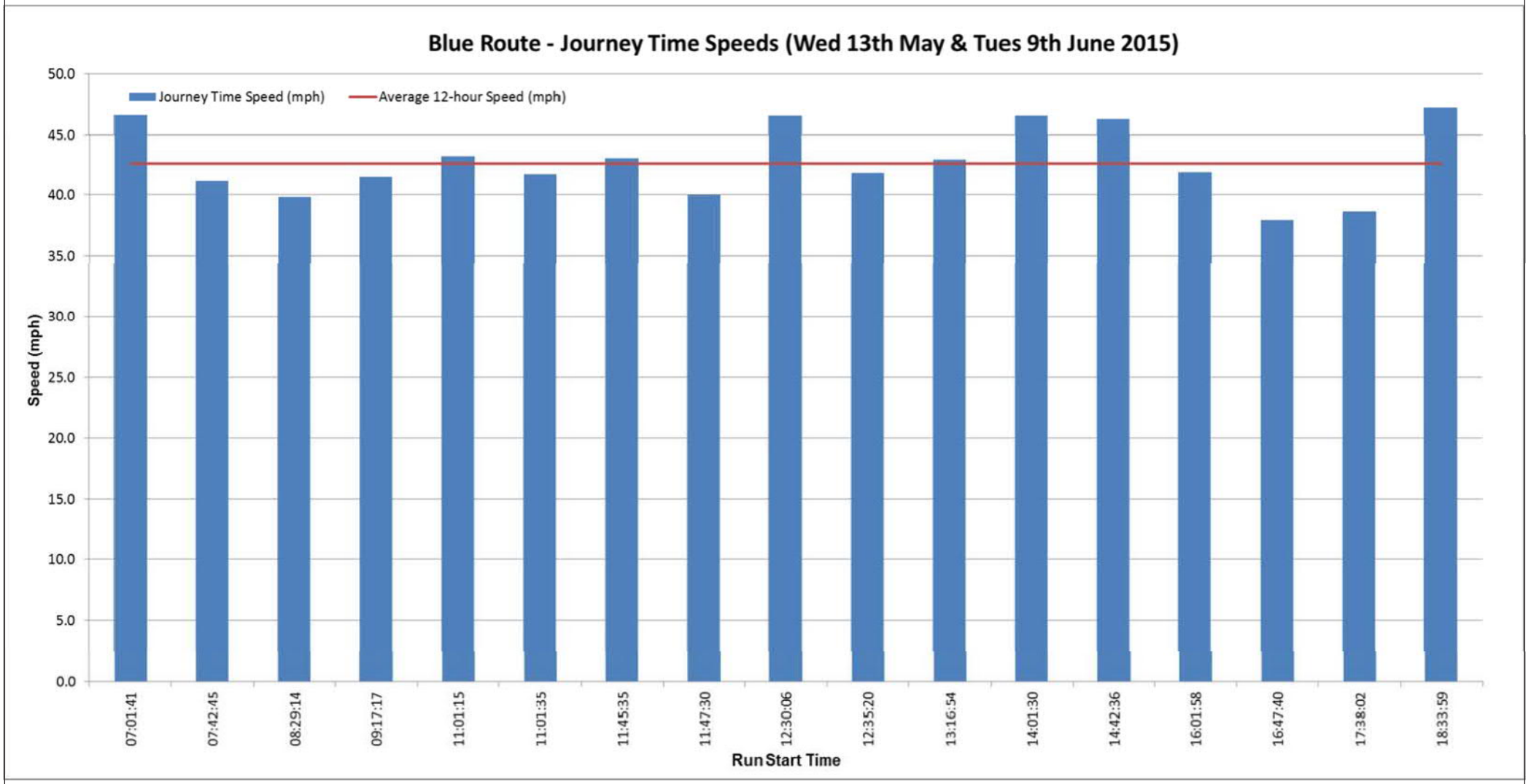

KEY

Project Title
NEWRY SOUTHERN
RELIEF ROAD

Drawing Title
JOURNEY TIME SURVEY – BLUE ROUTE
JOURNEY TIME SPEEDS (MPH)
07:00 HOURS – 19:00 HOURS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3:
NTS

AECOM Internal Project Number: 60472927

Figure 8.2.26

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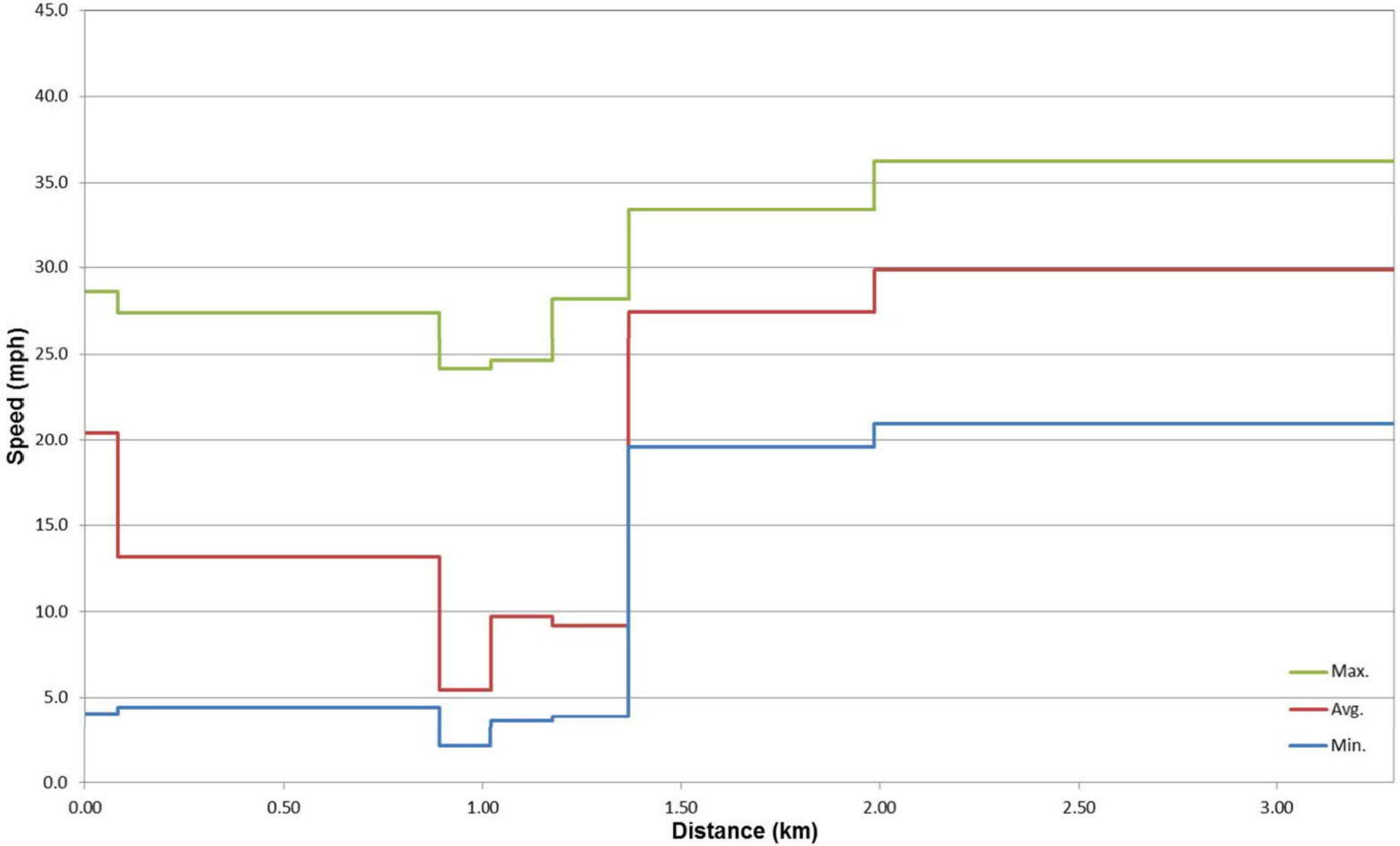
Red Route JT Speeds - Greenbank Roundabout to Cloghogue Junction



KEY

Project Title
NEWRY SOUTHERN RELIEF ROAD

Client: Department for Infrastructure | An Roinn Bonneagair

Drawing Title
JOURNEY TIME SURVEY – RED ROUTE VARIATIONS IN JOURNEY TIME SPEEDS (MPH) 07:00 HOURS – 19:00 HOURS

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.27

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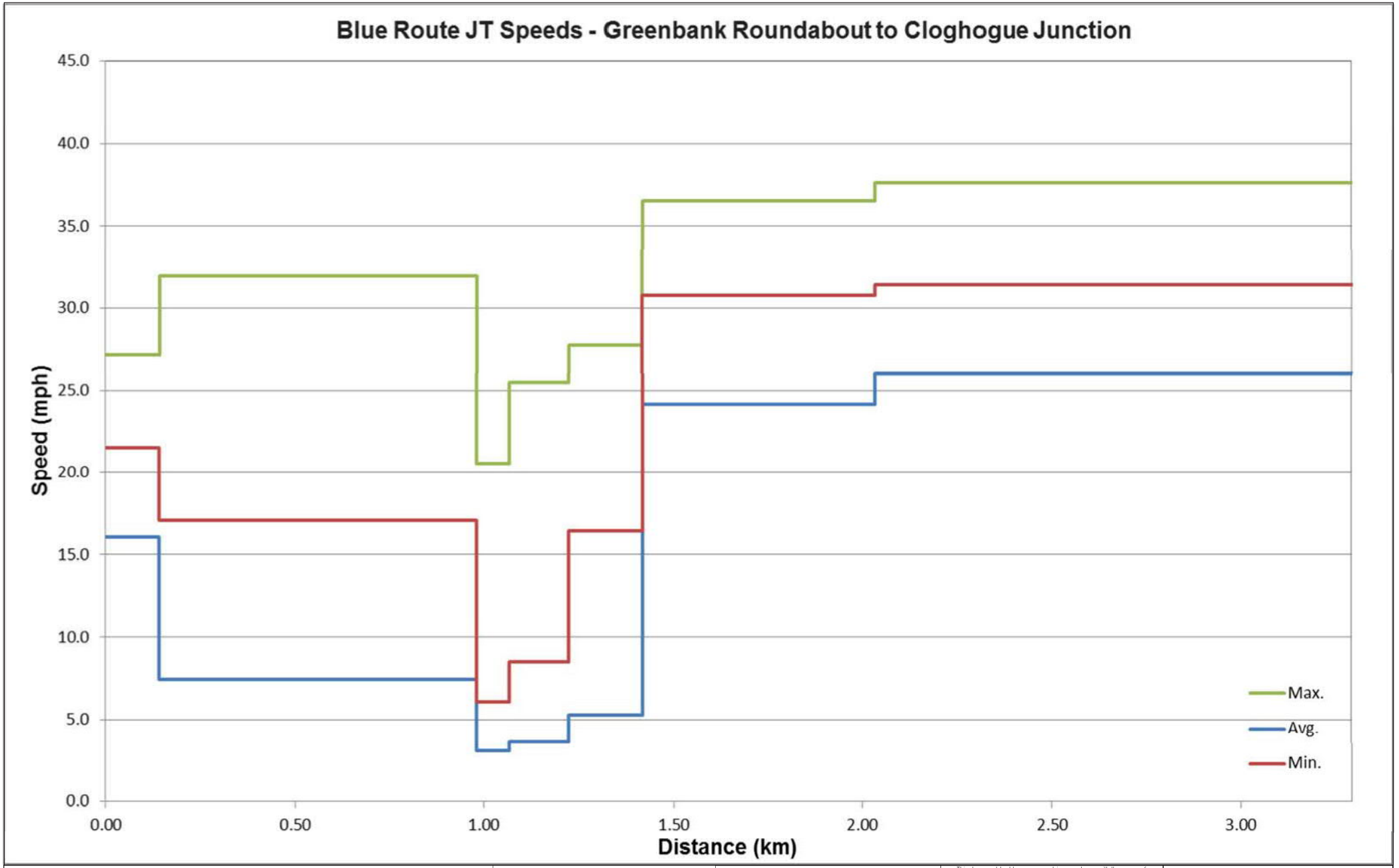

KEY

Project Title
NEWRY SOUTHERN RELIEF ROAD

Client: Department for Infrastructure | An Roinn Bonneagair

Drawing Title
JOURNEY TIME SURVEY – BLUE ROUTE
VARIATIONS IN JOURNEY TIME SPEEDS (MPH)
07:00 HOURS – 19:00 HOURS

Scale @ A3:
NTS

AECOM Internal Project Number: 60472927

Figure 8.2.28

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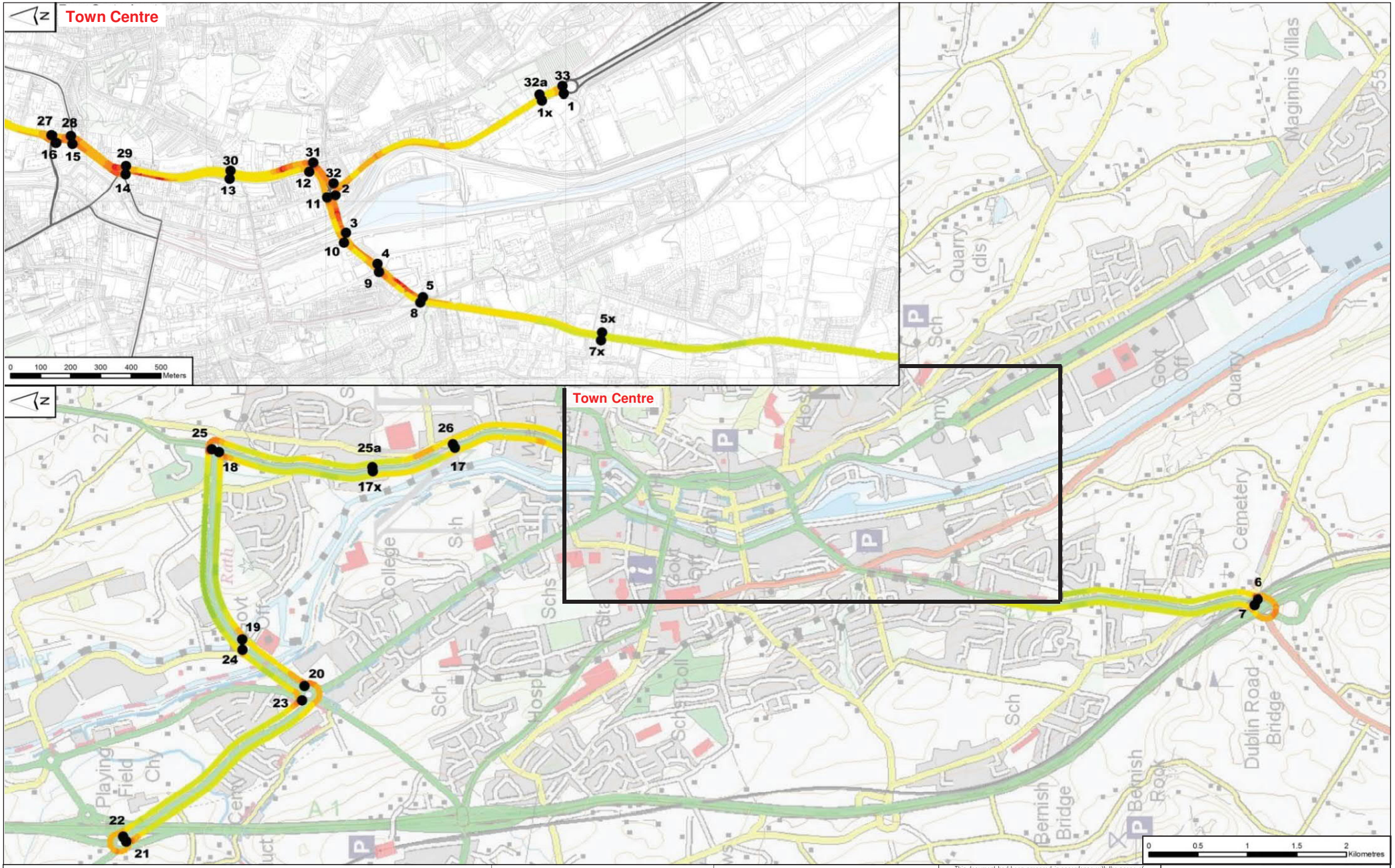

KEY

GPS Data has a time interval of approximately 1 second.

● Journey Time Survey Measurement Point

GPS Speeds (kph)

0 -10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
70 - 80	80 -90	90 -100	100 - 120			

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: JOURNEY TIME SURVEY – RED ROUTE TYPICAL AM PEAK RUN (07:52:50 – 08:23:46)

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.29

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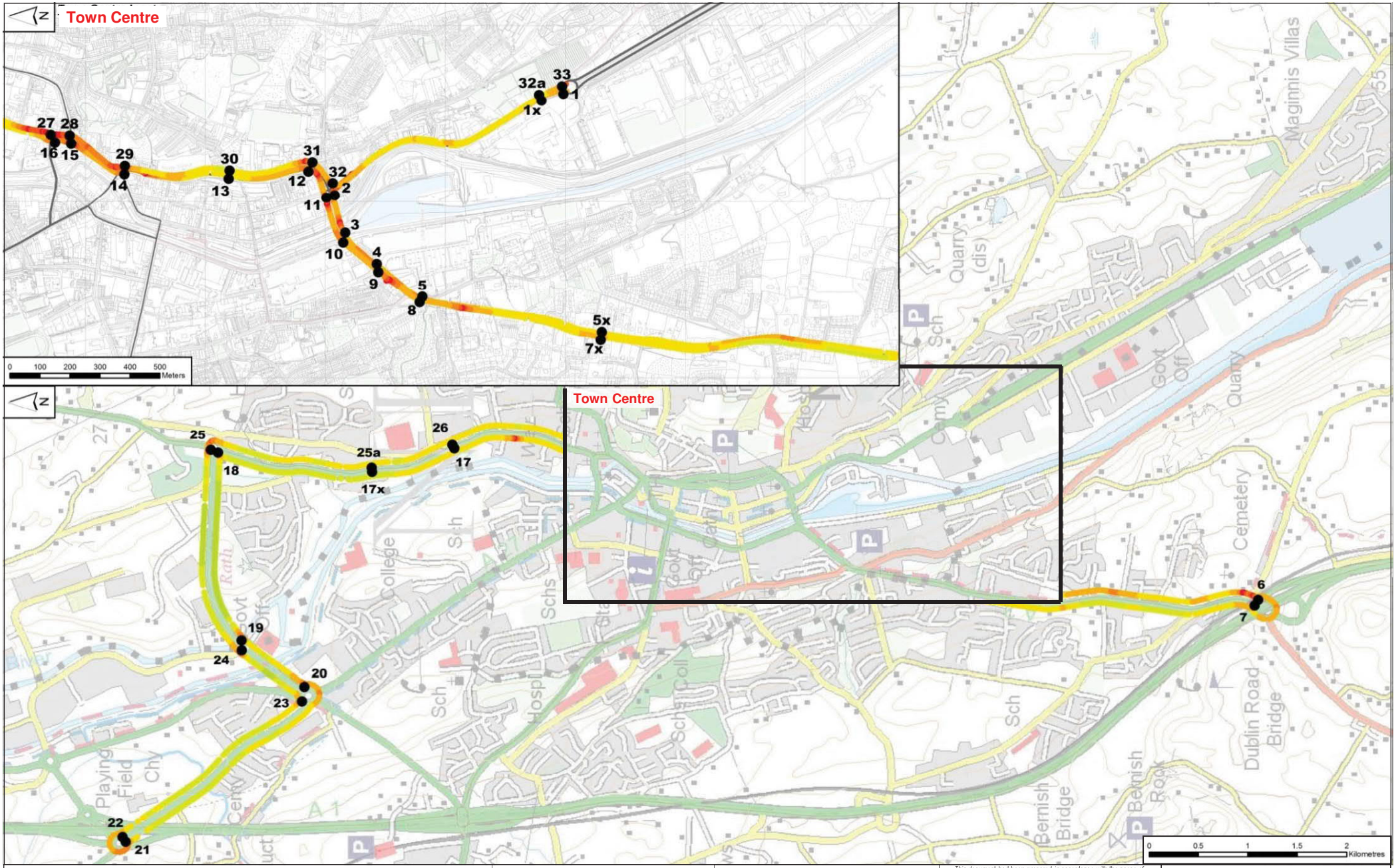

KEY

GPS Data has a time interval of approximately 1 second.

● Journey Time Survey Measurement Point

GPS Speeds (kph)

0 -10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
70 - 80	80 -90	90 -100	100 - 120			

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: JOURNEY TIME SURVEY – RED ROUTE TYPICAL INTERPEAK RUN (13:52:37 – 14:25:27)

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.30

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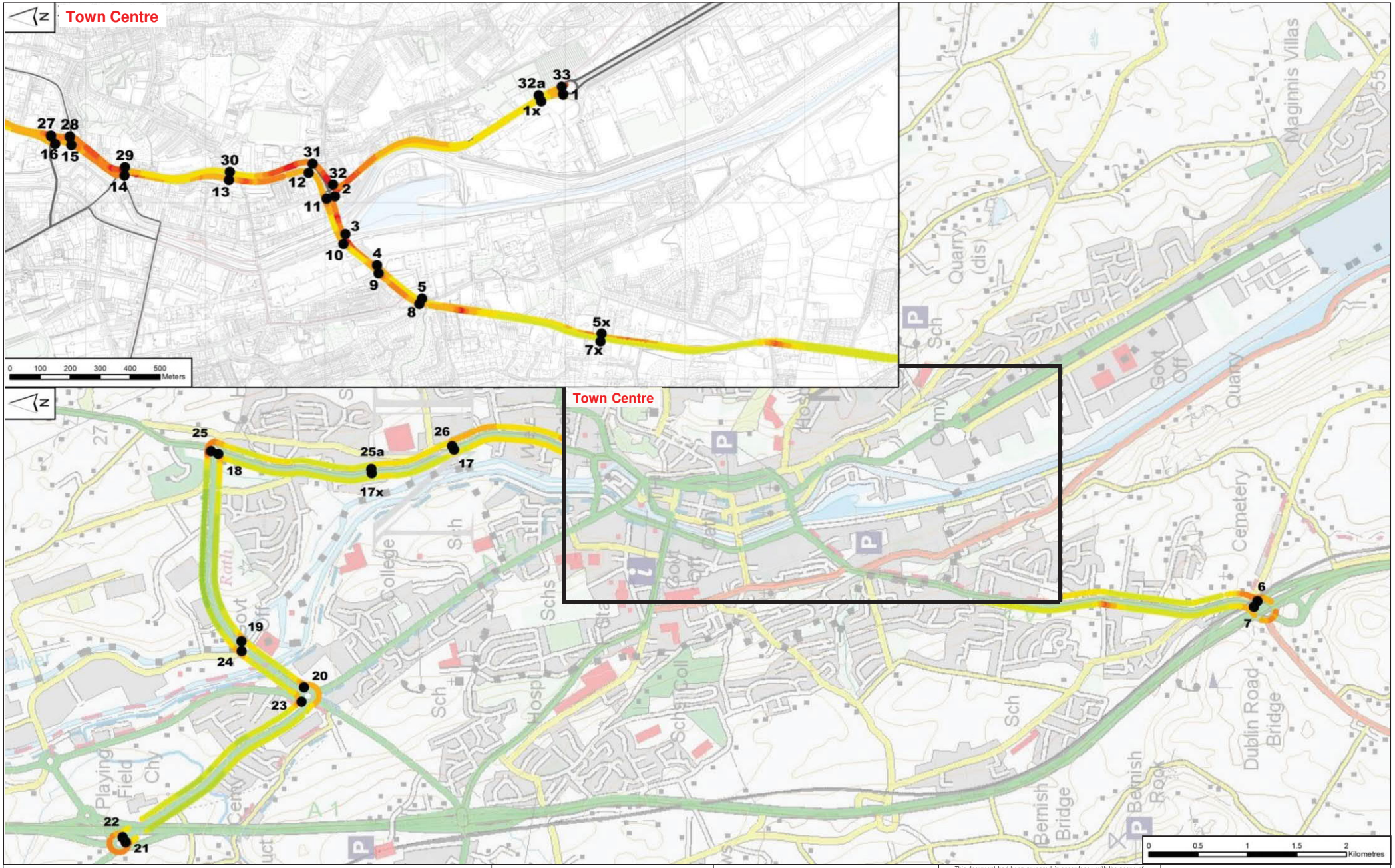

KEY

GPS Data has a time interval of approximately 1 second.

● Journey Time Survey Measurement Point

GPS Speeds (kph)

● 0 -10 ● 10 - 20 ● 20 - 30 ● 30 - 40 ● 40 - 50 ● 50 - 60 ● 60 - 70 ● 70 - 80 ● 80 -90 ● 90 -100 ● 100 - 120

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: JOURNEY TIME SURVEY – RED ROUTE TYPICAL PM PEAK RUN (16:00:26 – 16:34:11)

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.31

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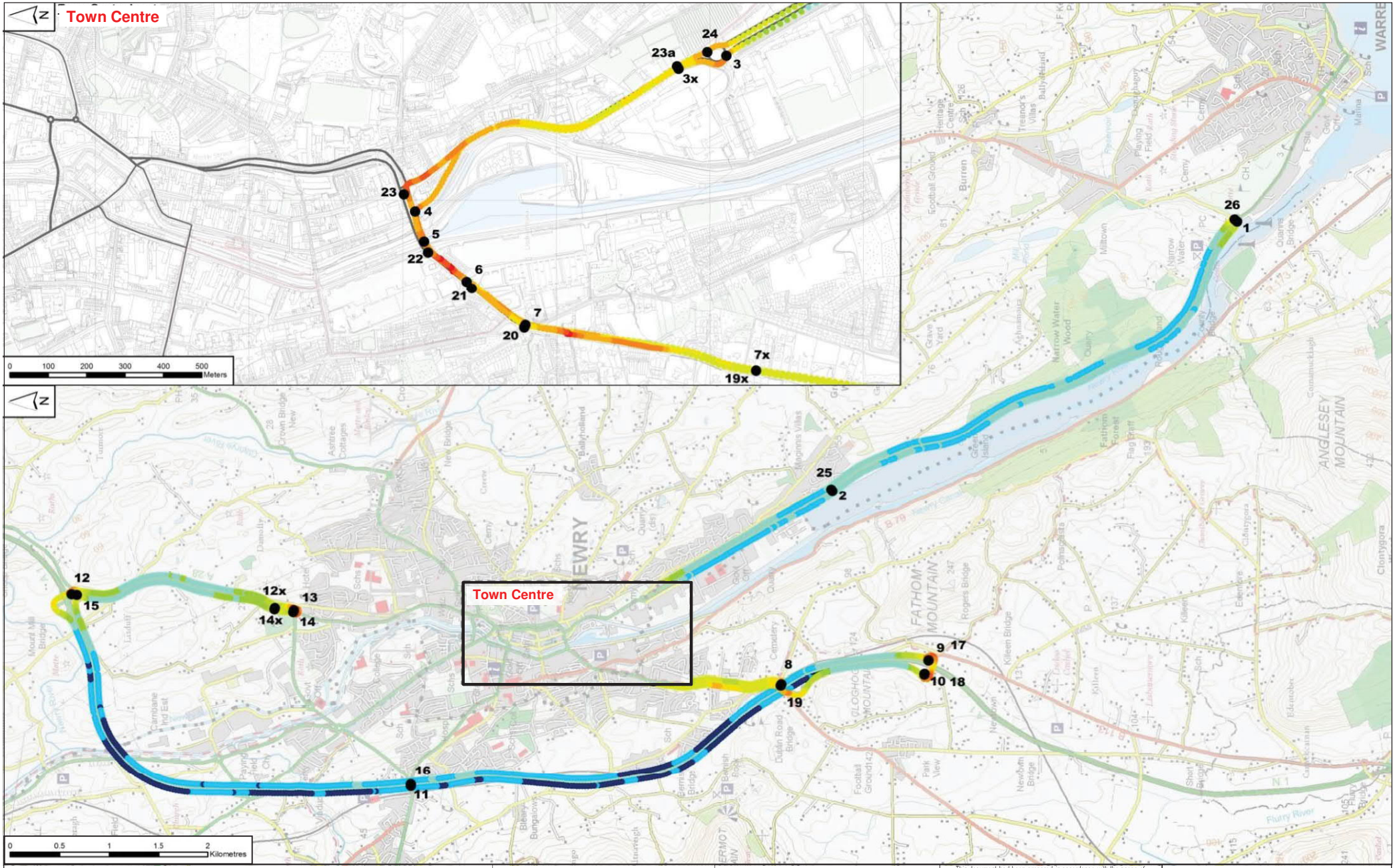

KEY

GPS Data has a time interval of approximately 1 second.

● Journey Time Survey Measurement Point

GPS Speeds (kph)

0 -10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60 - 70 | 70 - 80 | 80 -90 | 90 -100 | 100 - 120

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

JOURNEY TIME SURVEY – BLUE ROUTE
TYPICAL AM PEAK RUN (09:17:17 – 10:03:10)

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.32

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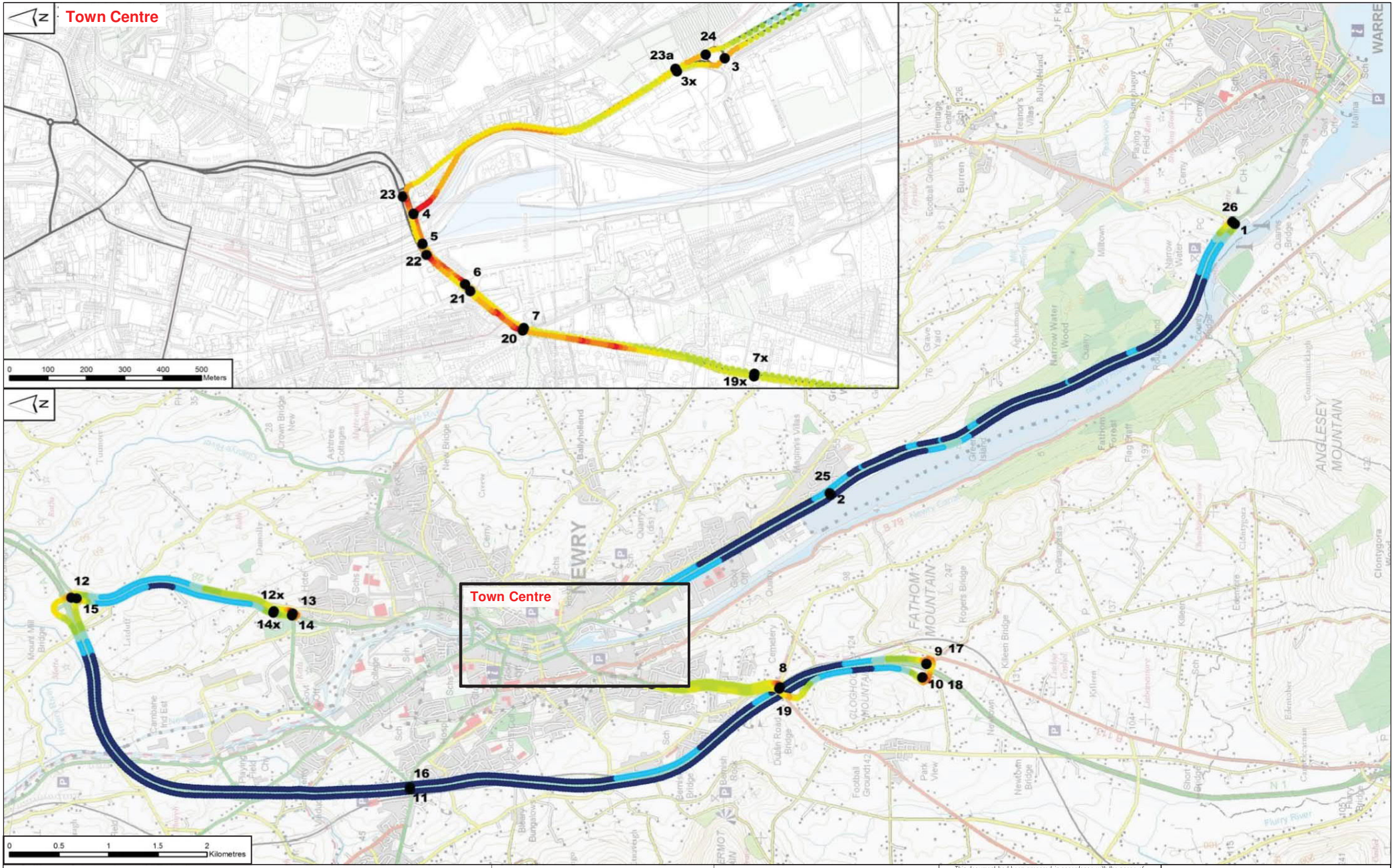

KEY

GPS Data has a time interval of approximately 1 second.

● Journey Time Survey Measurement Point

GPS Speeds (kph)

0 -10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60 - 70 | 70 - 80 | 80 -90 | 90 -100 | 100 - 120

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: JOURNEY TIME SURVEY – BLUE ROUTE TYPICAL INTERPEAK RUN (13:16:54 – 14:01:14)

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.33

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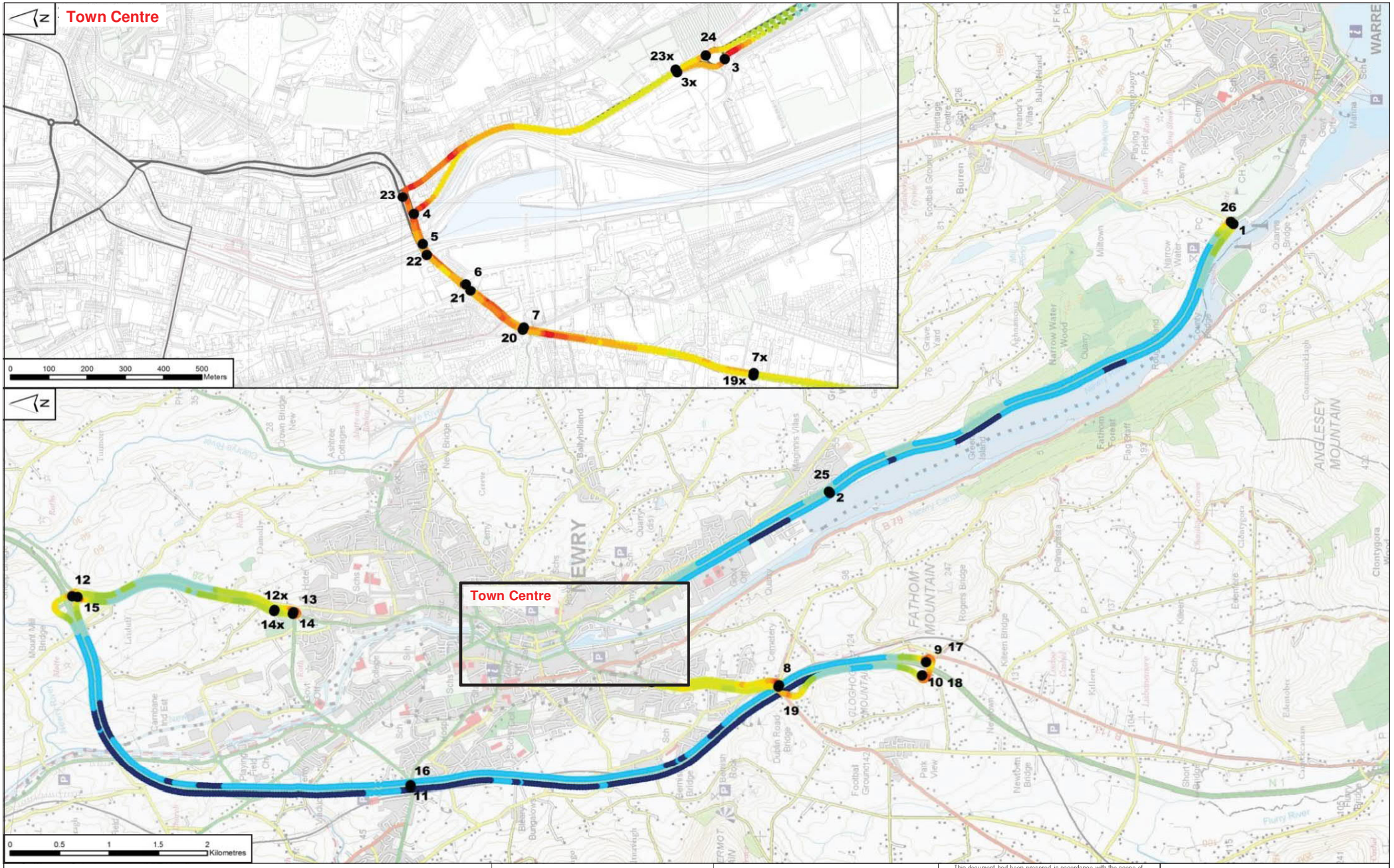

KEY

GPS Data has a time interval of approximately 1 second.

● Journey Time Survey Measurement Point

GPS Speeds (kph)

● 0 -10 ● 10 - 20 ● 20 - 30 ● 30 - 40 ● 40 - 50 ● 50 - 60 ● 60 - 70 ● 70 - 80 ● 80 -90 ● 90 -100 ● 100 - 120

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

JOURNEY TIME SURVEY – BLUE ROUTE
TYPICAL PM PEAK RUN (16:01:58 – 16:47:26)

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.2.34

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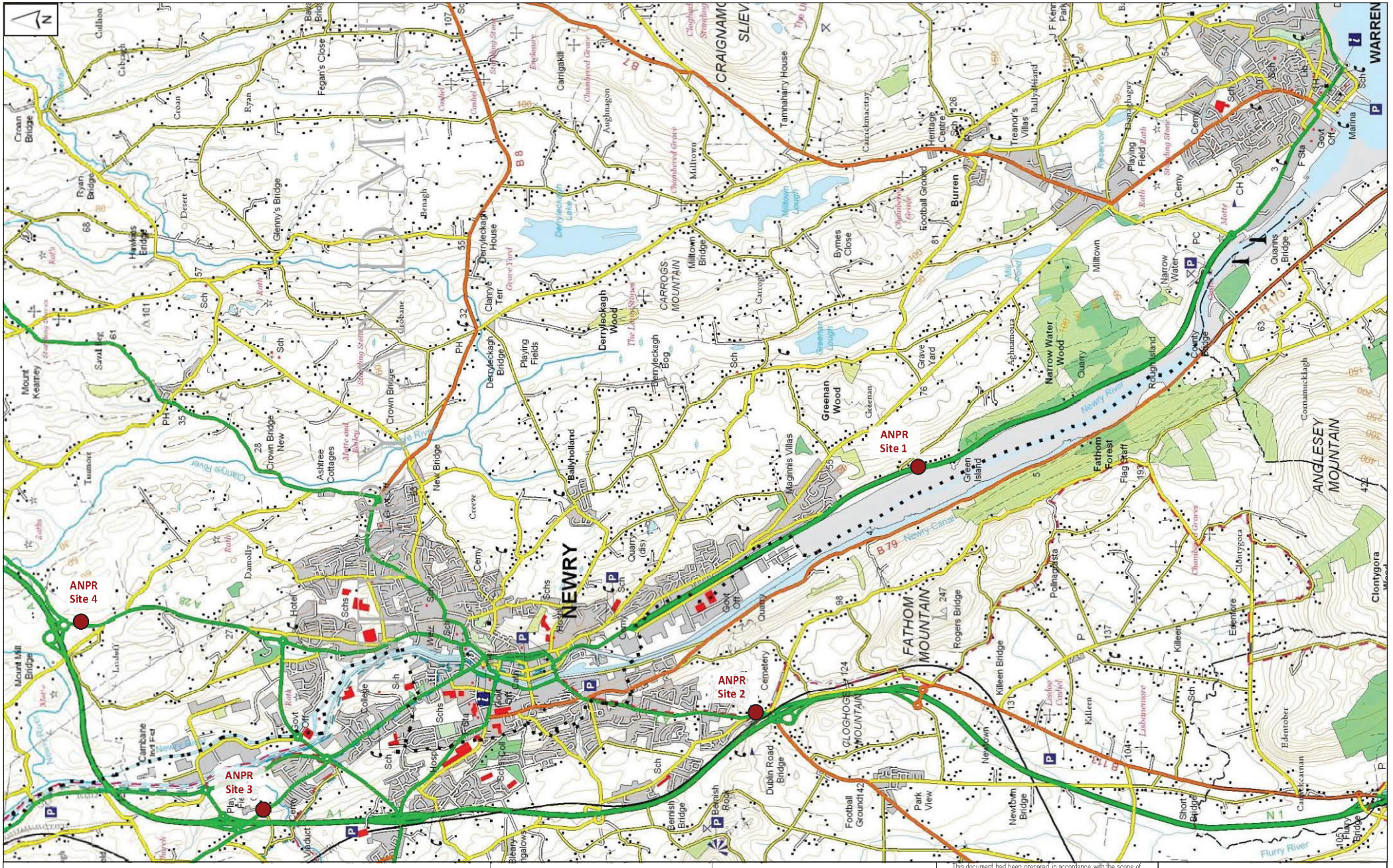

KEY

- Automatic Number Plate Recognition Survey Location

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: AUTOMATIC NUMBER PLATE RECOGNITION SURVEY LOCATIONS		
Client: Department for Infrastructure / An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.35

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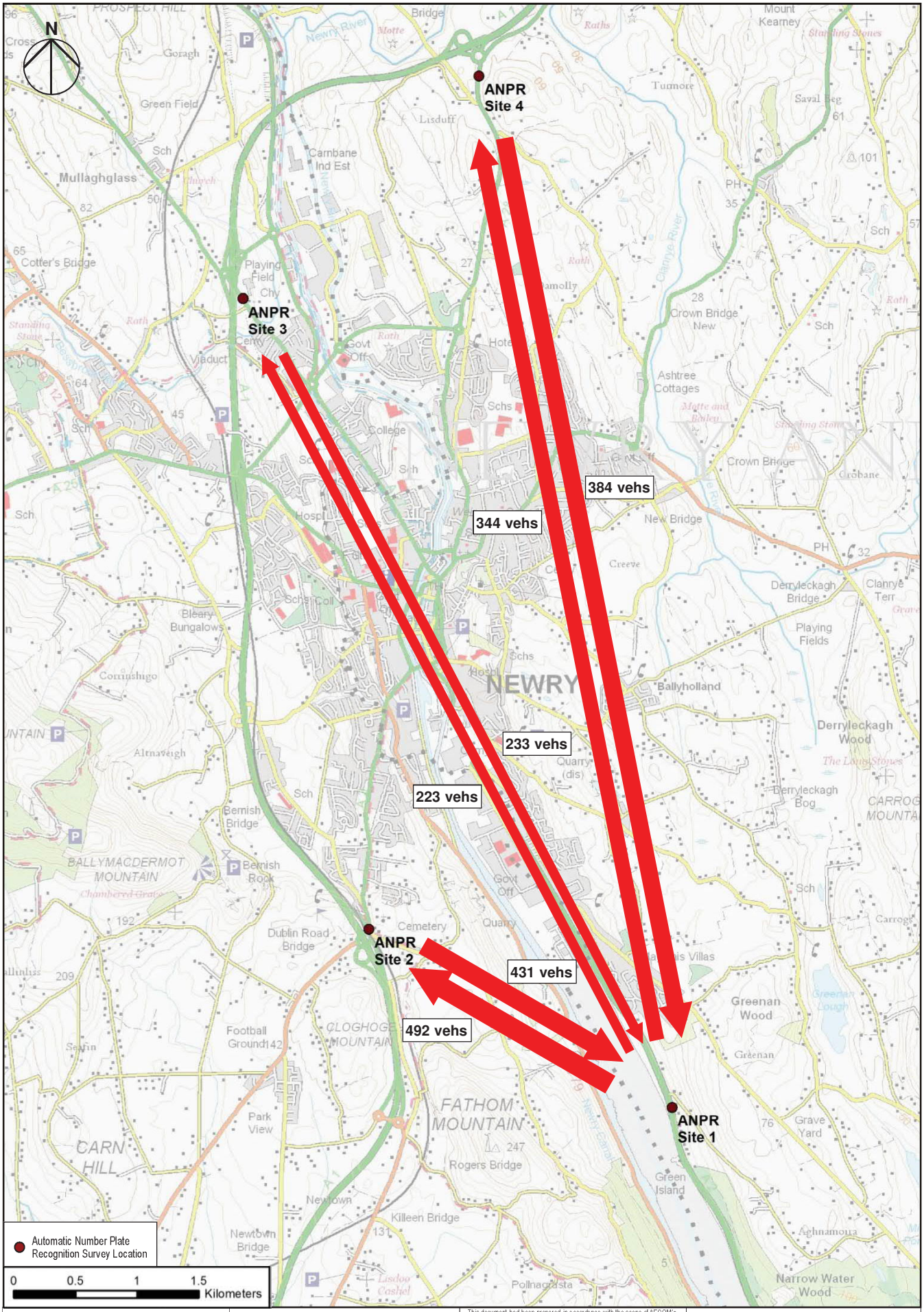
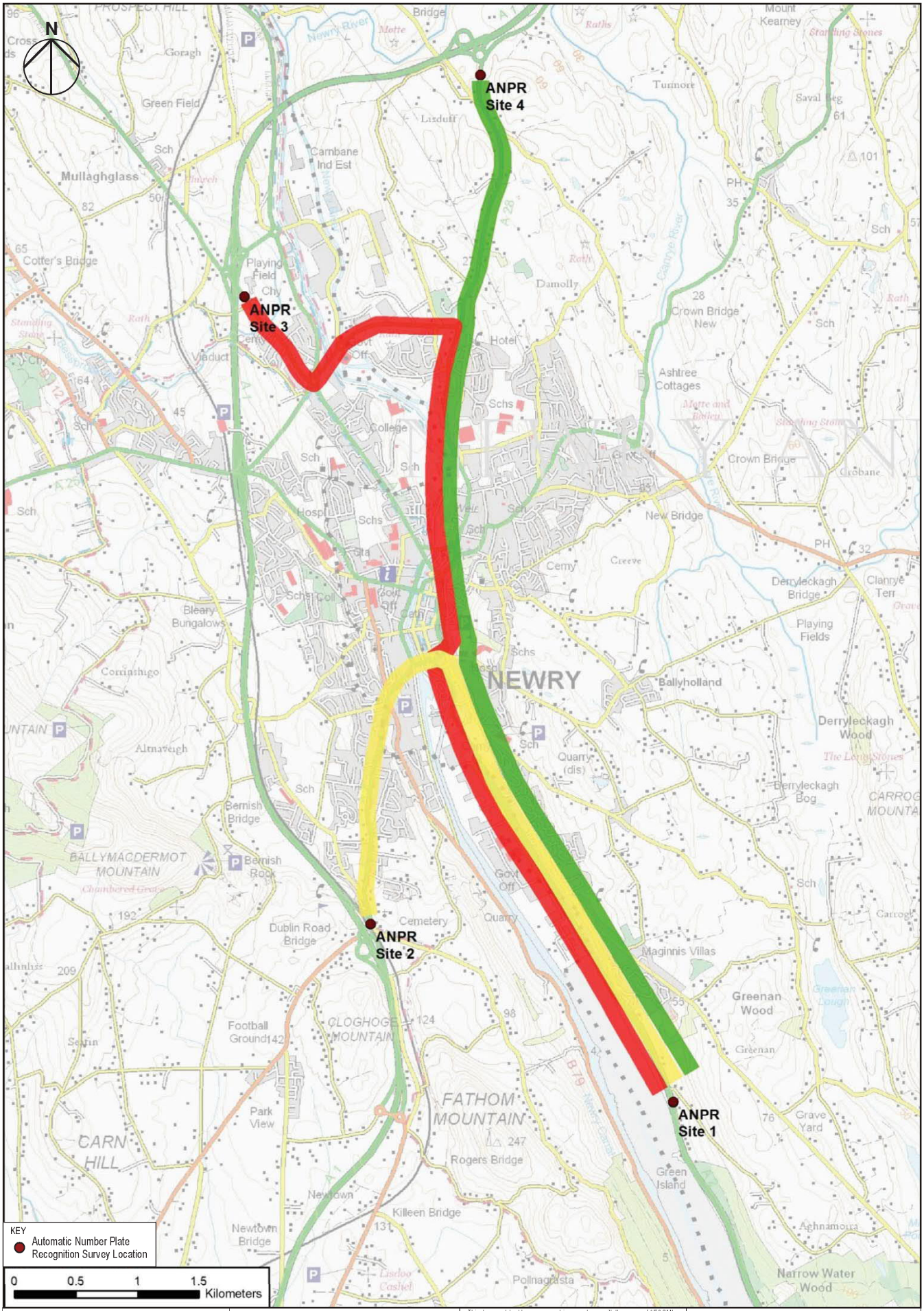
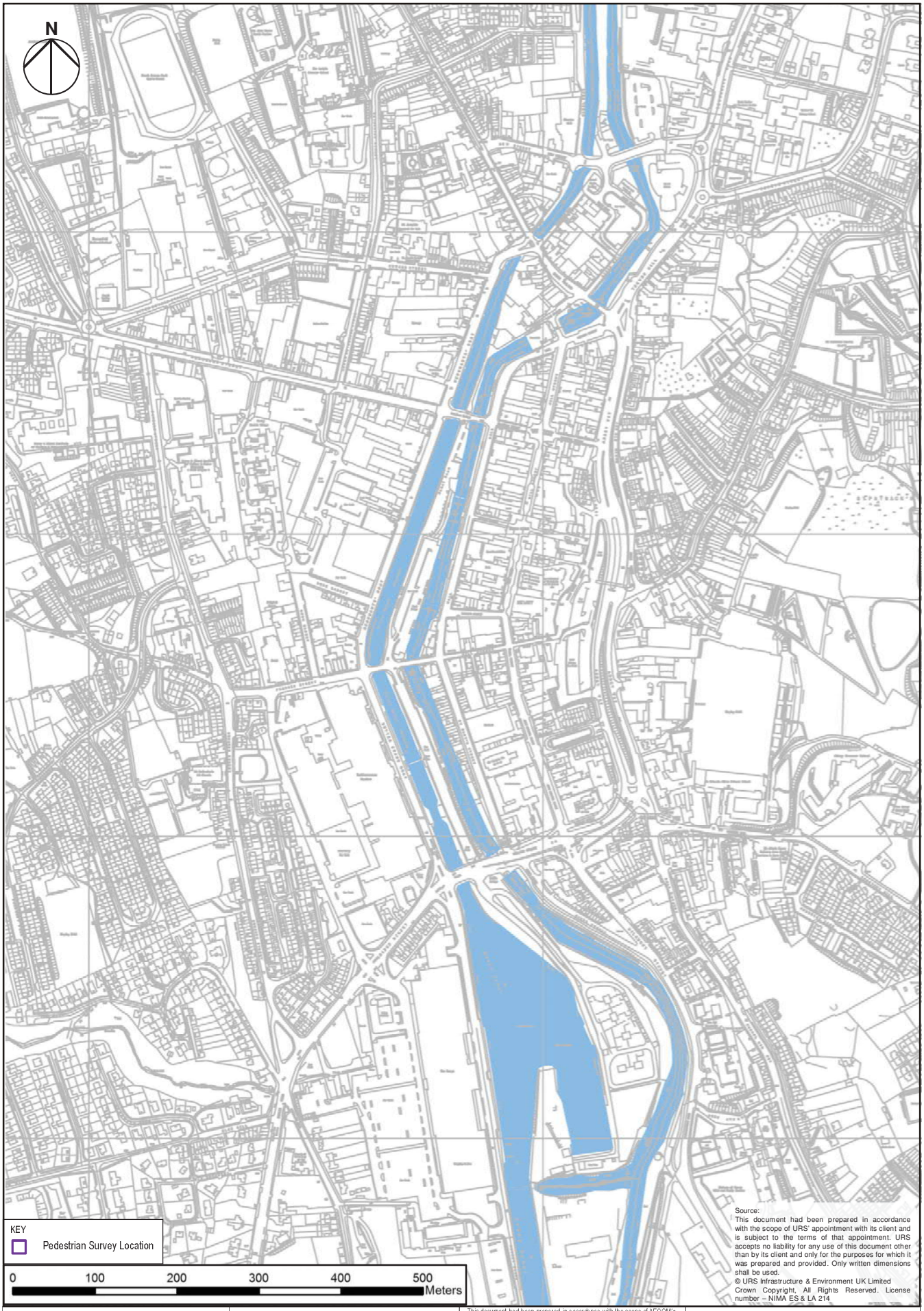


Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: ANPR TRIP PATTERNS (07:00 – 19:00) (DURATION LESS THAN 20 MINUTES)		AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
Client: Department for Infrastructure / An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.36	



Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: ANPR KEY ROUTES		AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com	
Client: Department for Infrastructure / An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.37	



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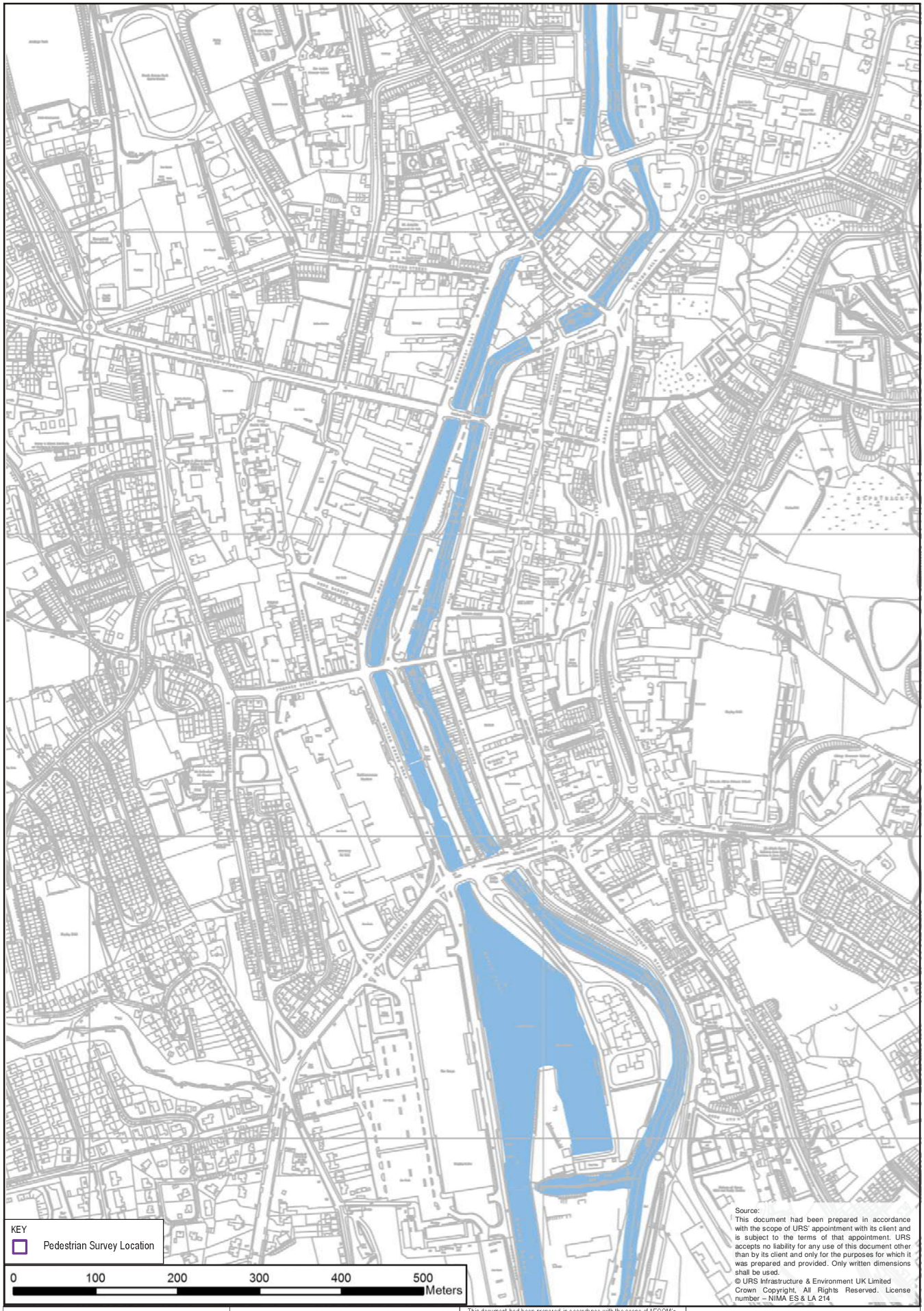

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Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.2.39	

KEY

- Corridor 1
- Corridor 2
- Corridor 3
- Corridor 4 – Option A & Option B
- Corridor 5
- Indicative Alignment Option
- Study Area

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
PROPOSED IMPROVEMENT CORRIDORS AND INDICATIVE ALIGNMENT OPTIONS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.3.1

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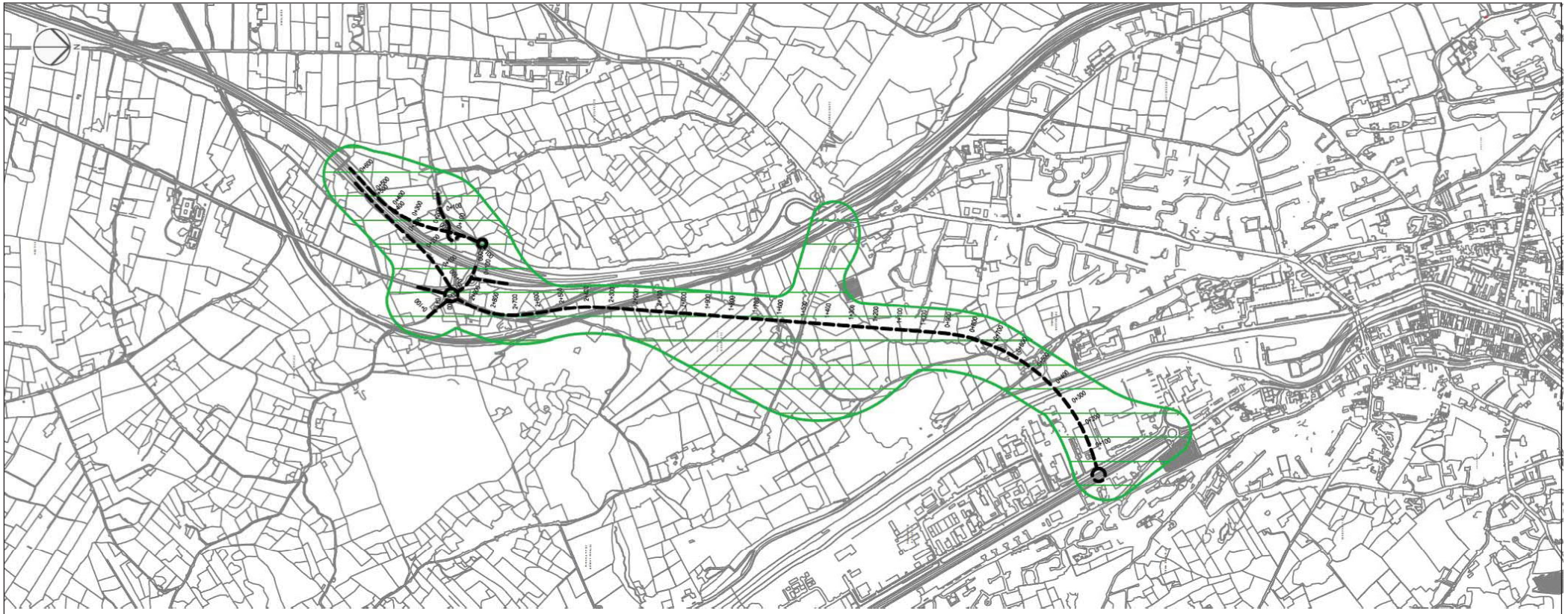

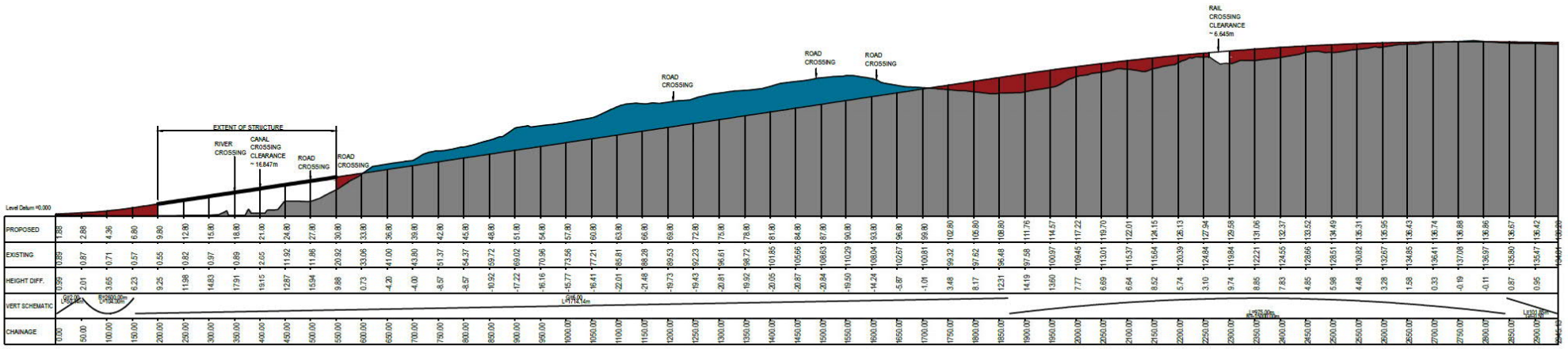

Warrenpoint Road to Ellisholding

KEY

- Corridor 1
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: PROPOSED IMPROVEMENT CORRIDOR AND INDICATIVE ALIGNMENT OPTION CORRIDOR 1

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.3.2

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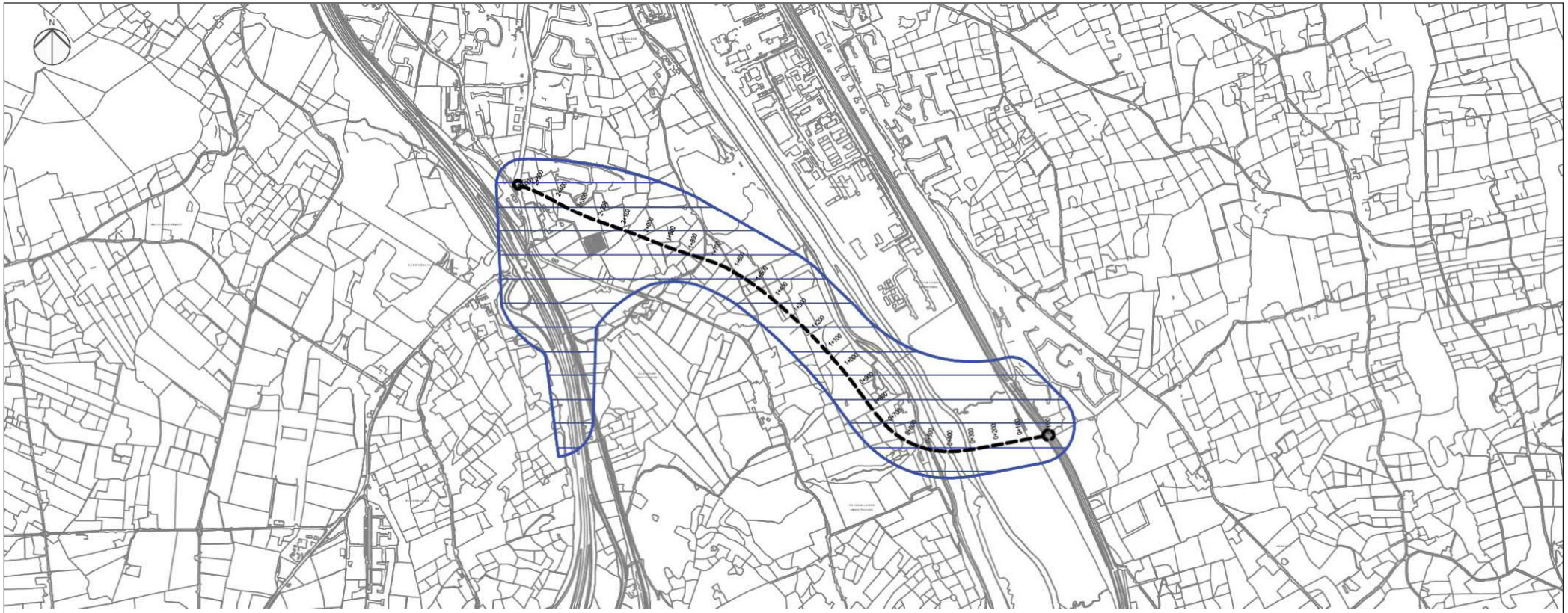

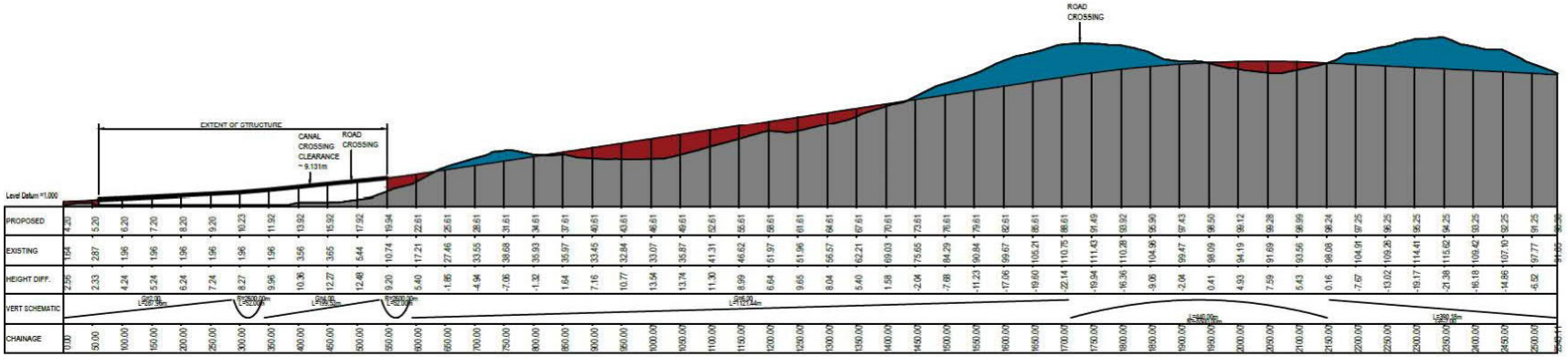

Warrenpoint Road to Dublin Road/Chancellors Road Junction

KEY

- Corridor 2
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: PROPOSED IMPROVEMENT CORRIDOR AND INDICATIVE ALIGNMENT OPTION CORRIDOR 2

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.3.3

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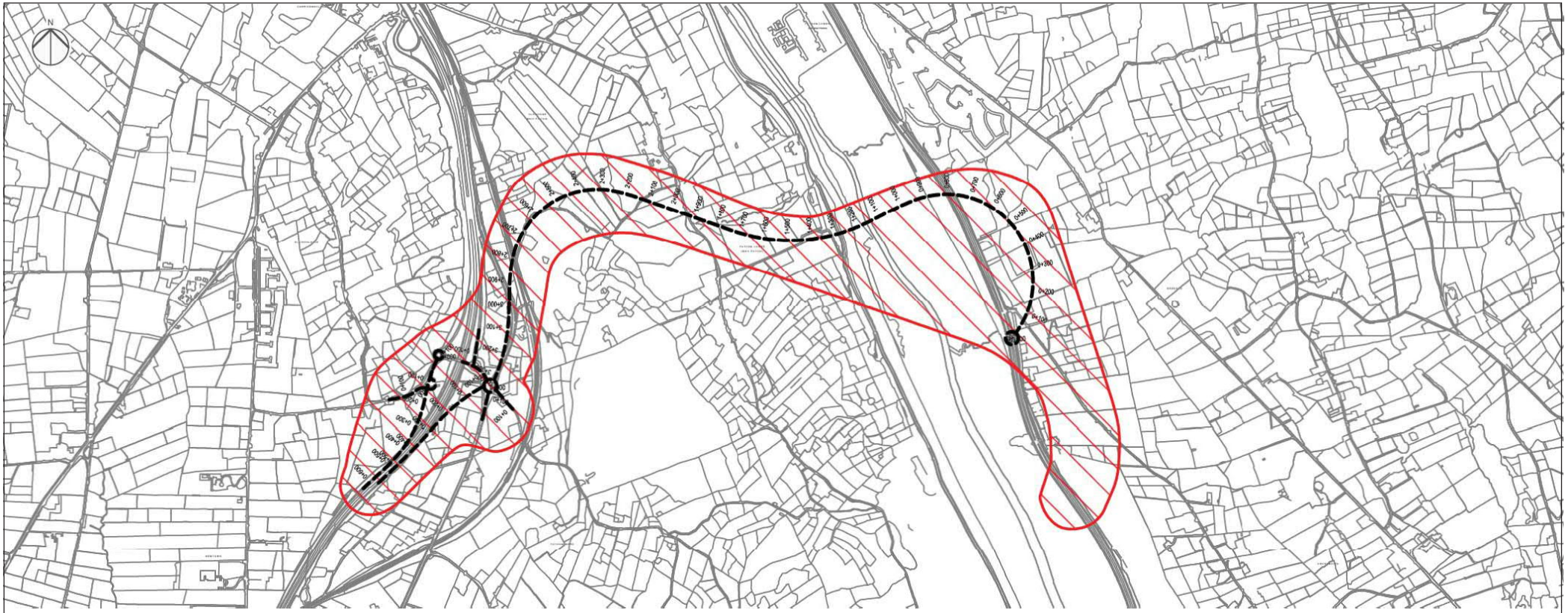

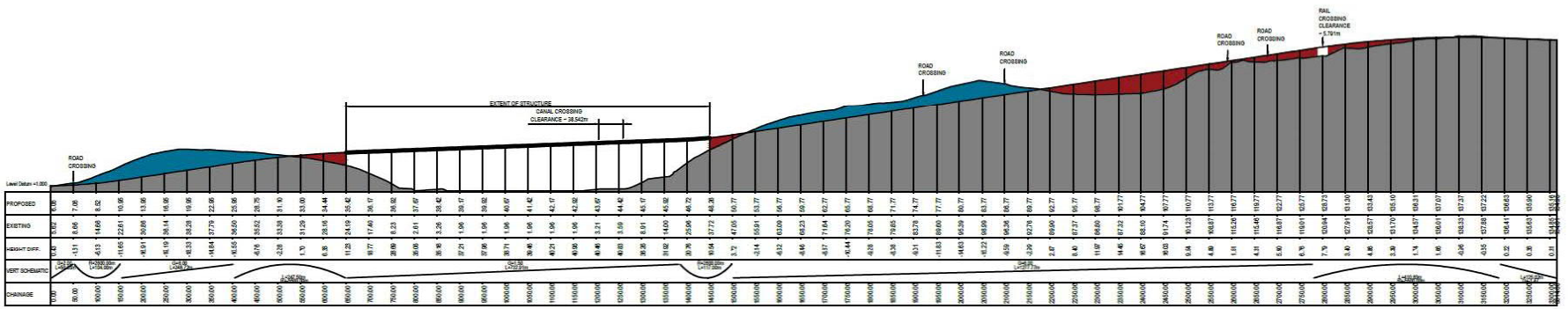

A2 Warrenpoint Road to Ellisholding

KEY

- Corridor 3
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

PROPOSED IMPROVEMENT CORRIDOR AND INDICATIVE ALIGNMENT OPTION CORRIDOR 3

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.3.4

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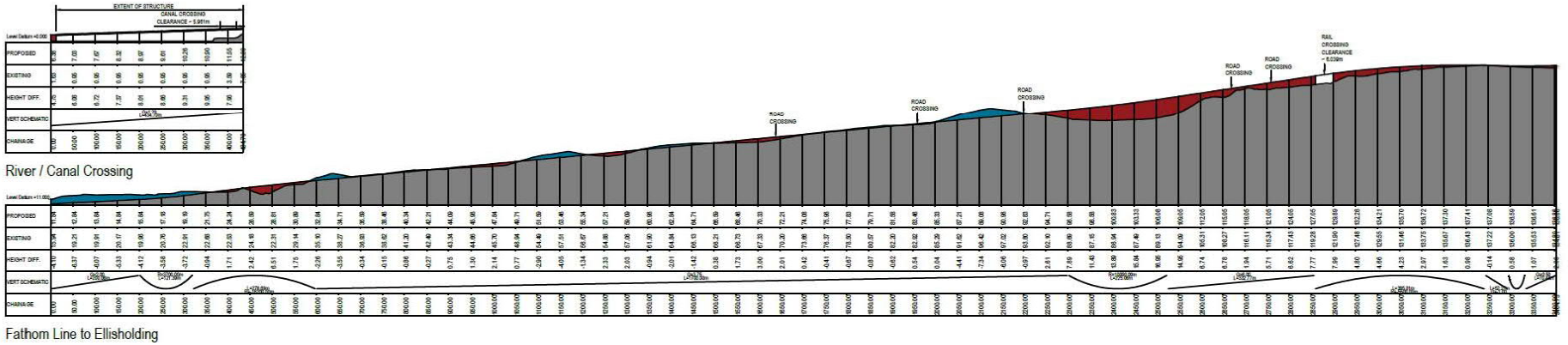

River / Canal Crossing

Fathom Line to Ellisholding

KEY

- Corridor 4 – Option A
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

PROPOSED IMPROVEMENT CORRIDOR AND INDICATIVE ALIGNMENT OPTION CORRIDOR 4 – OPTION A

Client: Department for Infrastructure | An Roinn Bonneagair

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AECOM Internal Project Number: 60472927

Figure 8.3.5

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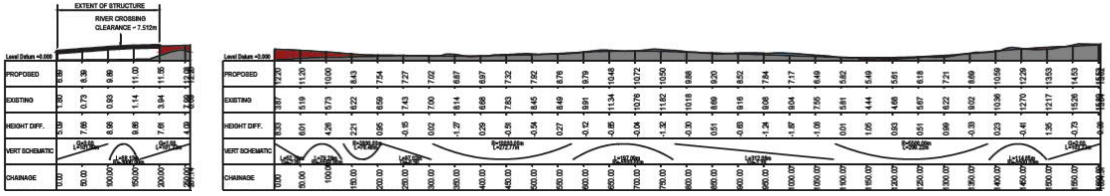
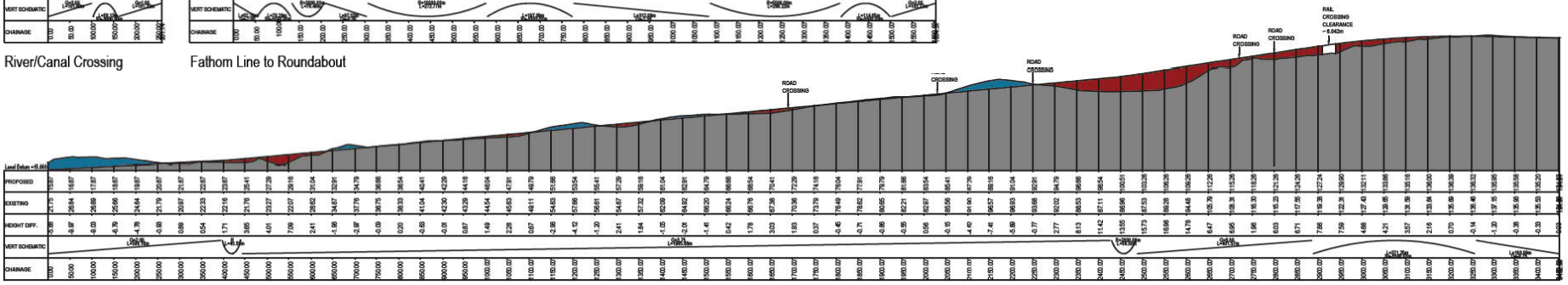


River/Canal Crossing

Fathom Line to Roundabout



Roundabout to Ellisholding

KEY

- Corridor 4 – Option B
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: PROPOSED IMPROVEMENT CORRIDOR AND INDICATIVE ALIGNMENT OPTION CORRIDOR 4 – OPTION B

Client: Department for Infrastructure | An Roinn Bonneagair

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AECOM Internal Project Number: 60472927

Figure 8.3.6

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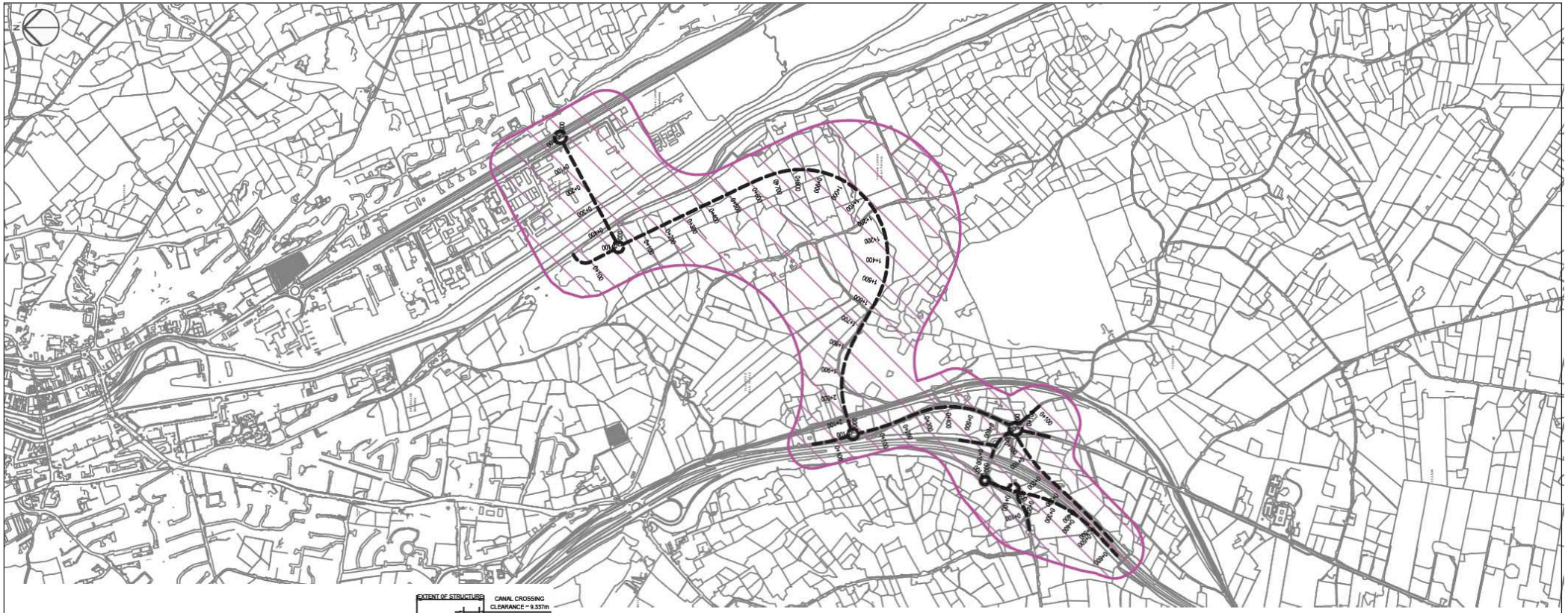
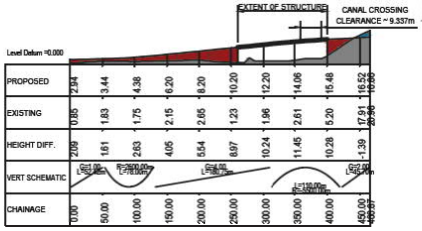
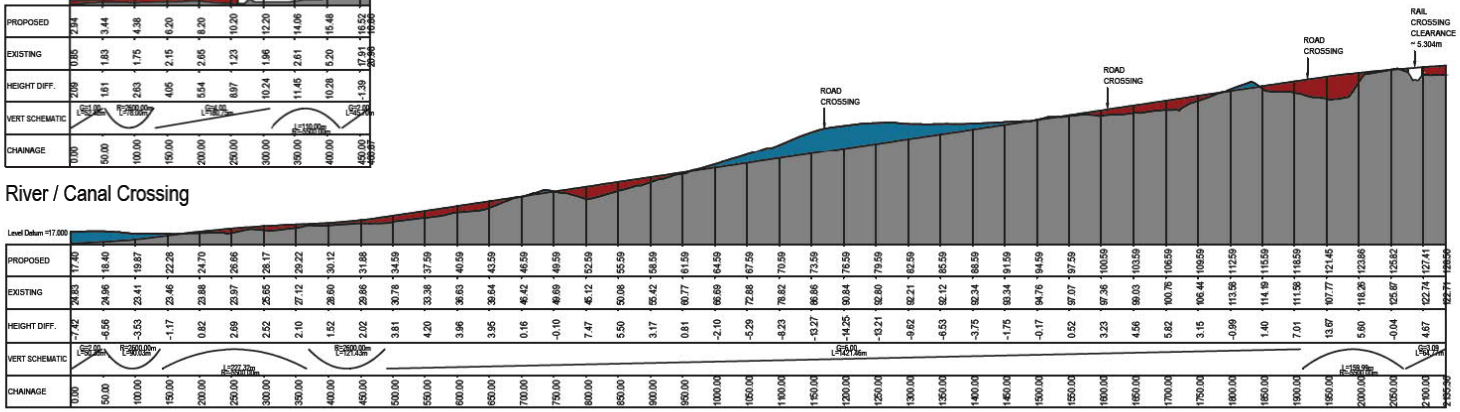




River / Canal Crossing



Fathom Line to Dublin Road Roundabout

KEY

- Corridor 5
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: PROPOSED IMPROVEMENT CORRIDOR AND INDICATIVE ALIGNMENT OPTION CORRIDOR 5

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.3.7

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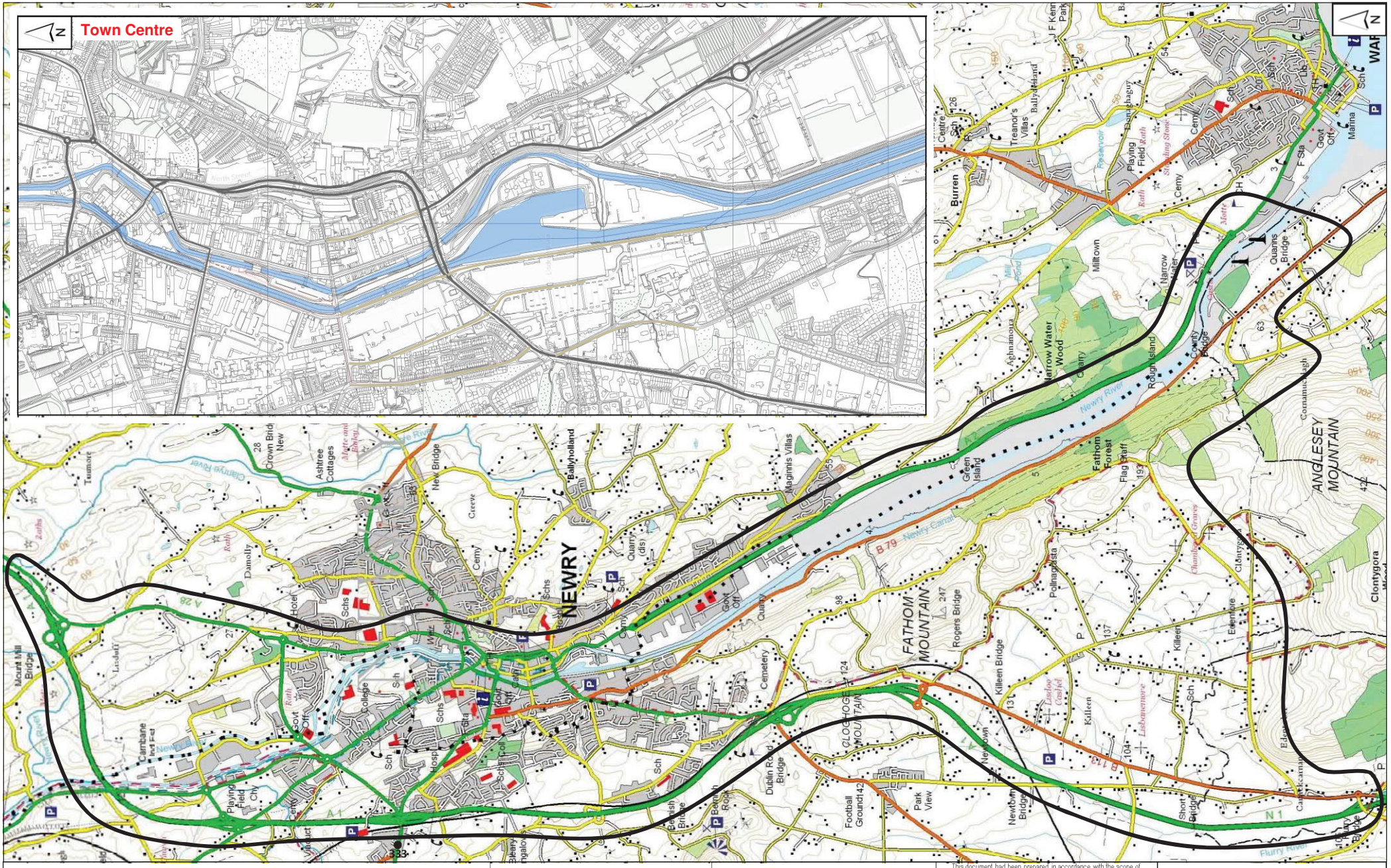

KEY

— Modelled Area

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: MODELLED AREA		
Client: Department for Infrastructure / An Roinn Bonneagair	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.1

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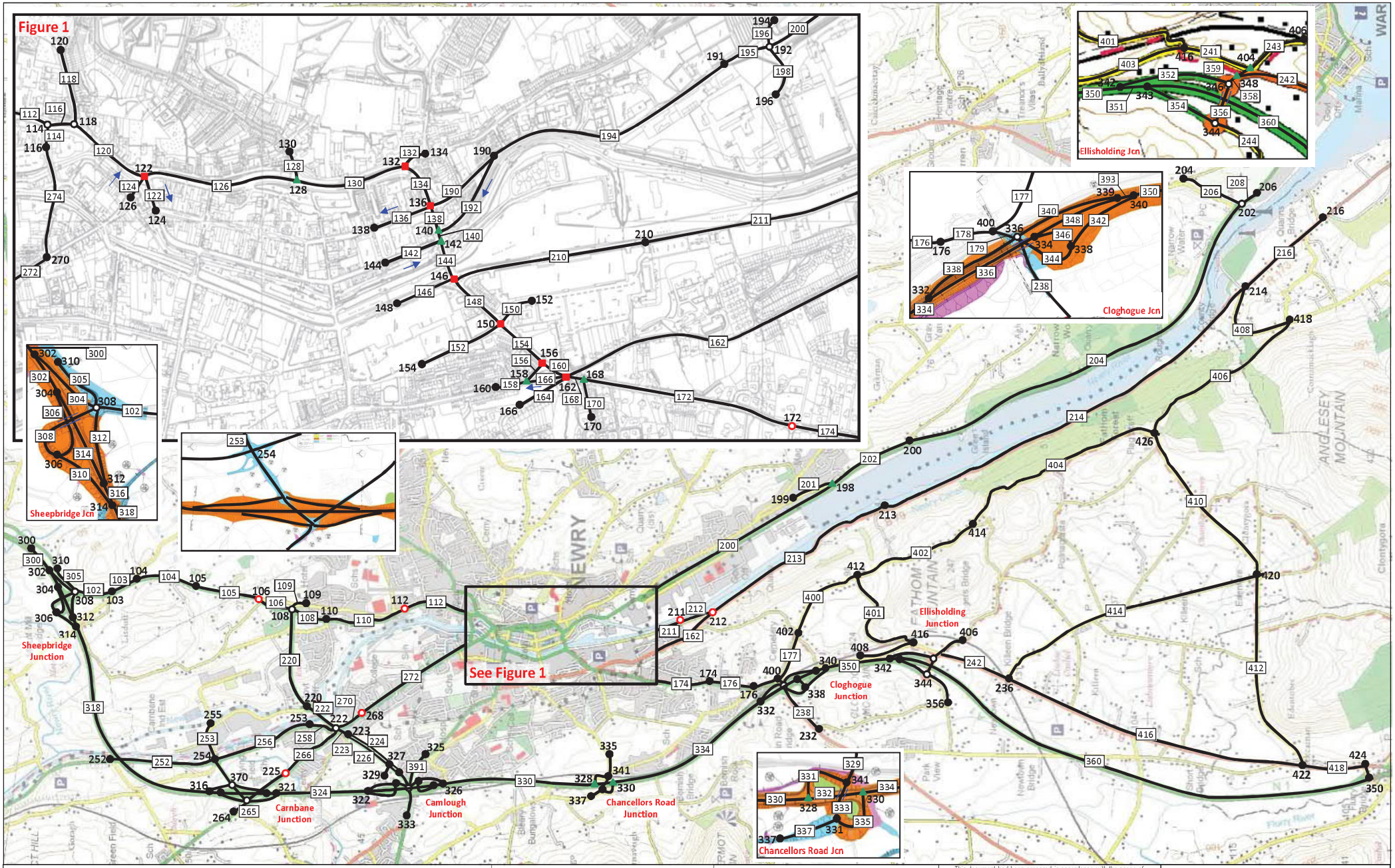

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-MINIMUM NETWORK COBA LINK AND NODE DIAGRAM	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used. © AECOM Infrastructure & Environment UK Limited. Crown Copyright, All Rights Reserved. License number – NIMA ES&LA214.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
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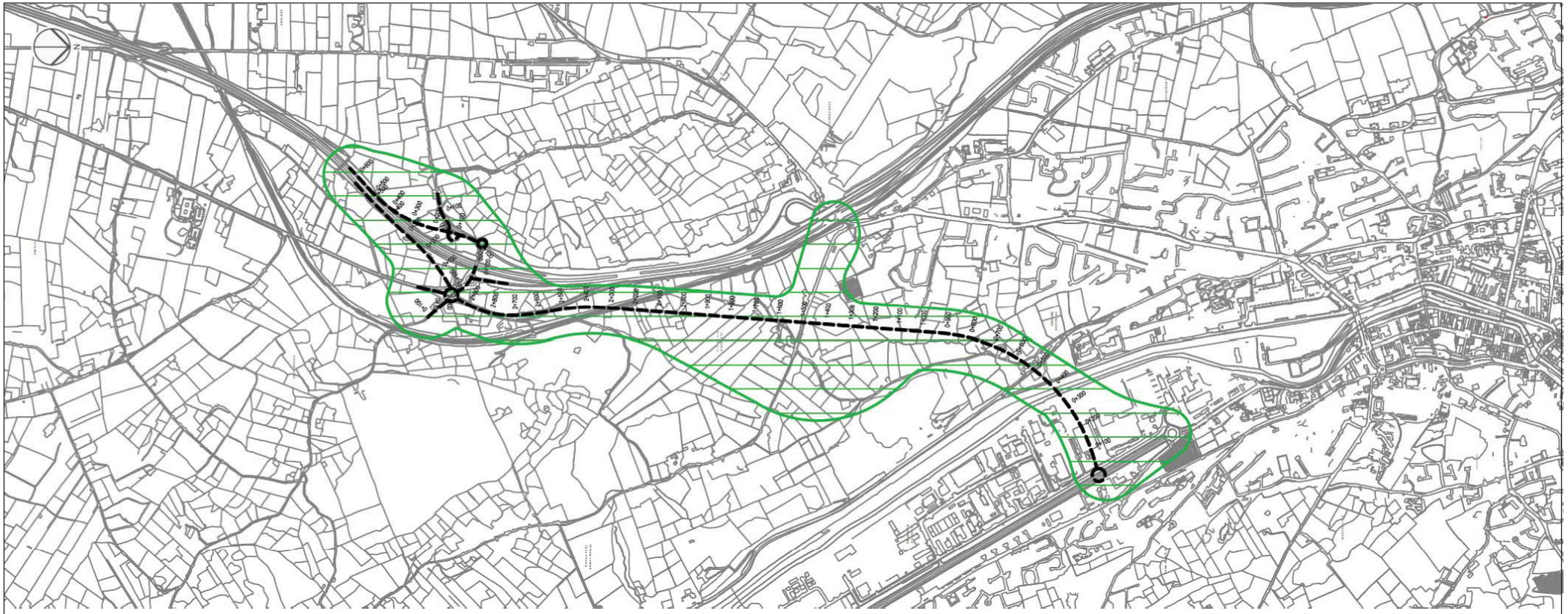

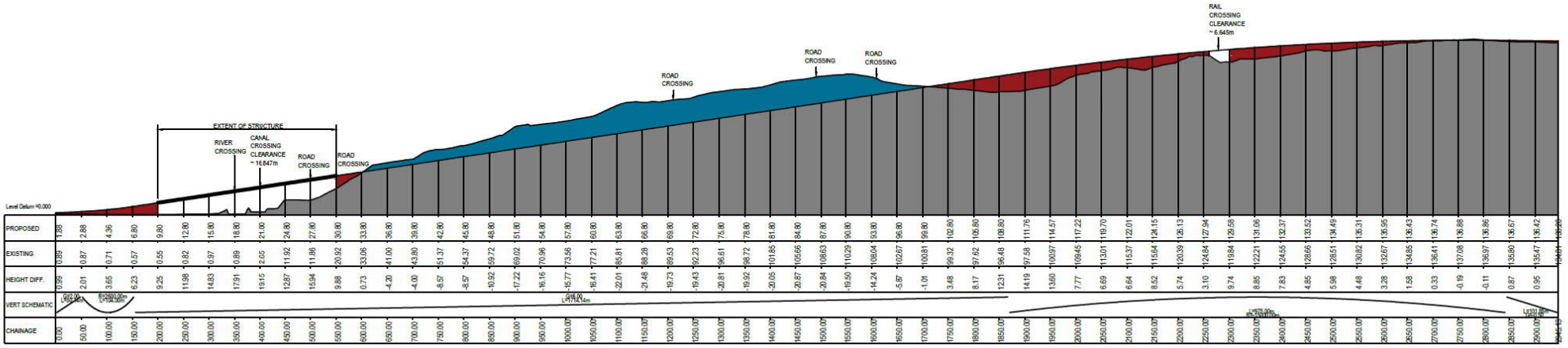

Warrenpoint Road to Ellisholding

KEY

- Corridor 1
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK PROPOSED IMPROVEMENT CORRIDOR CORRIDOR 1	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
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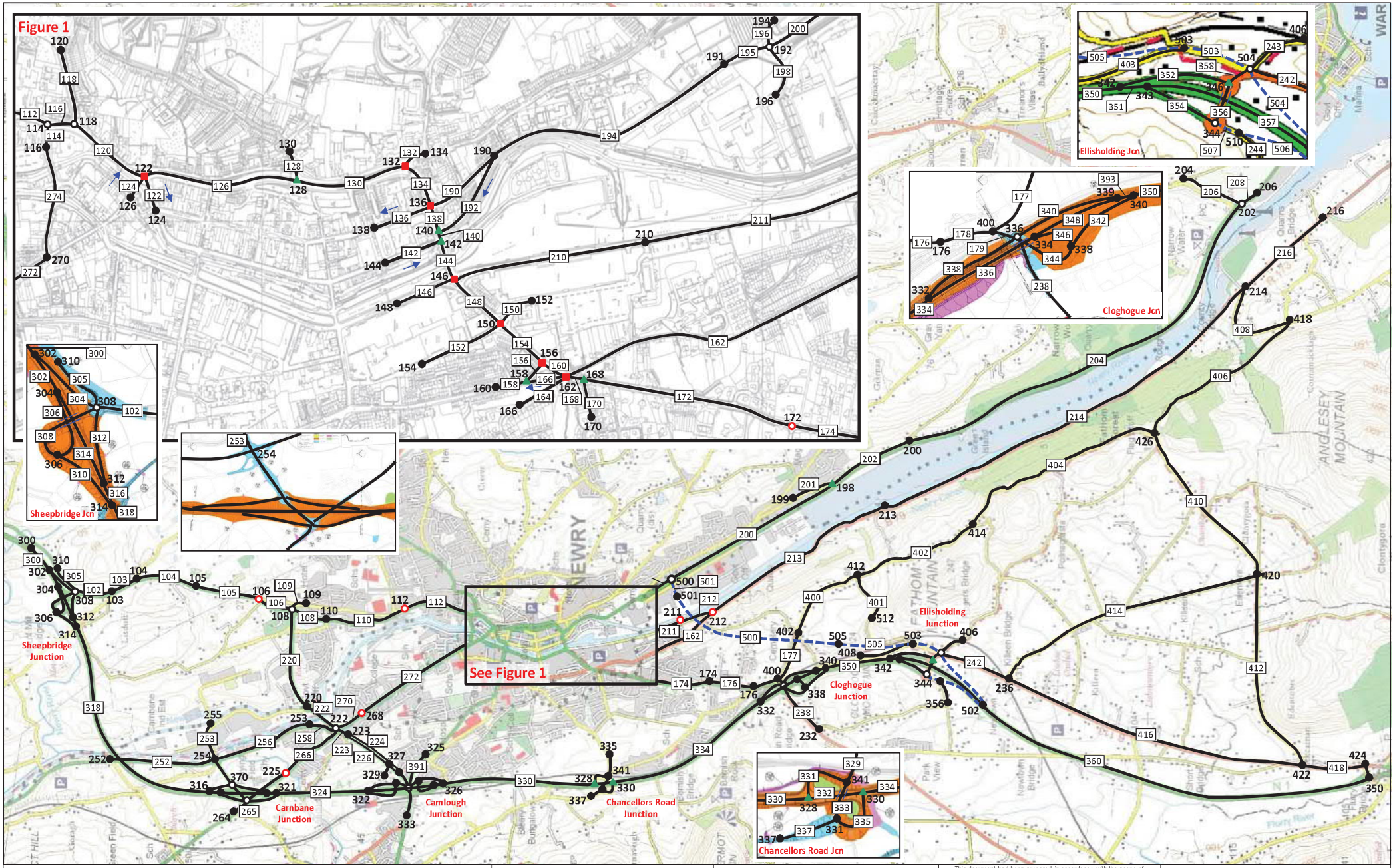

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link
Do-Something Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA LINK AND NODE DIAGRAM CORRIDOR 1		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.4

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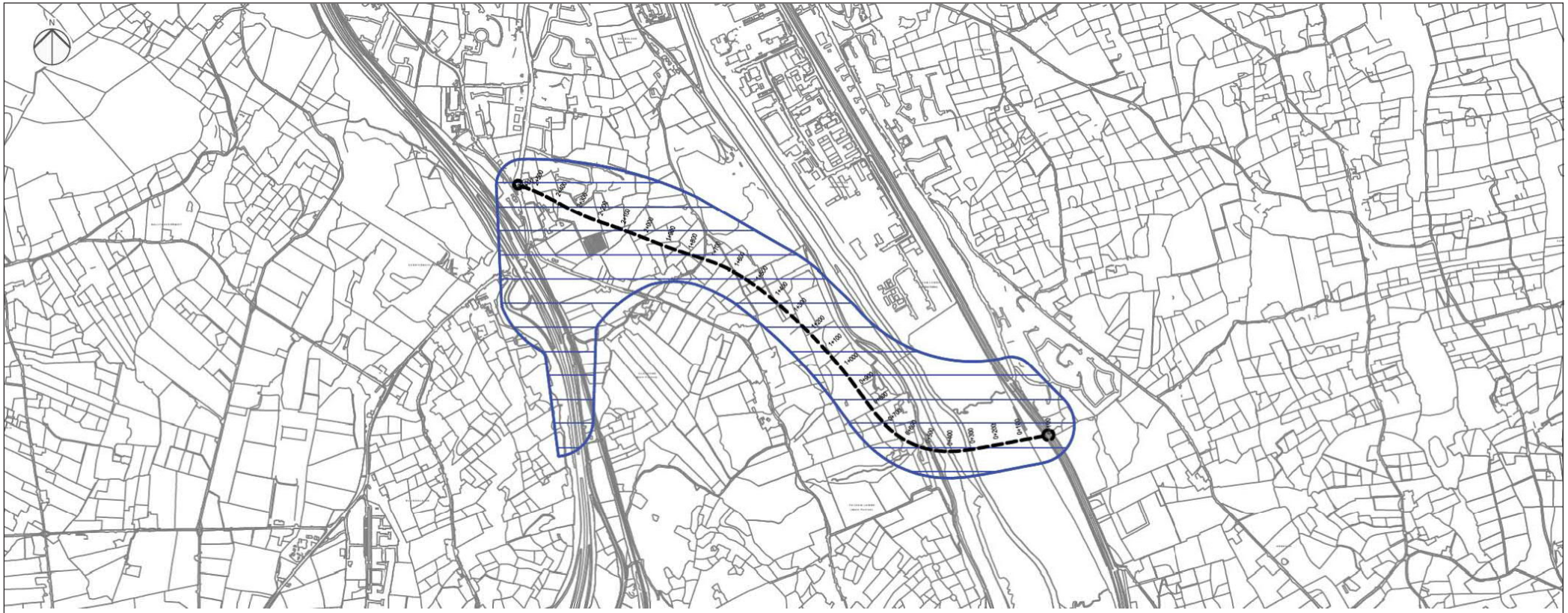

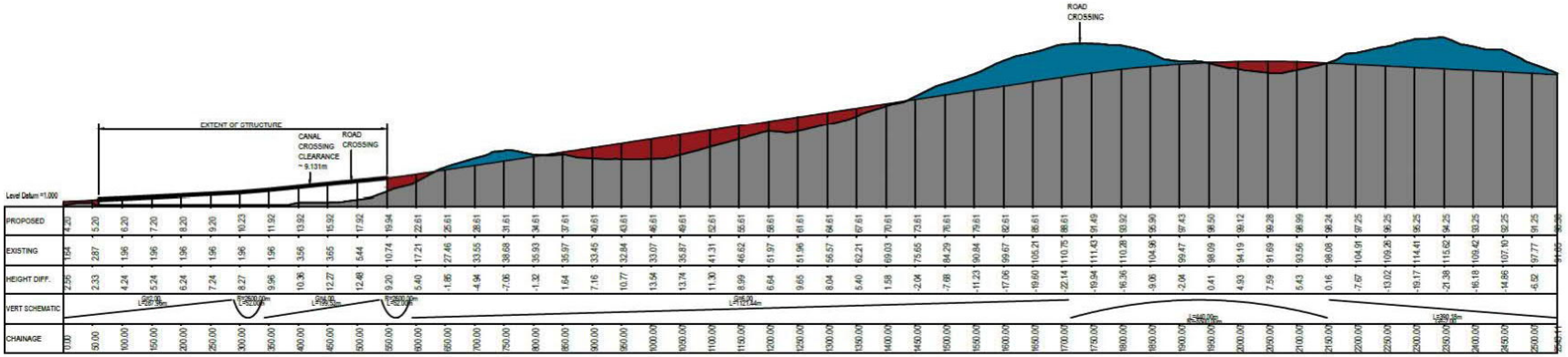

Warrenpoint Road to Dublin Road/Chancellors Road Junction

KEY

- Corridor 2
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: DO-SOMETHING NETWORK PROPOSED IMPROVEMENT CORRIDOR CORRIDOR 2

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.5

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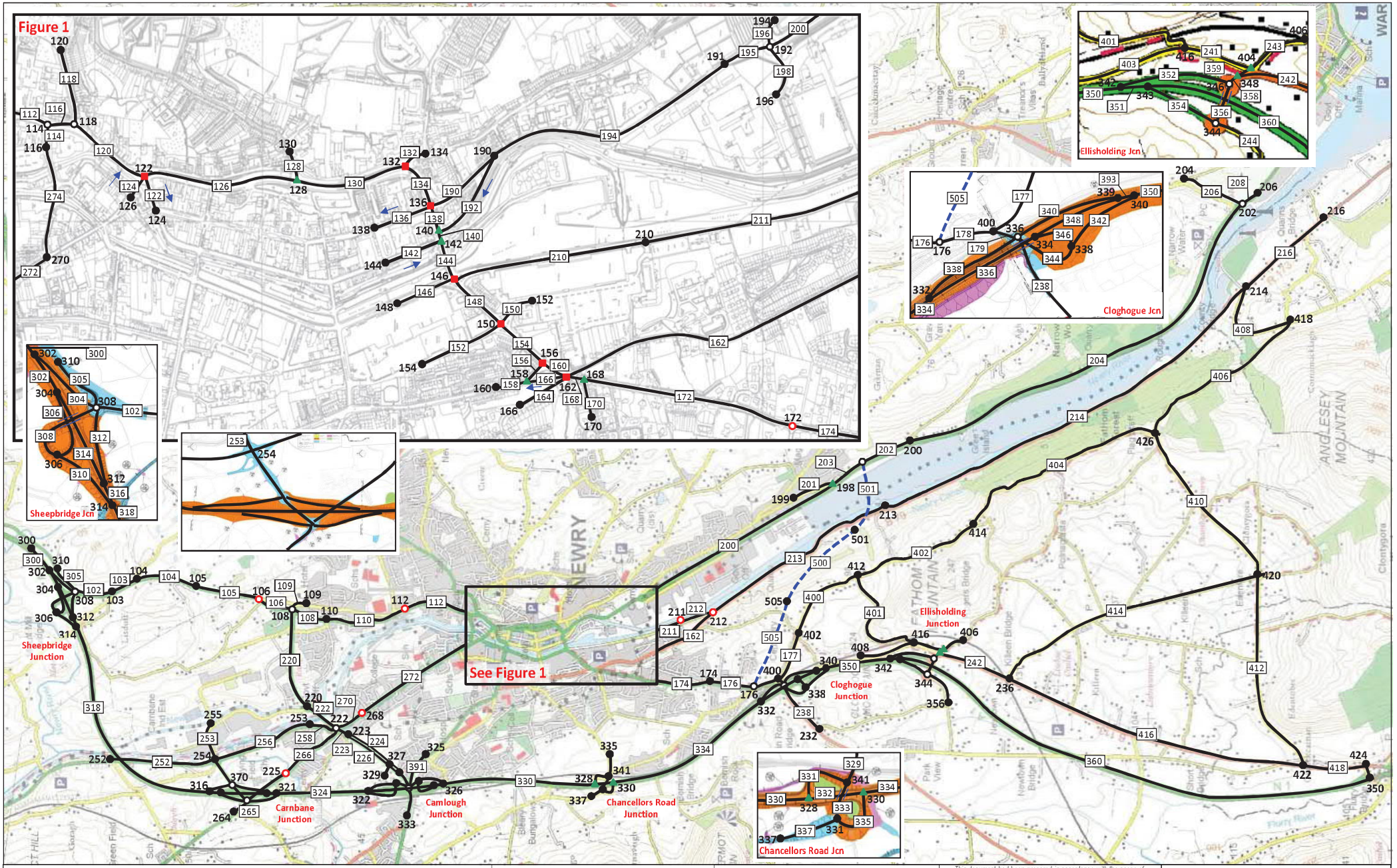

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link
Do-Something Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA LINK AND NODE DIAGRAM CORRIDOR 2		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.6

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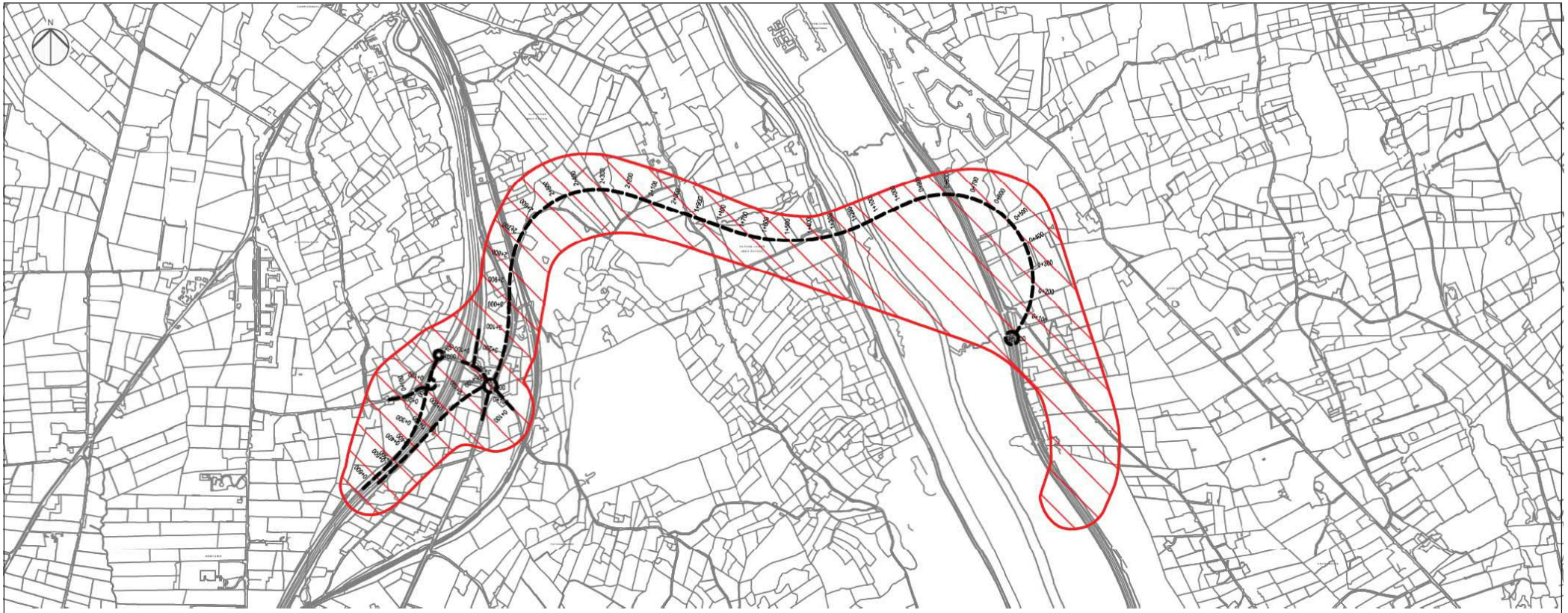

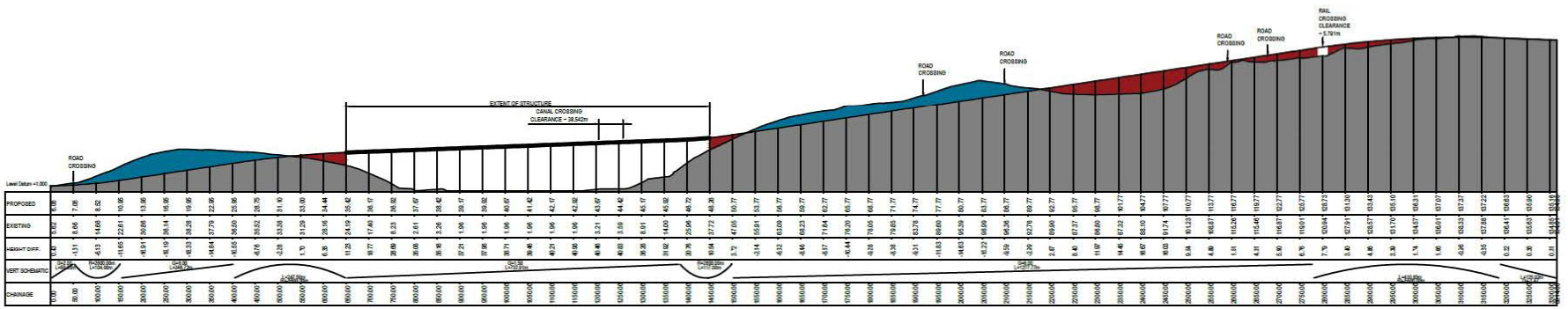

A2 Warrenpoint Road to Ellisholding

KEY

- Corridor 3
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

DO-SOMETHING NETWORK
PROPOSED IMPROVEMENT CORRIDOR
CORRIDOR 3

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.7

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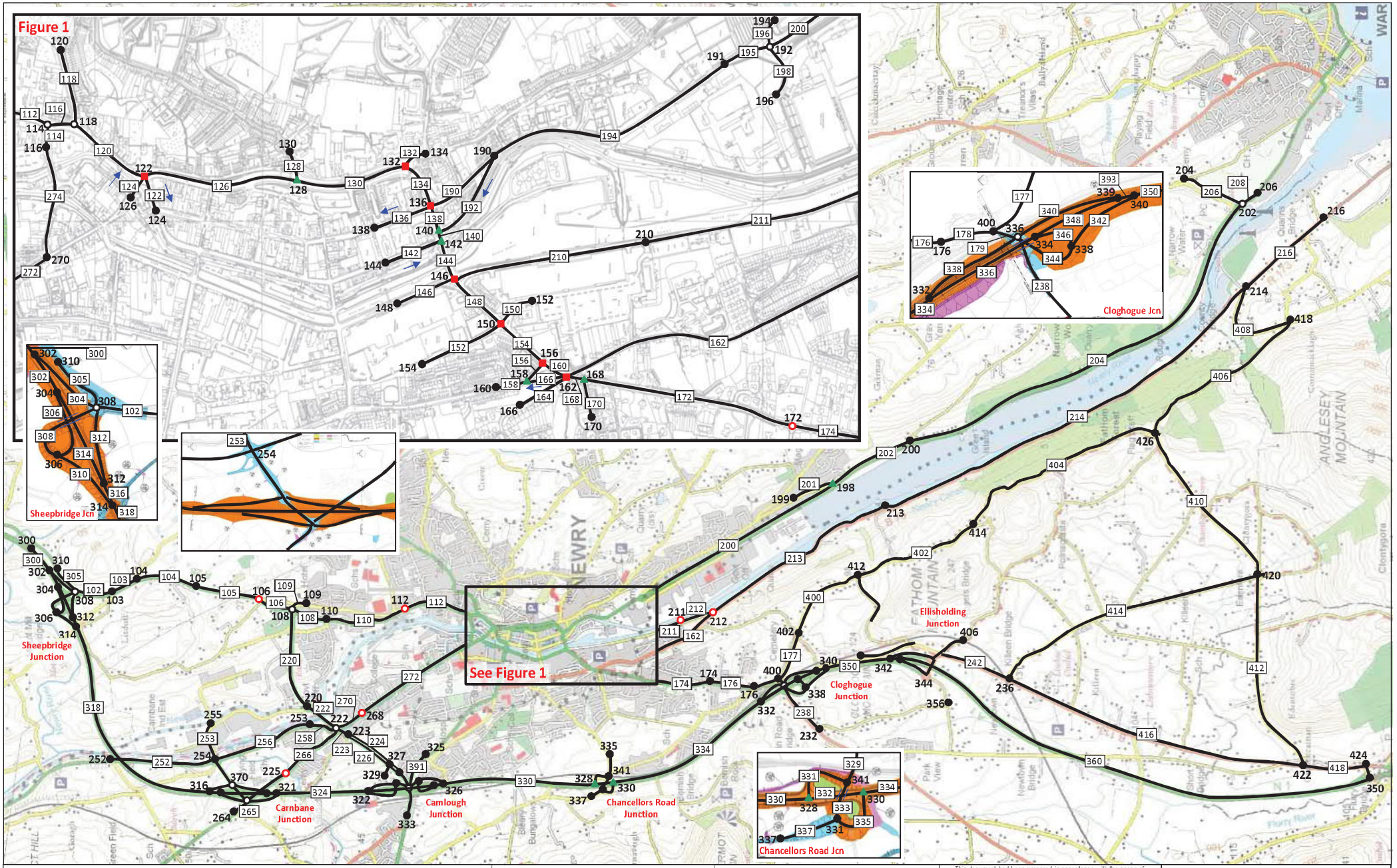

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA LINK AND NODE DIAGRAM CORRIDOR 3		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.8

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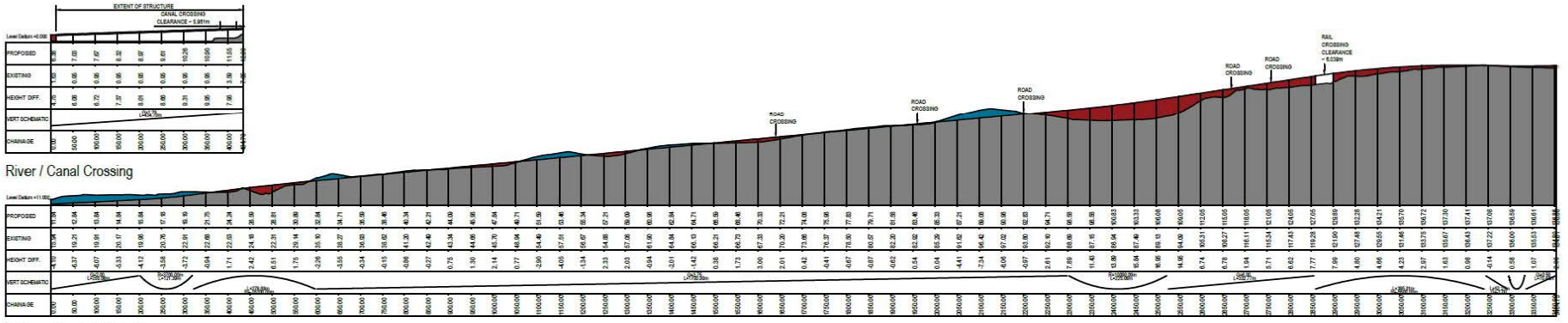

River / Canal Crossing

Fathom Line to Ellisholding

KEY

- Corridor 4 – Option A
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

DO-SOMETHING NETWORK
PROPOSED IMPROVEMENT CORRIDOR
CORRIDOR 4 – OPTION A

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.9

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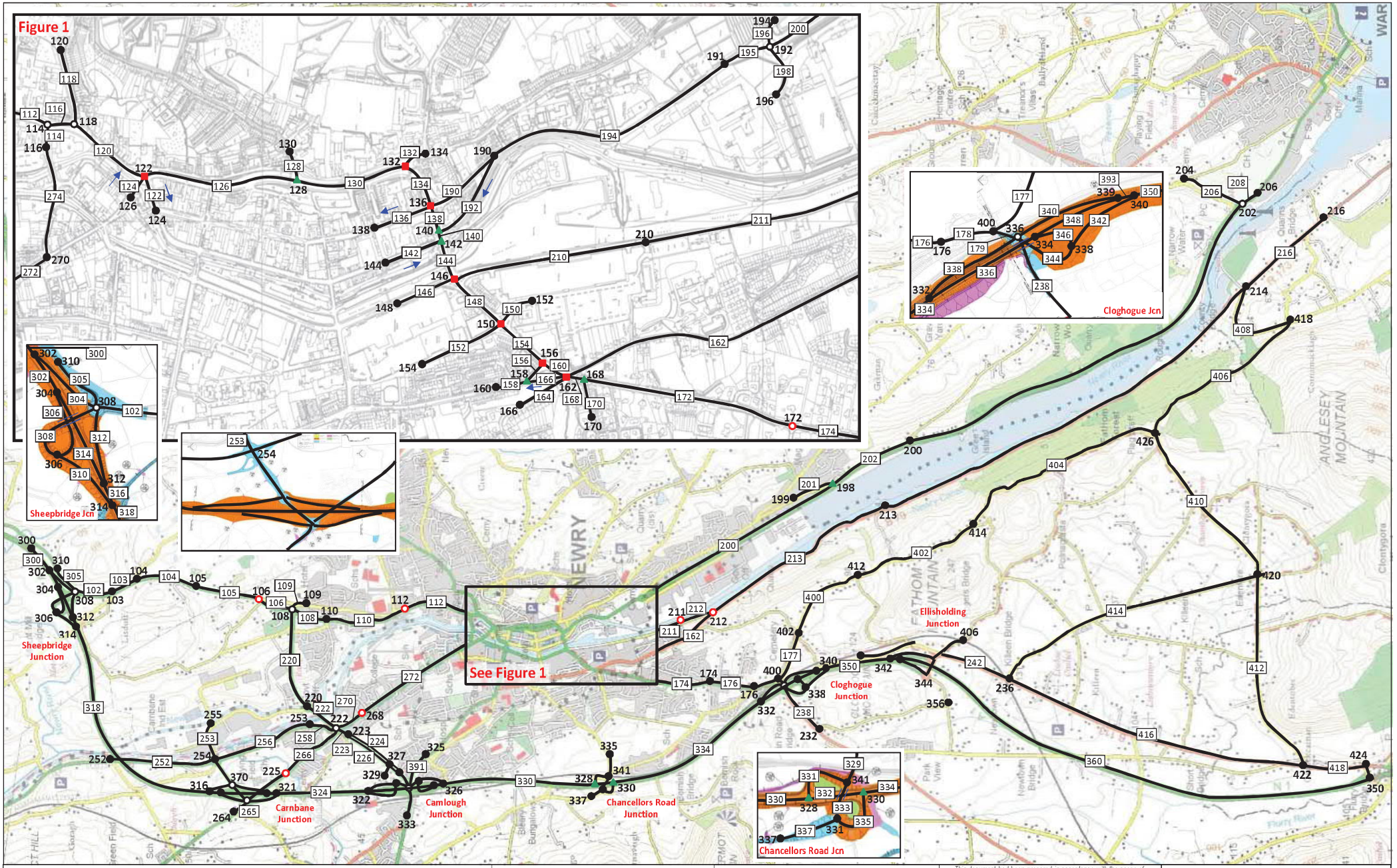

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA LINK AND NODE DIAGRAM CORRIDOR 4 – OPTION A		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.10

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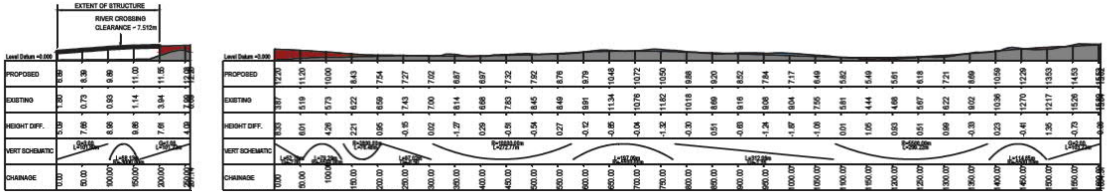
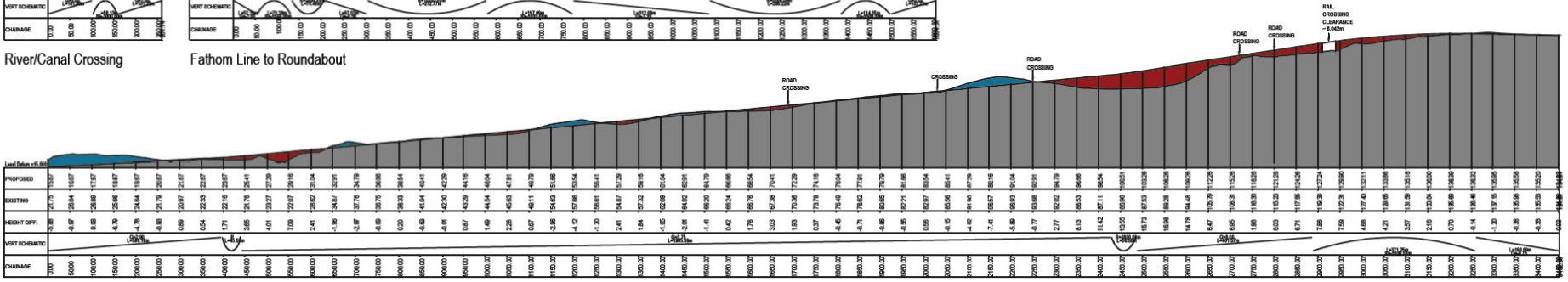


River/Canal Crossing

Fathom Line to Roundabout



Roundabout to Ellisholding

KEY

- Corridor 4 – Option B
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

DO-SOMETHING NETWORK
PROPOSED IMPROVEMENT CORRIDOR
CORRIDOR 4 – OPTION B

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Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.11

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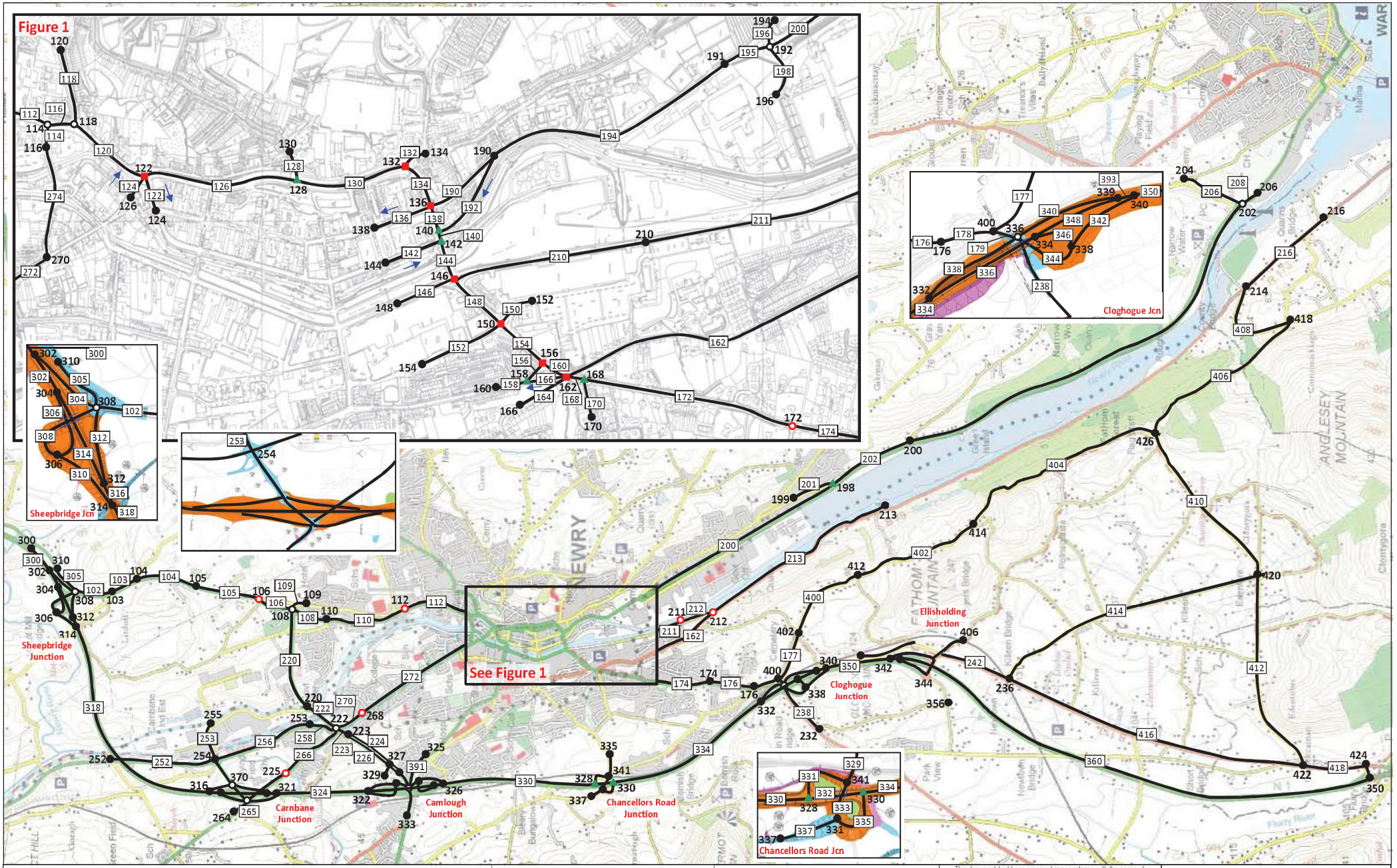

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA LINK AND NODE DIAGRAM CORRIDOR 4 – OPTION B		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.12

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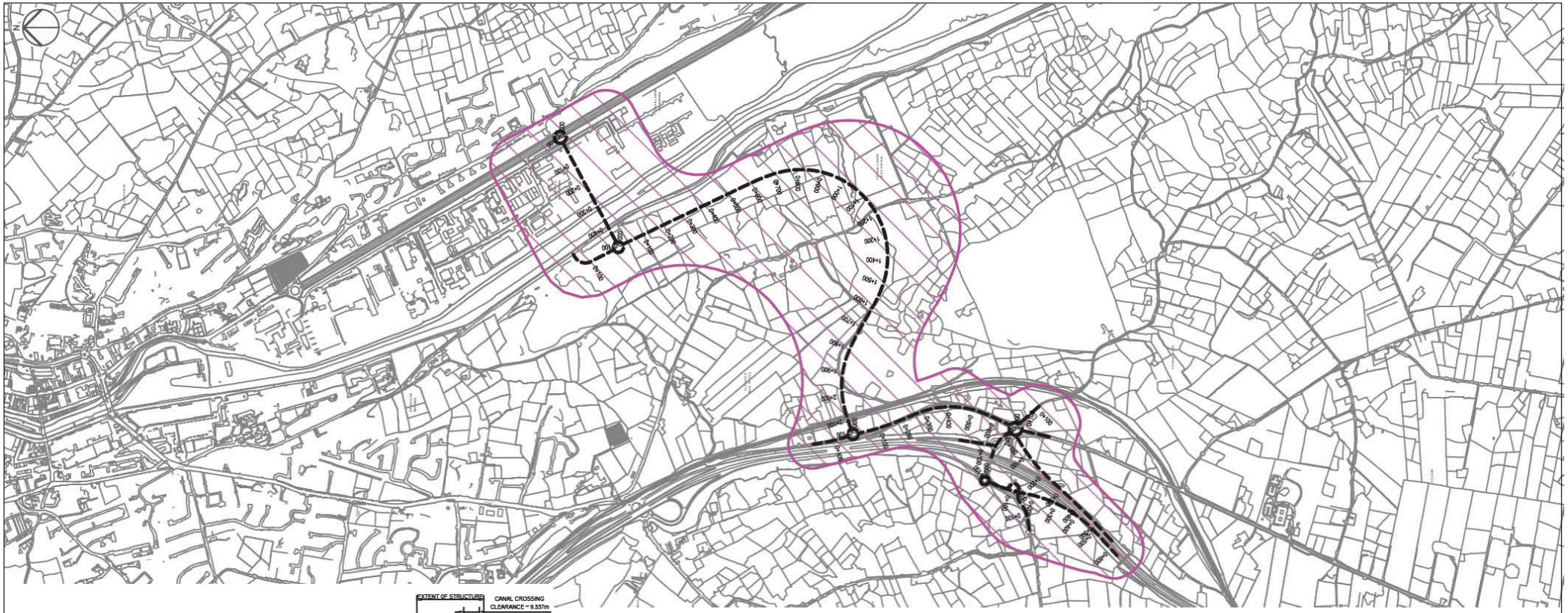
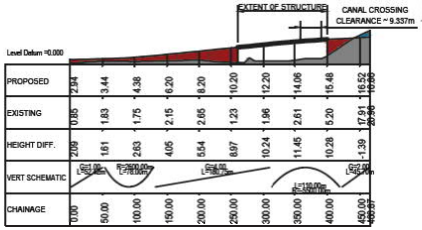
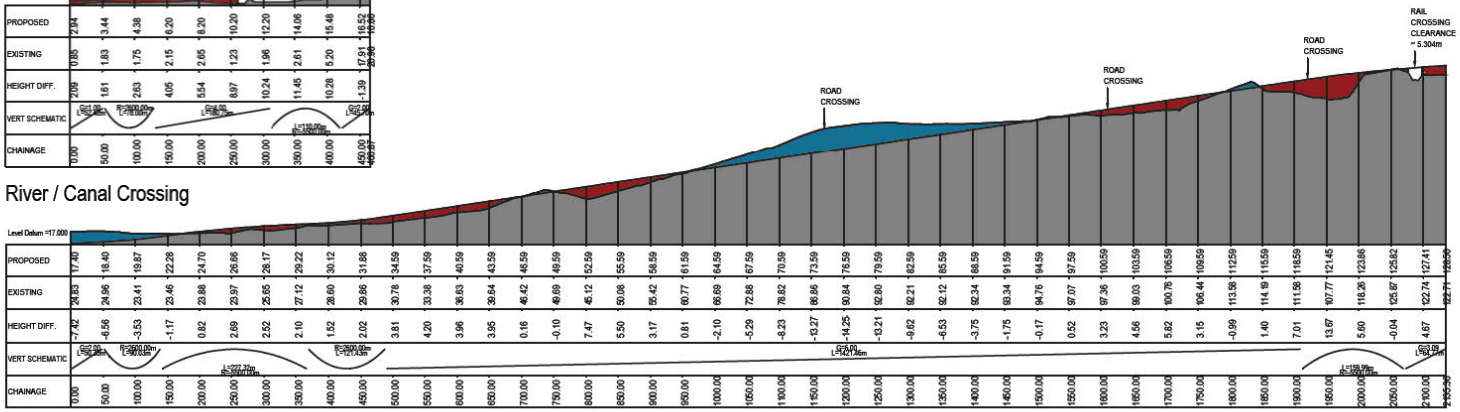




River / Canal Crossing



Fathom Line to Dublin Road Roundabout

KEY

- Corridor 5
- Indicative Alignment Option
- Existing Ground
- Fill
- Excavation

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: DO-SOMETHING NETWORK PROPOSED IMPROVEMENT CORRIDOR CORRIDOR 5

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Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.13

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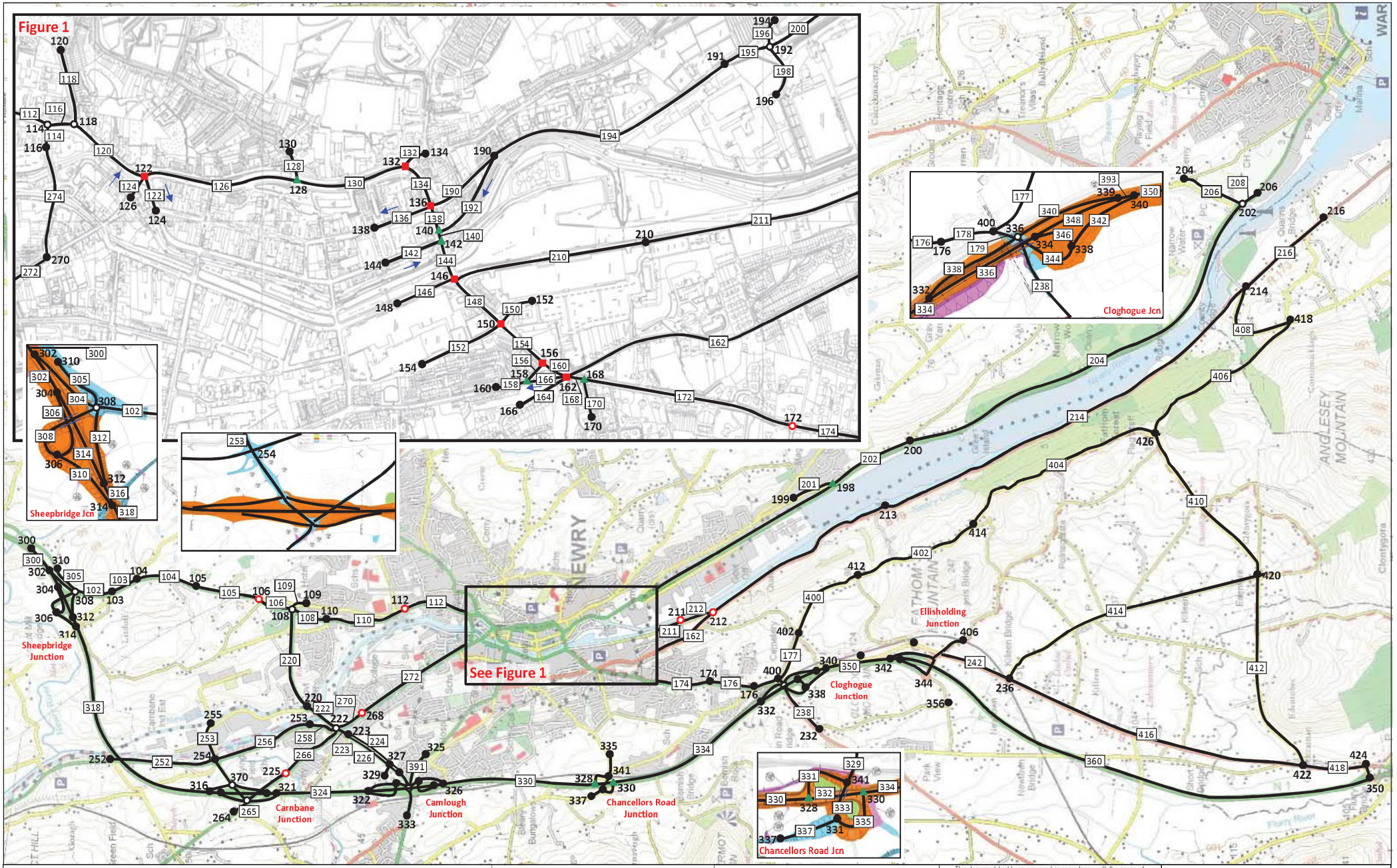

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA LINK AND NODE DIAGRAM CORRIDOR 5		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.5.14

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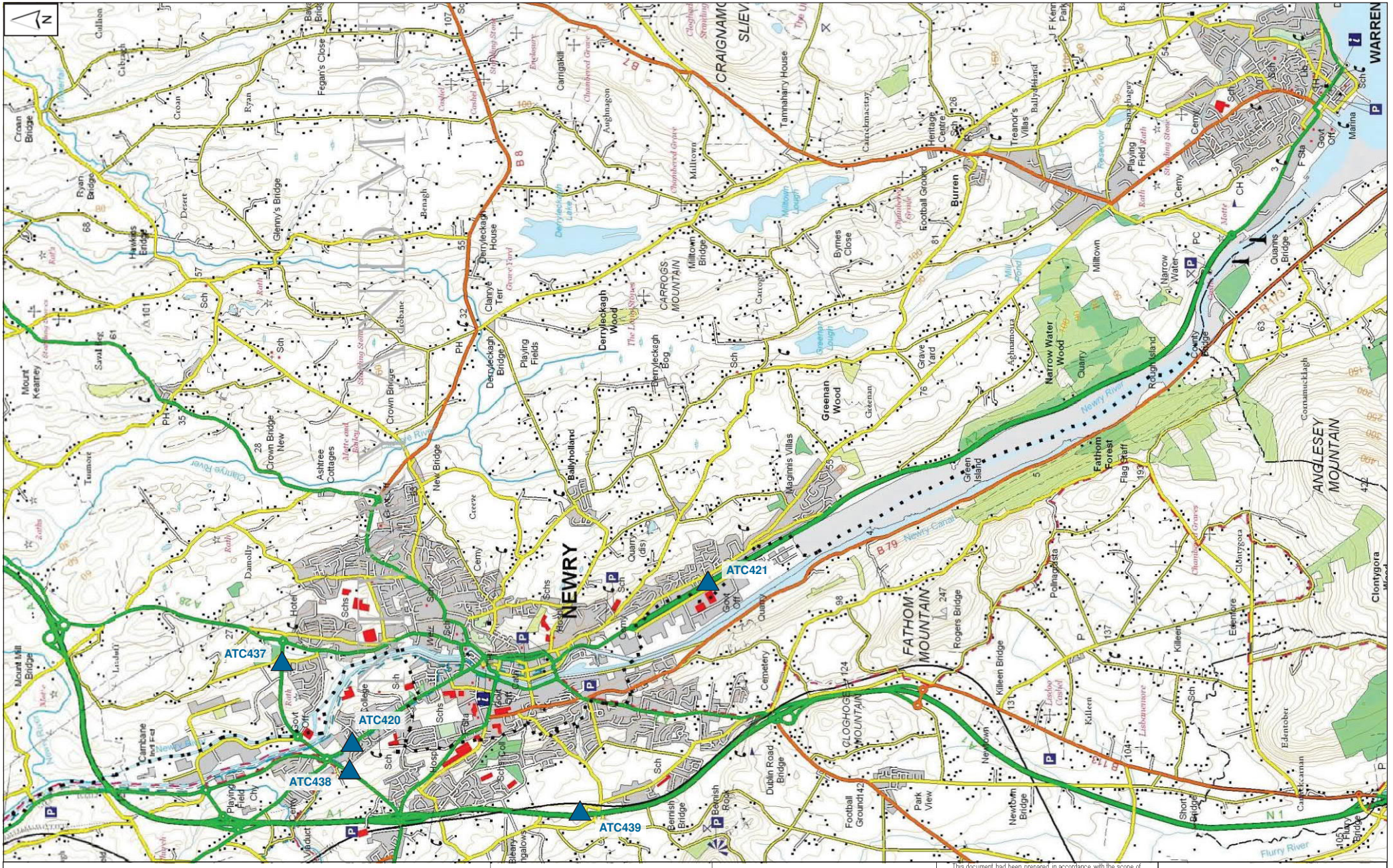

KEY

▲ Permanent Automatic Traffic Count Location

Project Title

NEWRY SOUTHERN RELIEF ROAD

Drawing Title

PERMANENT AUTOMATIC TRAFFIC COUNT LOCATIONS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.15

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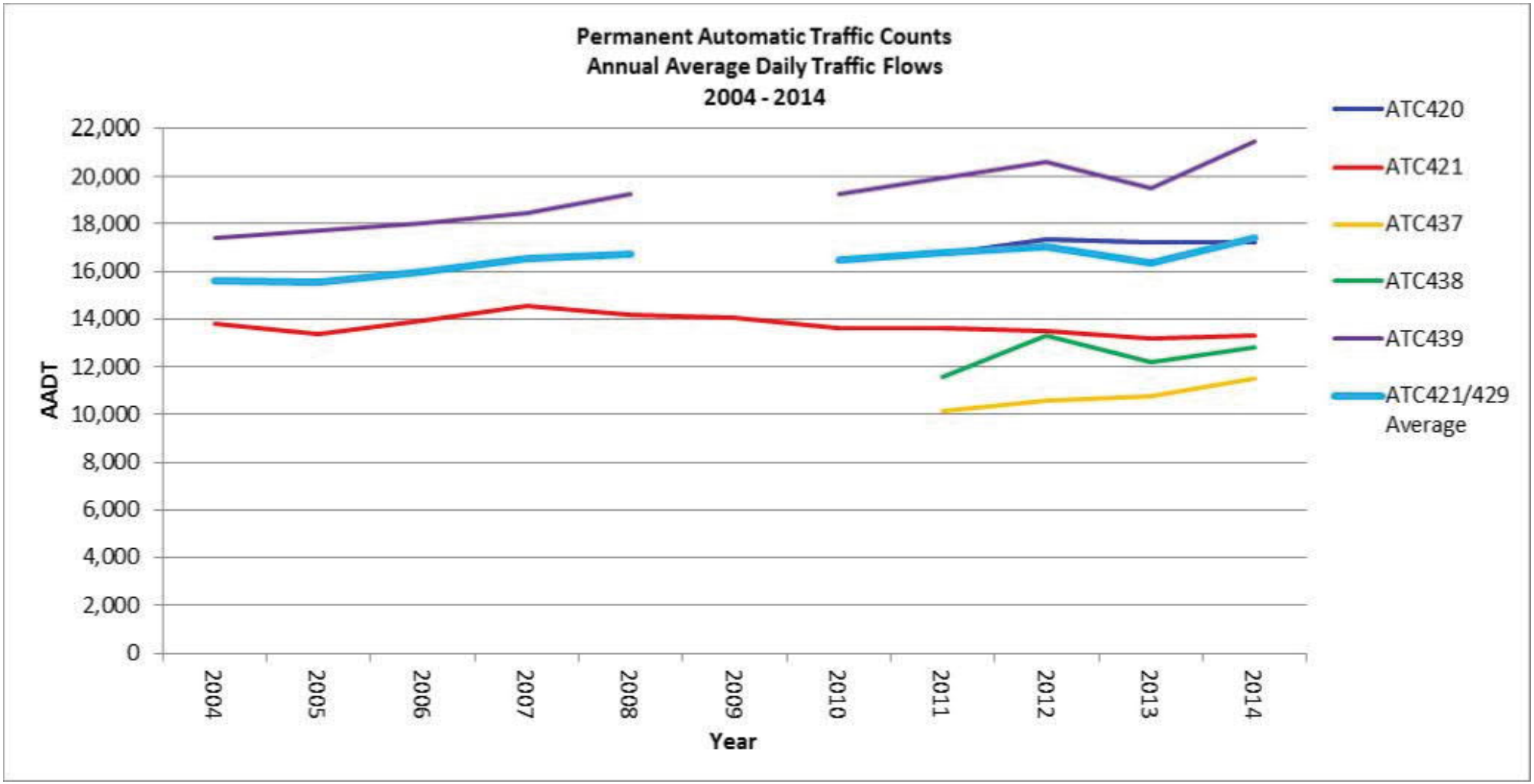

KEY

Project Title
NEWRY SOUTHERN RELIEF ROAD

Client Department for Infrastructure | An Roinn Bonneagair

Drawing Title
PERMANENT AUTOMATIC TRAFFIC COUNT 2004 – 2014TRAFFIC FLOWS

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.5.16

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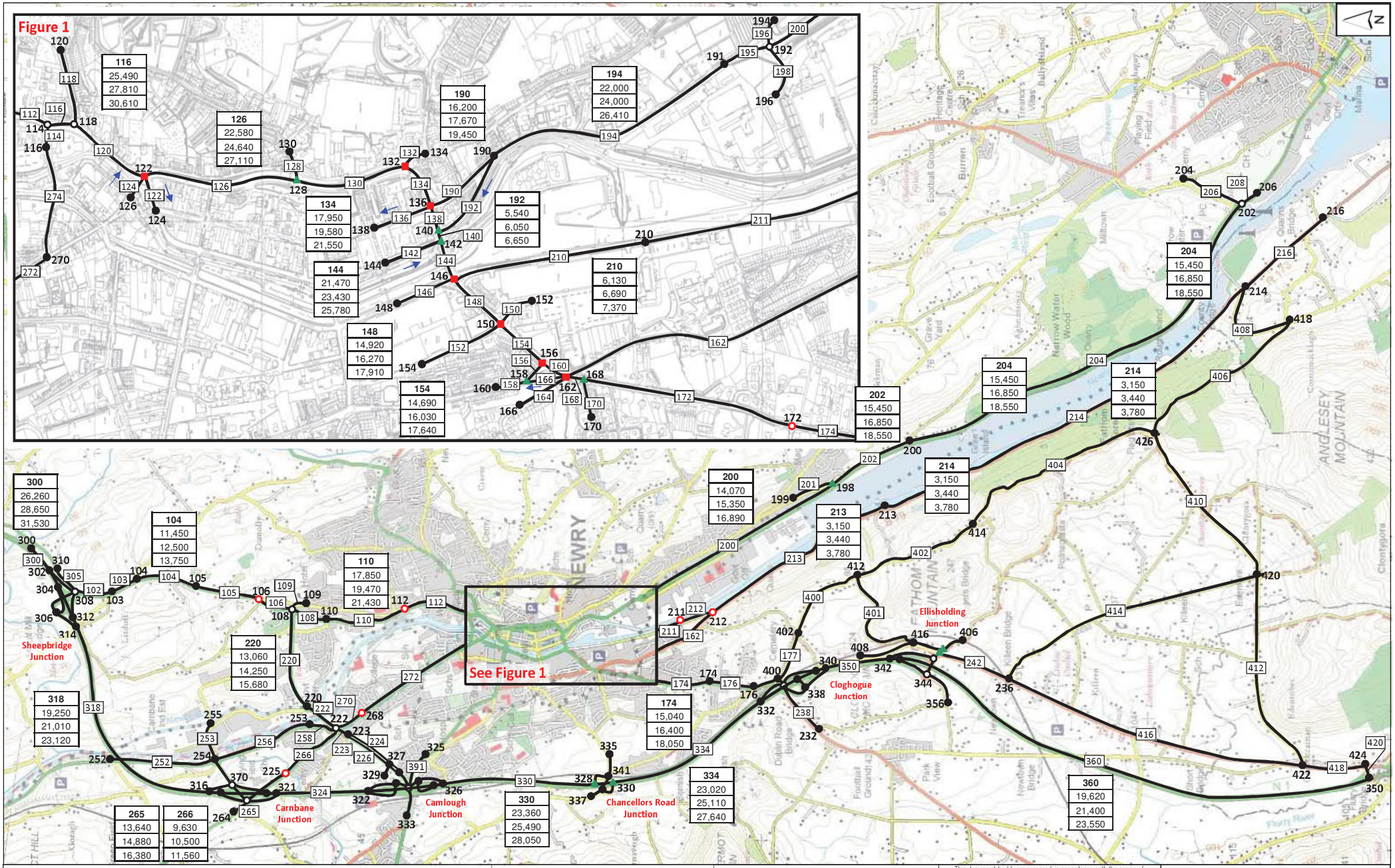

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Link Ref.
2015 Base Year (Equivalent)
2023 Opening Year
2037 Design Year

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
DO-MINIMUM NETWORK
COBA MODELLED 24-HOUR TRAFFIC FLOWS

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.6.1

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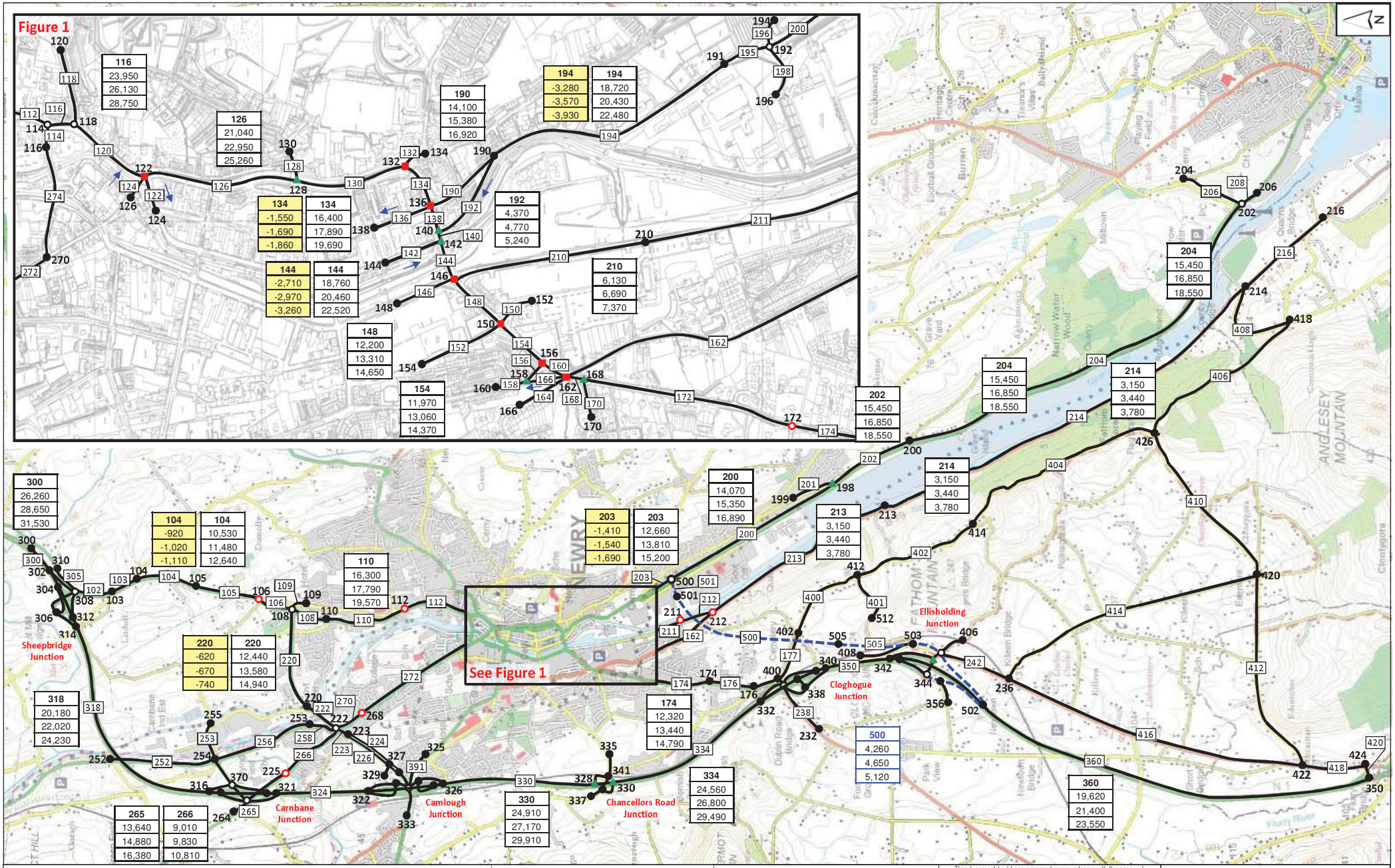

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link
Do-Something Link

Link Ref.	Link Ref.
2015 Base Year (Equivalent)	2015 Flow Difference vs. Do-Minimum
2023 Opening Year	2023 Flow Difference vs. Do-Minimum
2037 Design Year	2037 Flow Difference vs. Do-Minimum

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: DO-SOMETHING NETWORK COBA MODELLED 24-HOUR TRAFFIC FLOWS CORRIDOR 1

Client: Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.6.2

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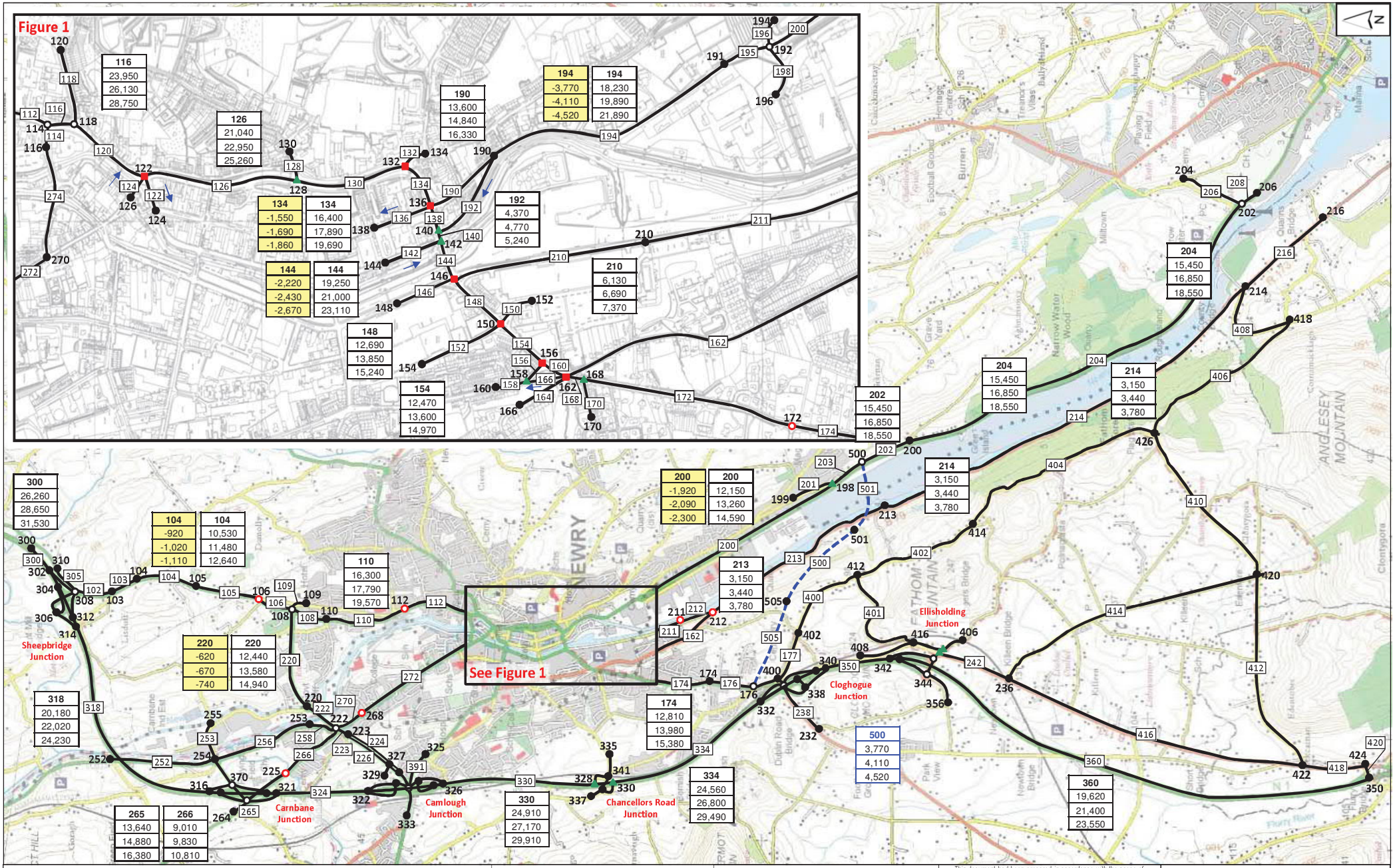

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link
Do-Something Link

Link Ref.	Link Ref.
2015 Base Year (Equivalent)	2015 Flow Difference vs. Do-Minimum
2023 Opening Year	2023 Flow Difference vs. Do-Minimum
2037 Design Year	2037 Flow Difference vs. Do-Minimum

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
DO-SOMETHING NETWORK
COBA MODELLED 24-HOUR TRAFFIC FLOWS
CORRIDOR 2

Client Department for Infrastructure | An Roinn Bonneagair

Scale @ A3: NTS

AECOM Internal Project Number: 60472927

Figure 8.6.3

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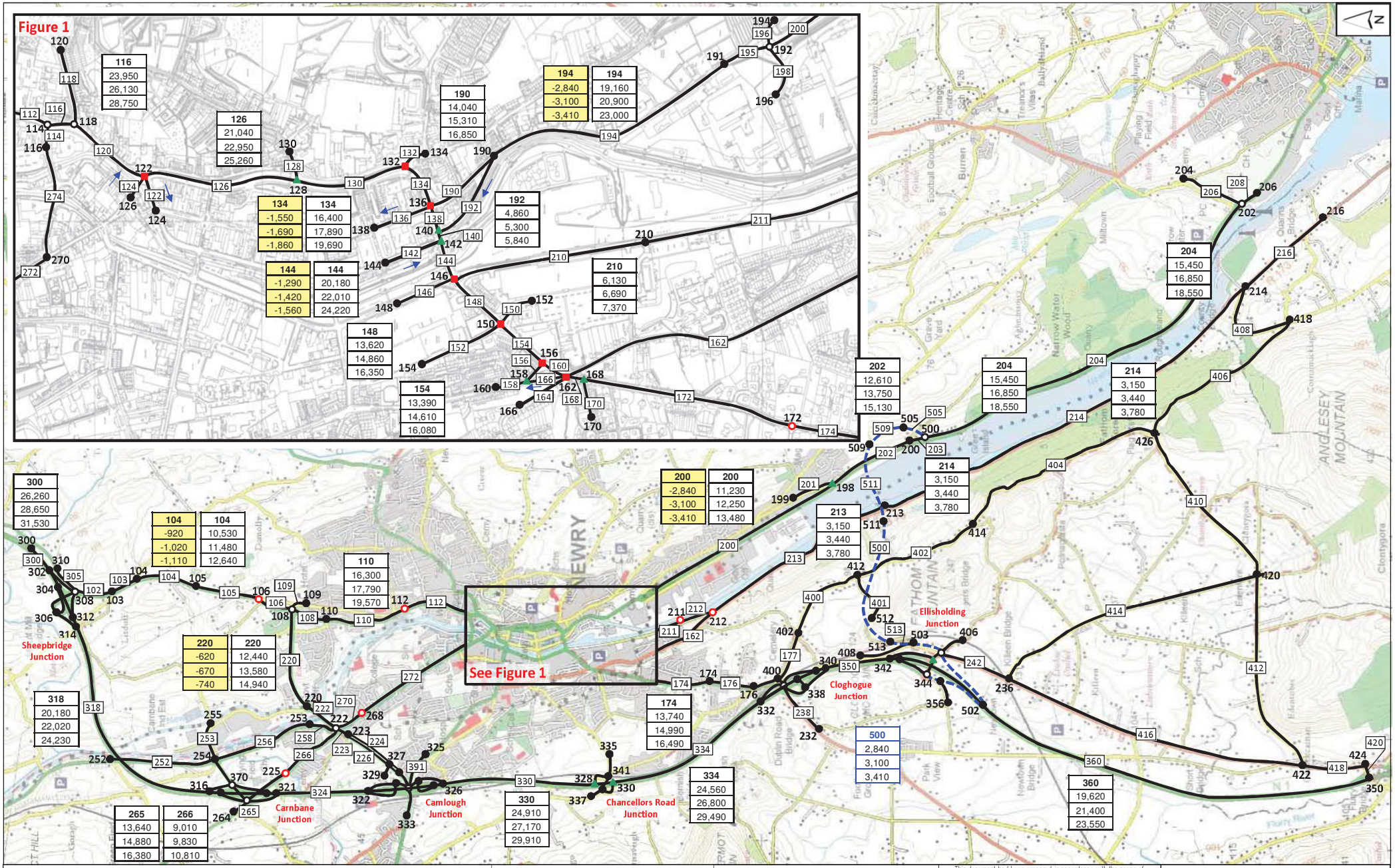

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link
Do-Something Link

Link Ref.	Link Ref.
2015 Base Year (Equivalent)	2015 Flow Difference vs. Do-Minimum
2023 Opening Year	2023 Flow Difference vs. Do-Minimum
2037 Design Year	2037 Flow Difference vs. Do-Minimum

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
DO-SOMETHING NETWORK
COBA MODELLED 24-HOUR TRAFFIC FLOWS
CORRIDOR 3

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AECOM Internal Project Number: 60472927

Figure 8.6.4

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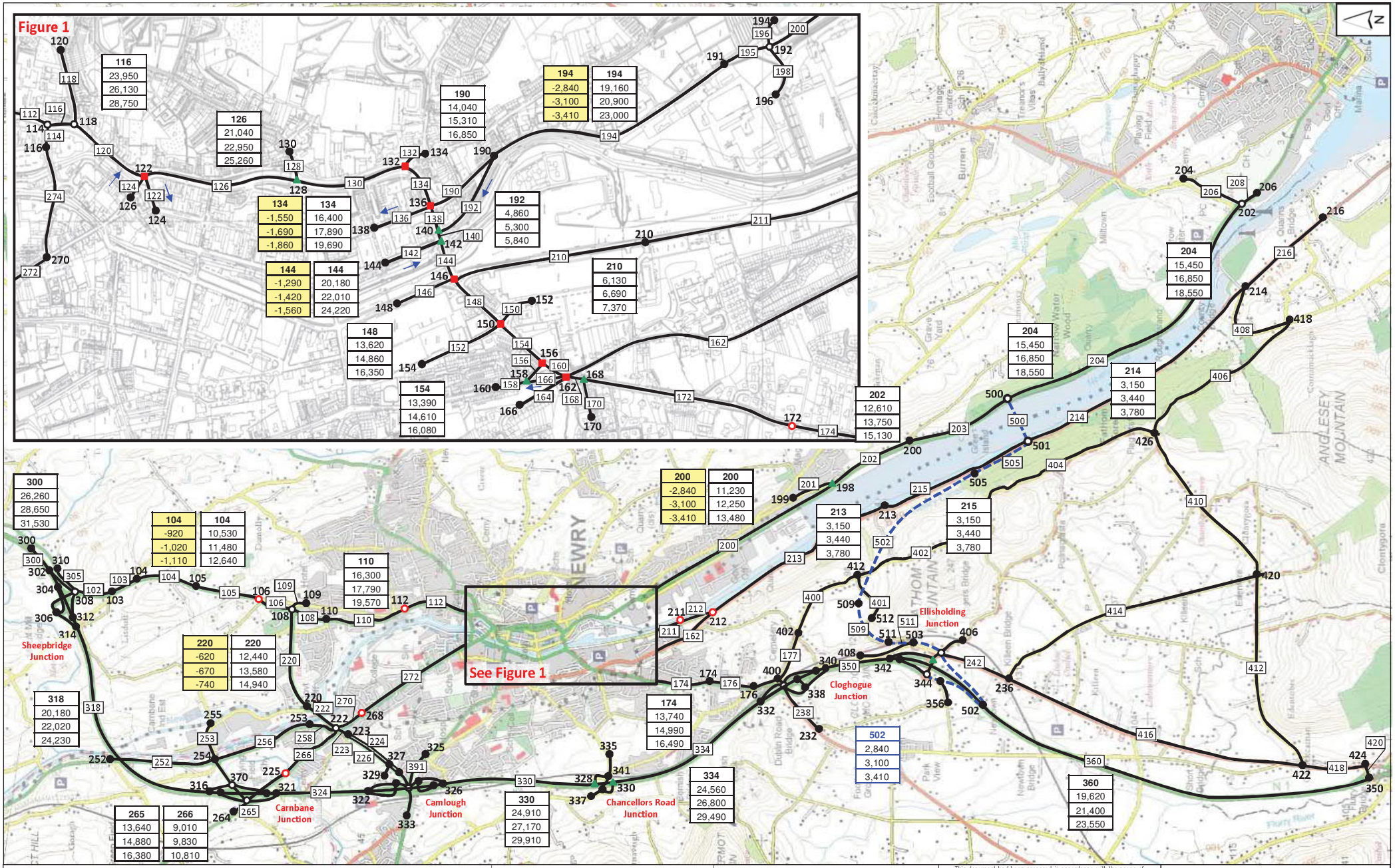

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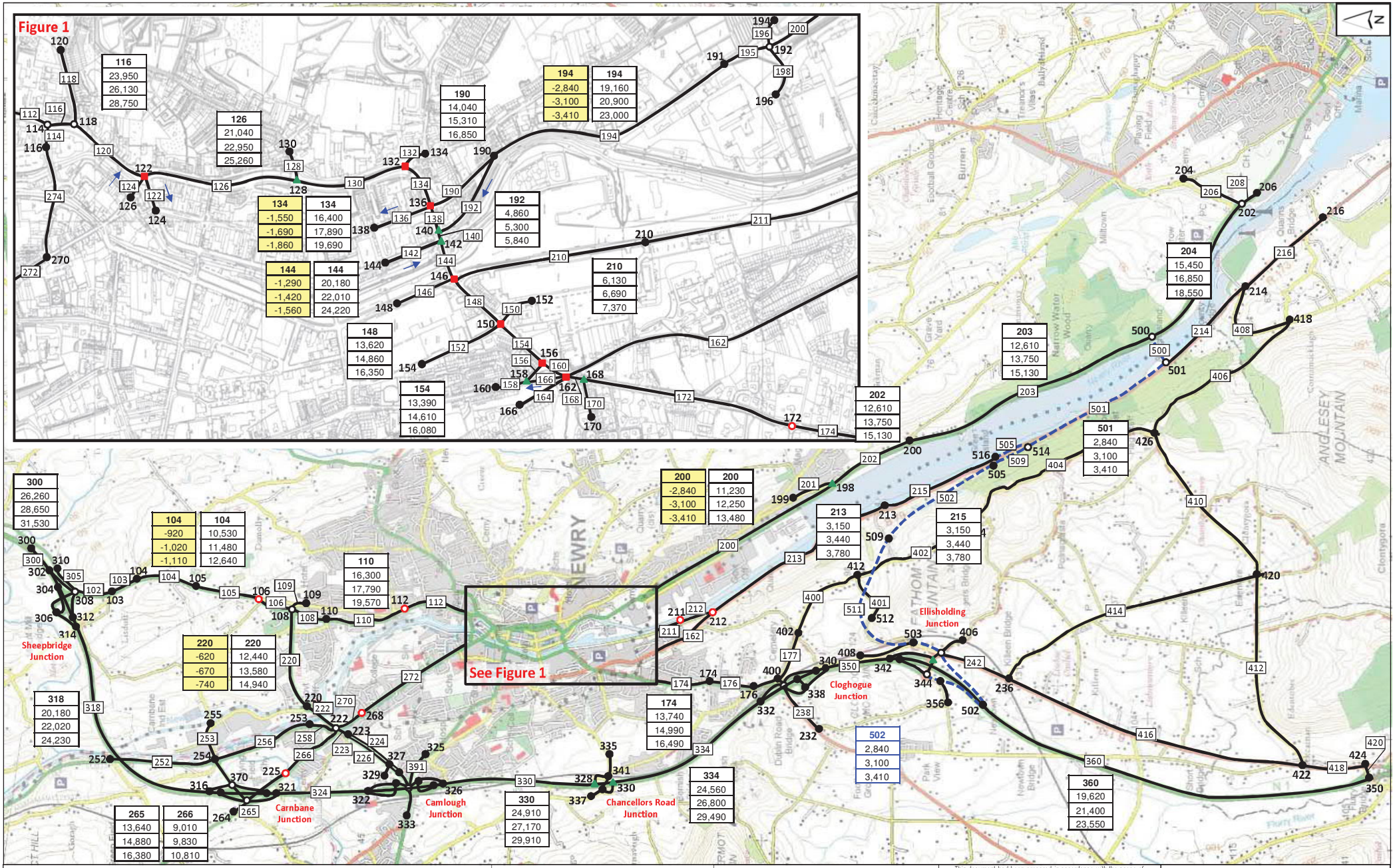

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link
Do-Something Link

Link Ref.	Link Ref.
2015 Base Year (Equivalent)	2015 Flow Difference vs. Do-Minimum
2023 Opening Year	2023 Flow Difference vs. Do-Minimum
2037 Design Year	2037 Flow Difference vs. Do-Minimum

Project Title
NEWRY SOUTHERN RELIEF ROAD

Drawing Title
DO-SOMETHING NETWORK
COBA MODELLED 24-HOUR TRAFFIC FLOWS
CORRIDOR 4 – OPTION B

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AECOM Internal Project Number: 60472927

Figure 8.6.6

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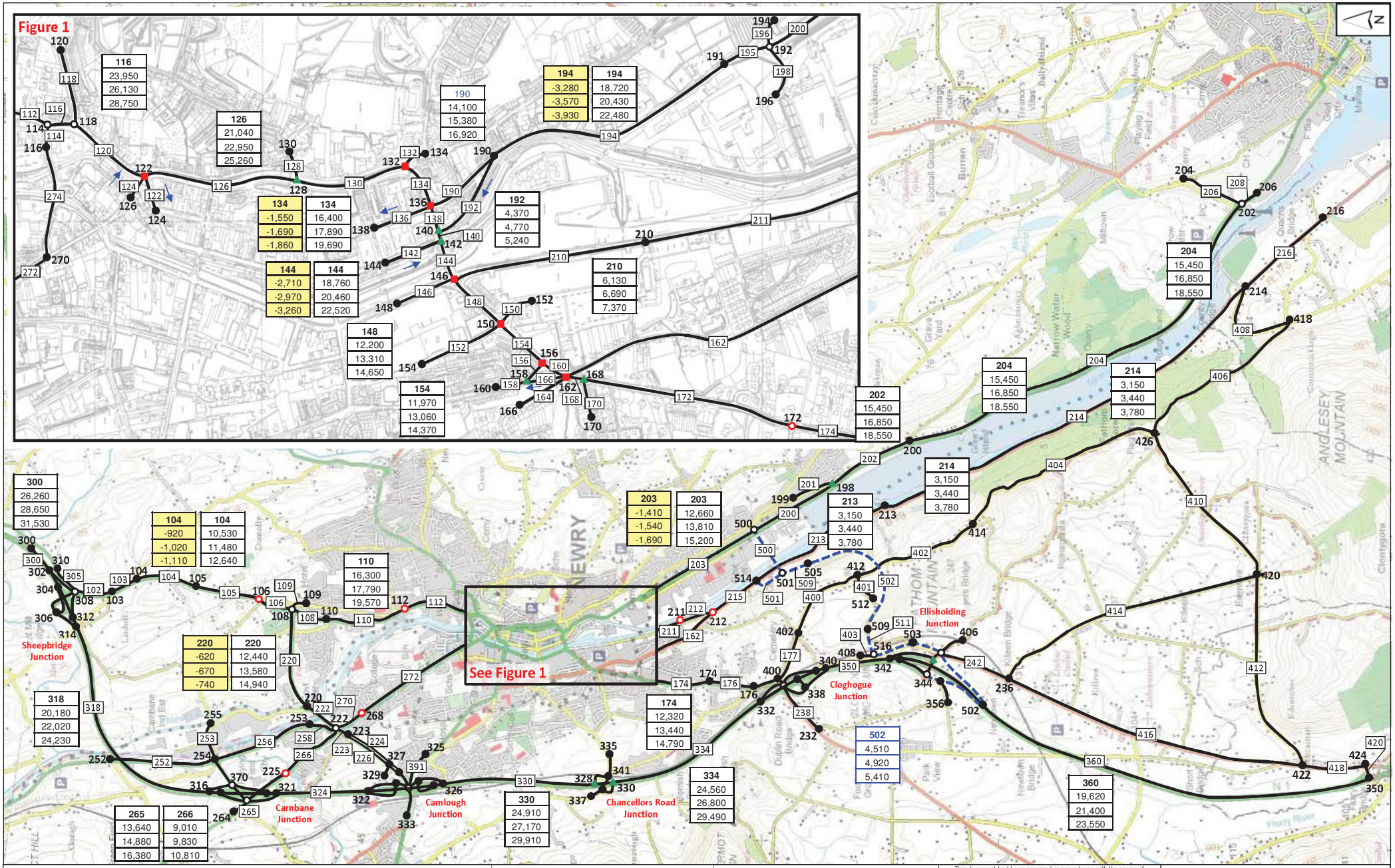

KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point
- 100 Node Number
- 100 Link Number
- Do-Minimum Link
- Do-Something Link

Link Ref.	Link Ref.
2015 Base Year (Equivalent)	2015 Flow Difference vs. Do-Minimum
2023 Opening Year	2023 Flow Difference vs. Do-Minimum
2037 Design Year	2037 Flow Difference vs. Do-Minimum

Project Title: NEWRY SOUTHERN RELIEF ROAD

Drawing Title: DO-SOMETHING NETWORK COBA MODELLED 24-HOUR TRAFFIC FLOWS CORRIDOR 5

Client: Department for Infrastructure | An Roinn Bonneagair

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AECOM Internal Project Number: 60472927

Figure 8.6.7

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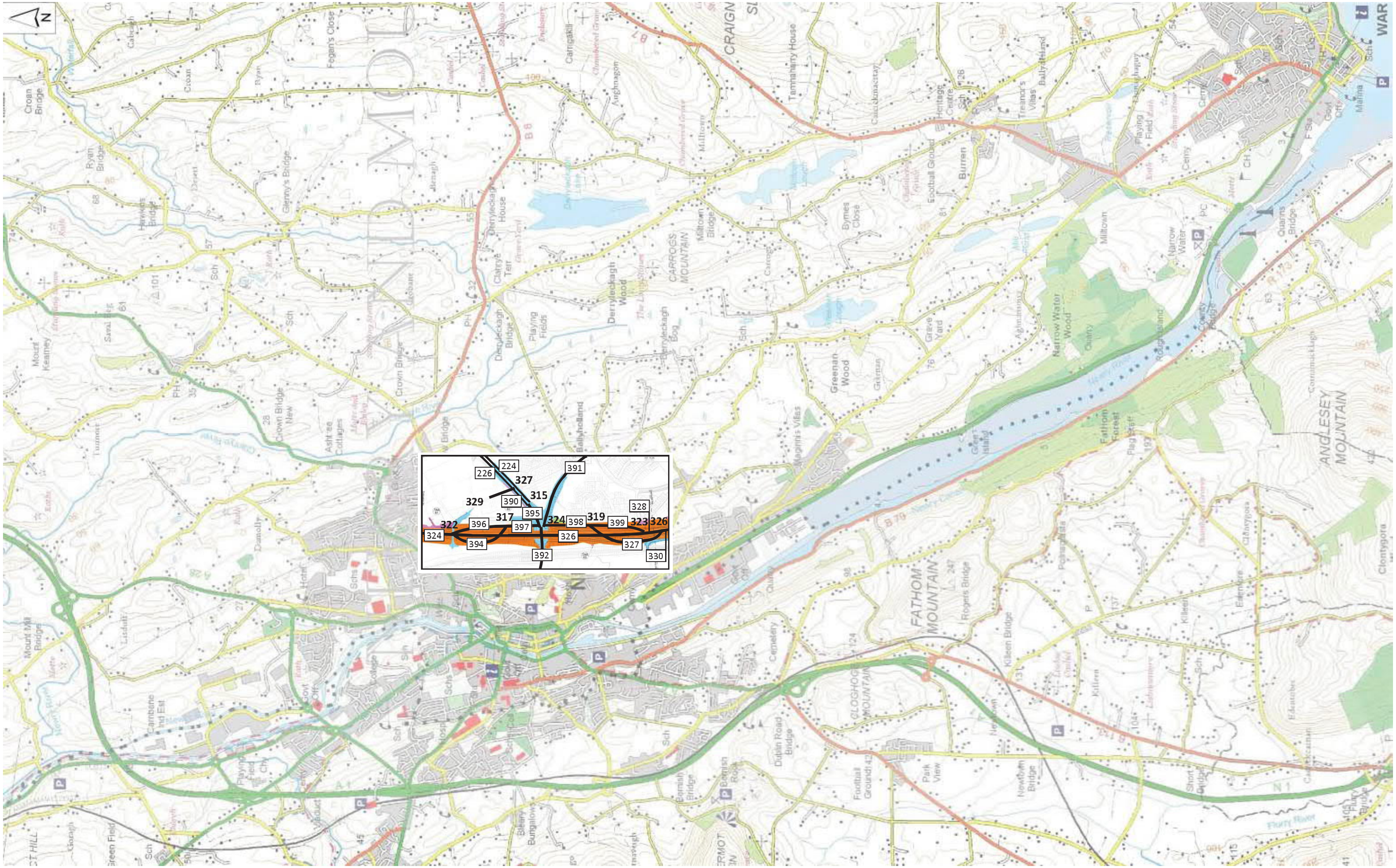
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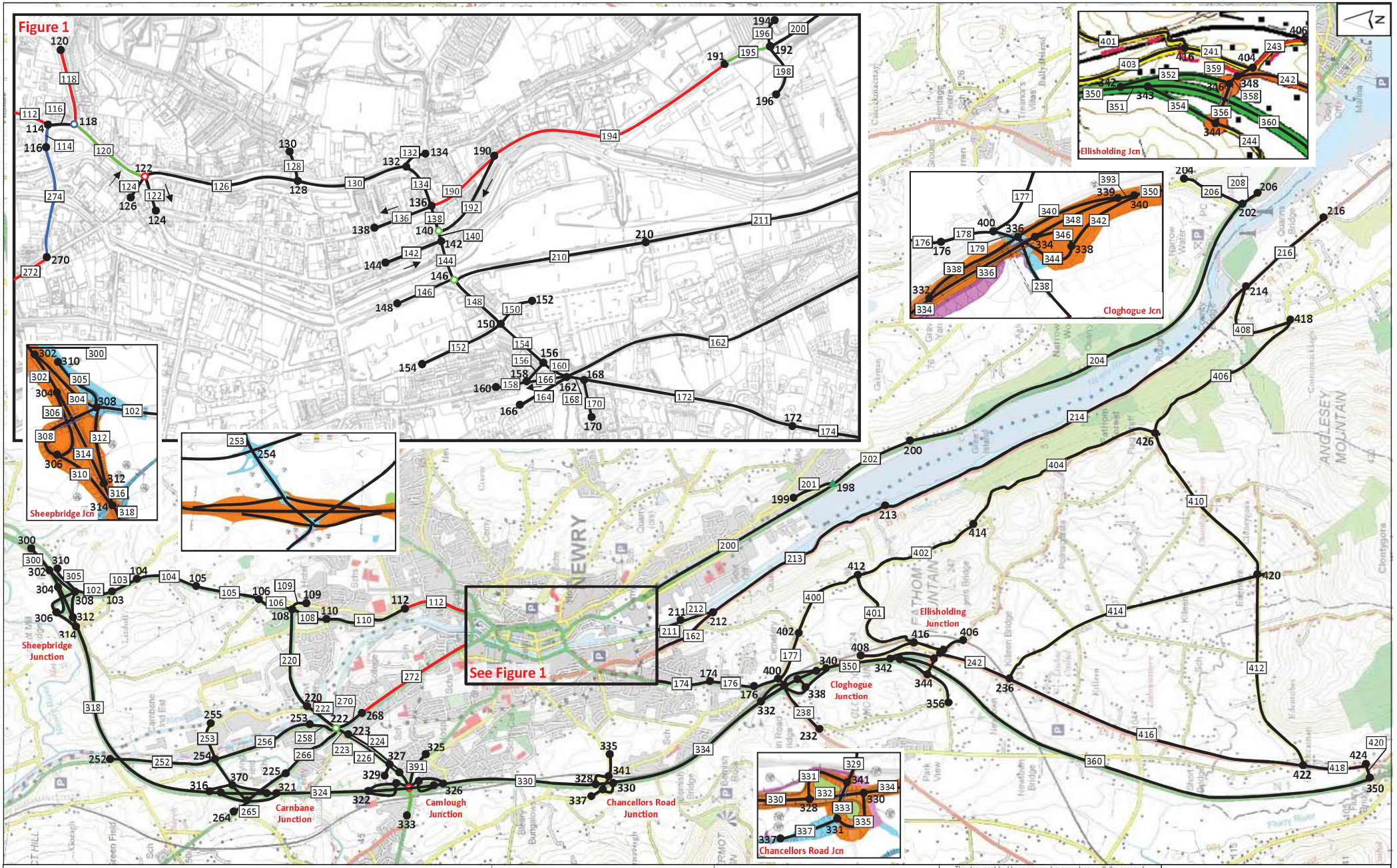

KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-MINIMUM NETWORK COBA OVER-CAPACITY LINKS AND JUNCTIONS		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.6.9

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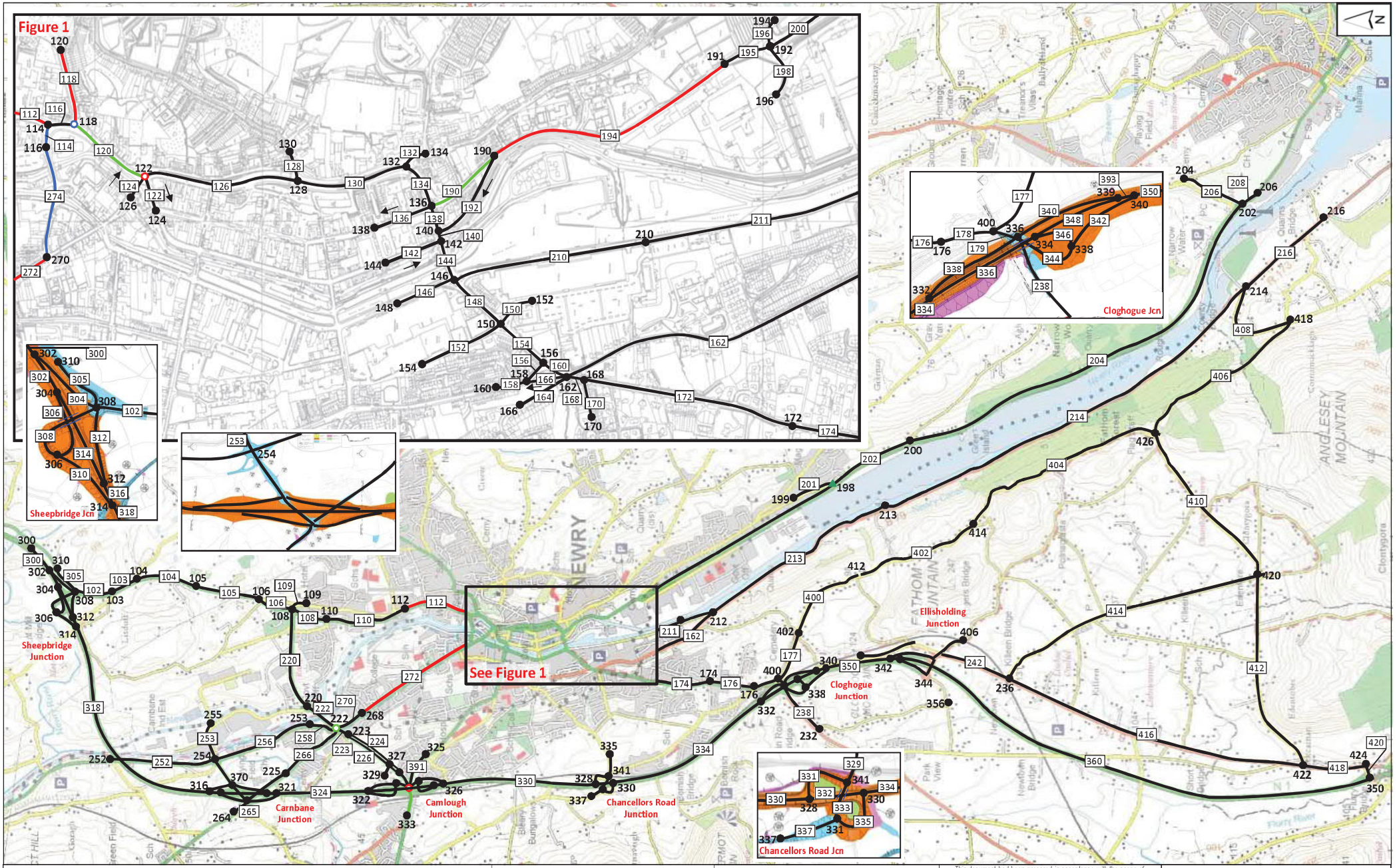

KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA OVER-CAPACITY LINKS AND JUNCTIONS CORRIDOR 1	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
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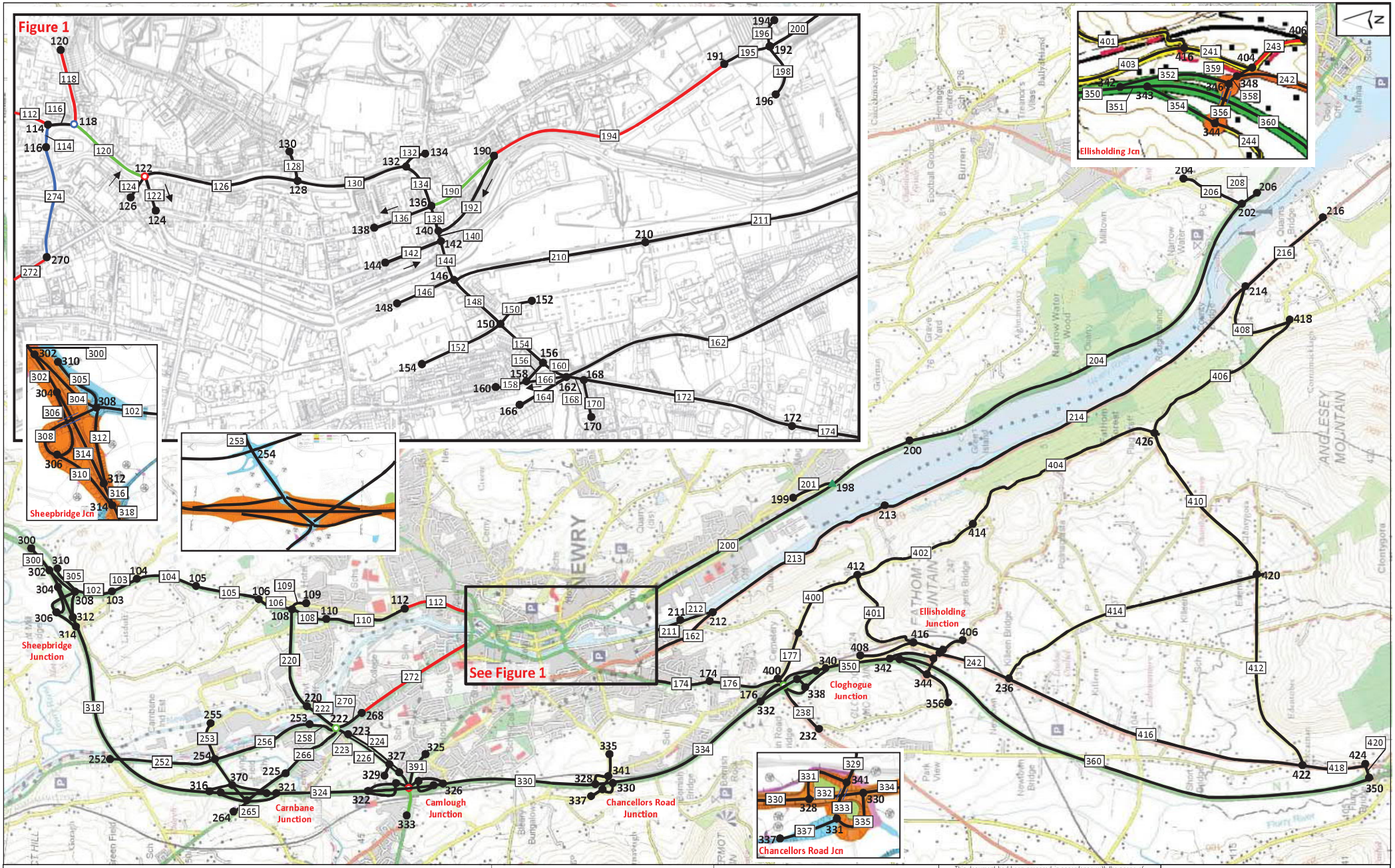

KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA OVER-CAPACITY LINKS AND JUNCTIONS CORRIDOR 2		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.6.11

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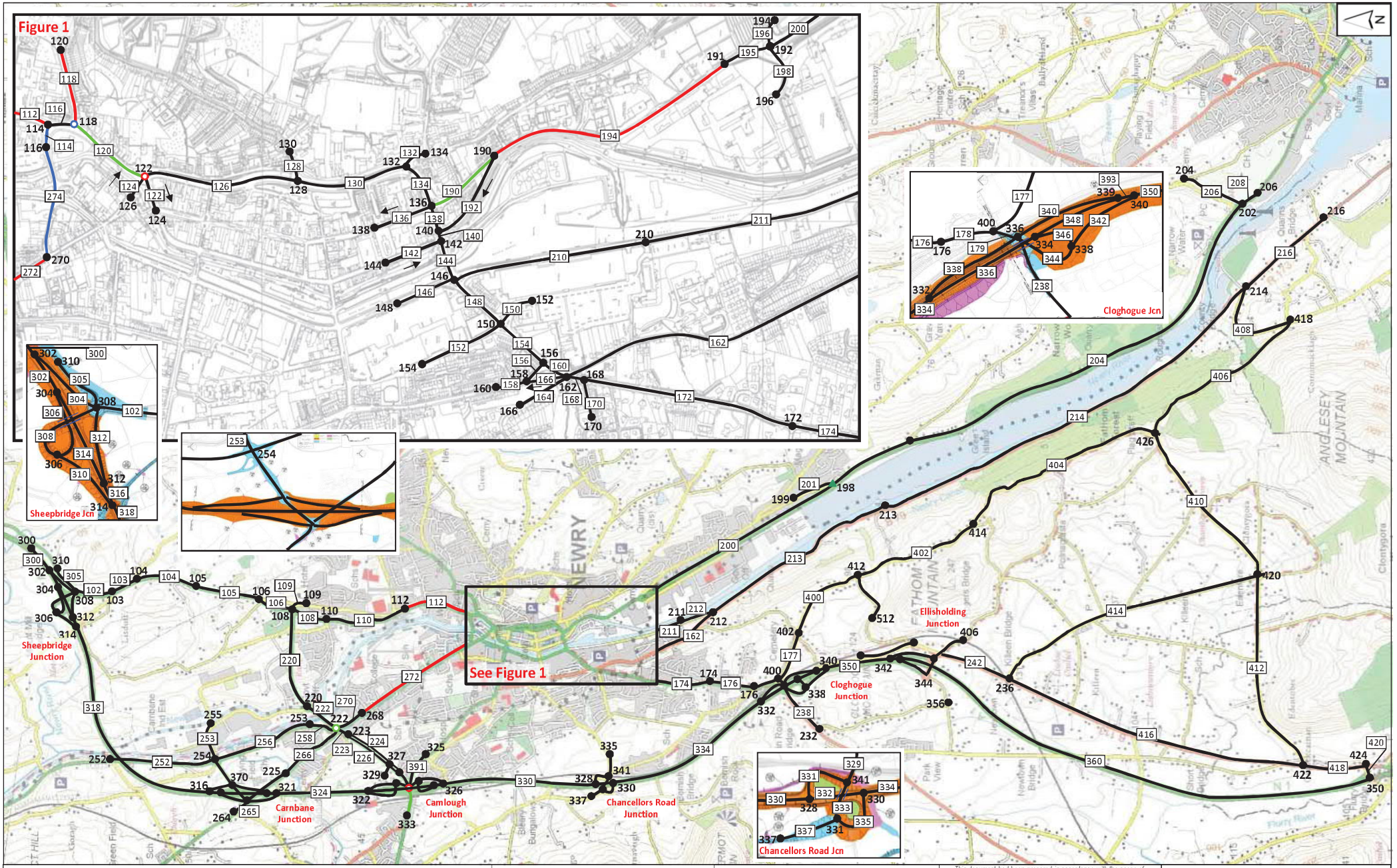

KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

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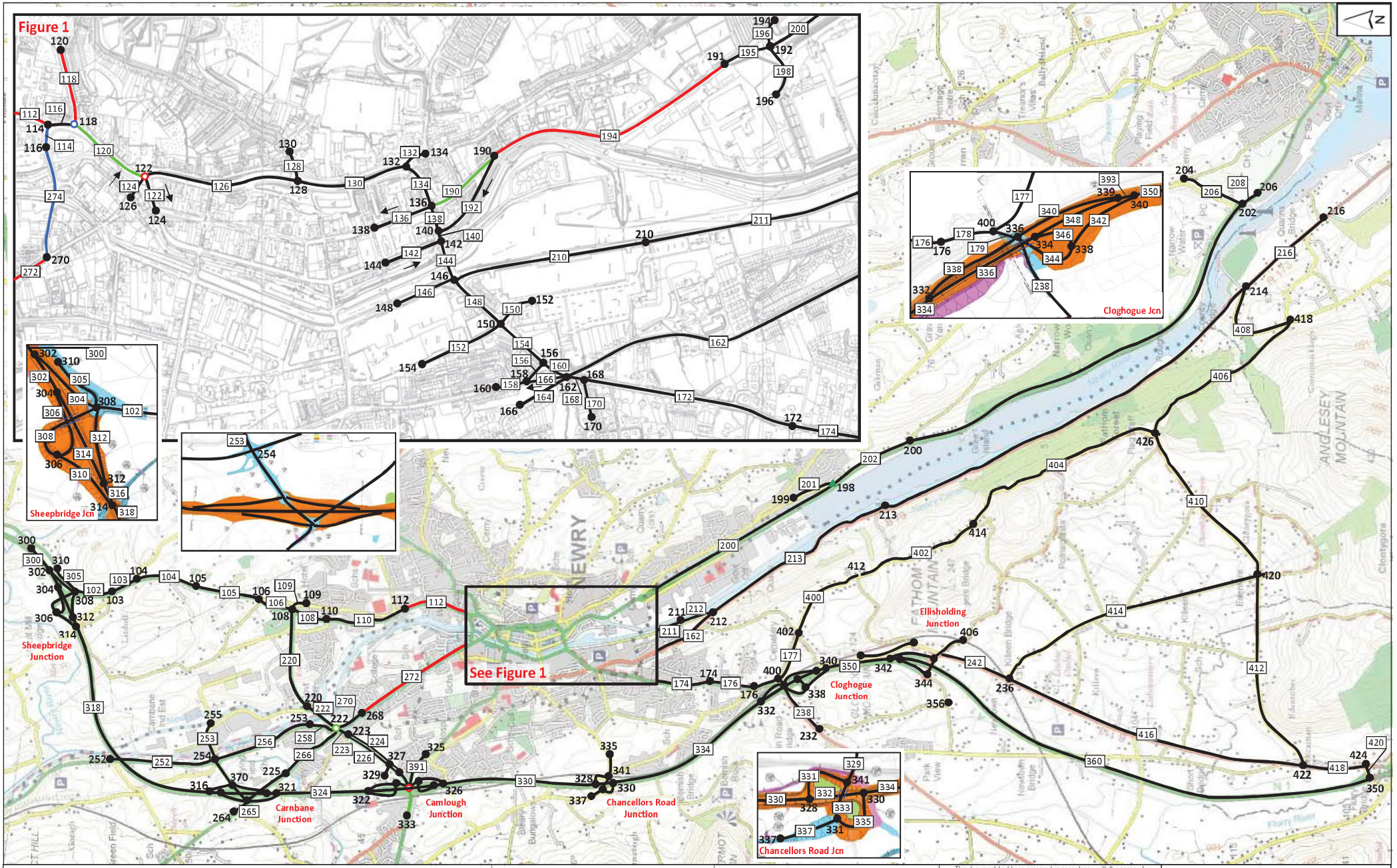
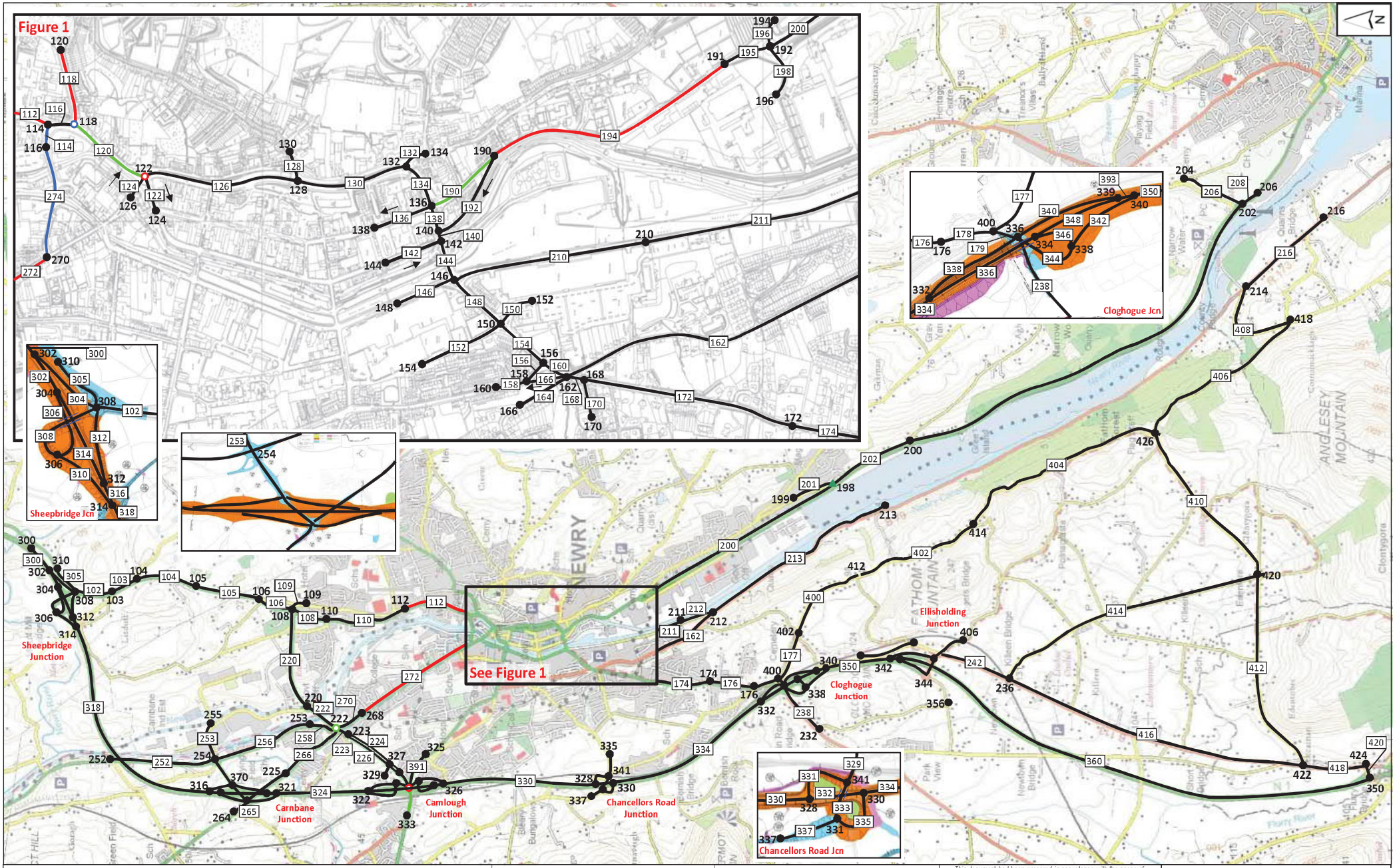


KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

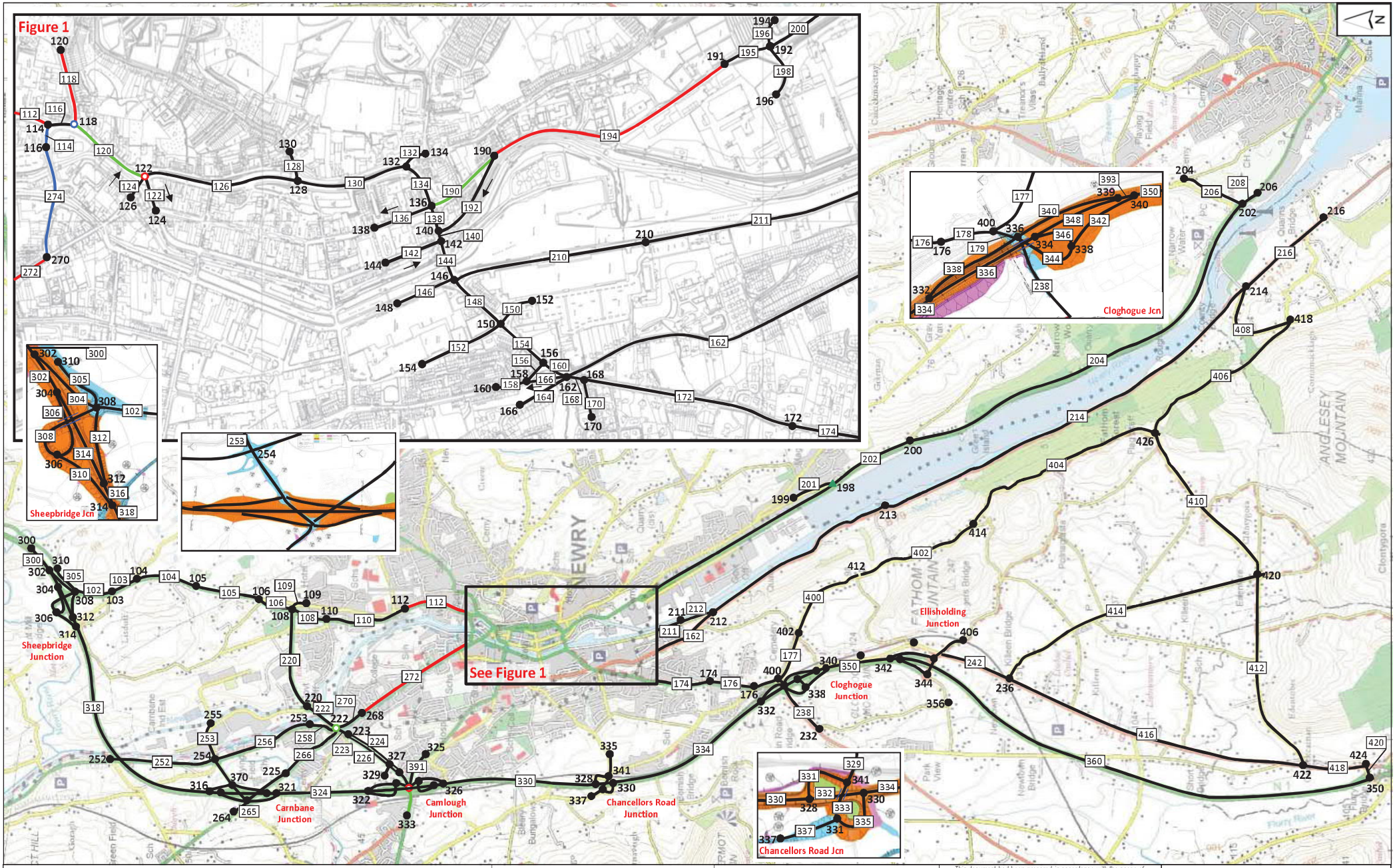
Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA OVER-CAPACITY LINKS AND JUNCTIONS CORRIDOR 4 – OPTION A	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
Client	Scale @ A3: NTS AECOM Internal Project Number: 60472927	Figure 8.6.13	



KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

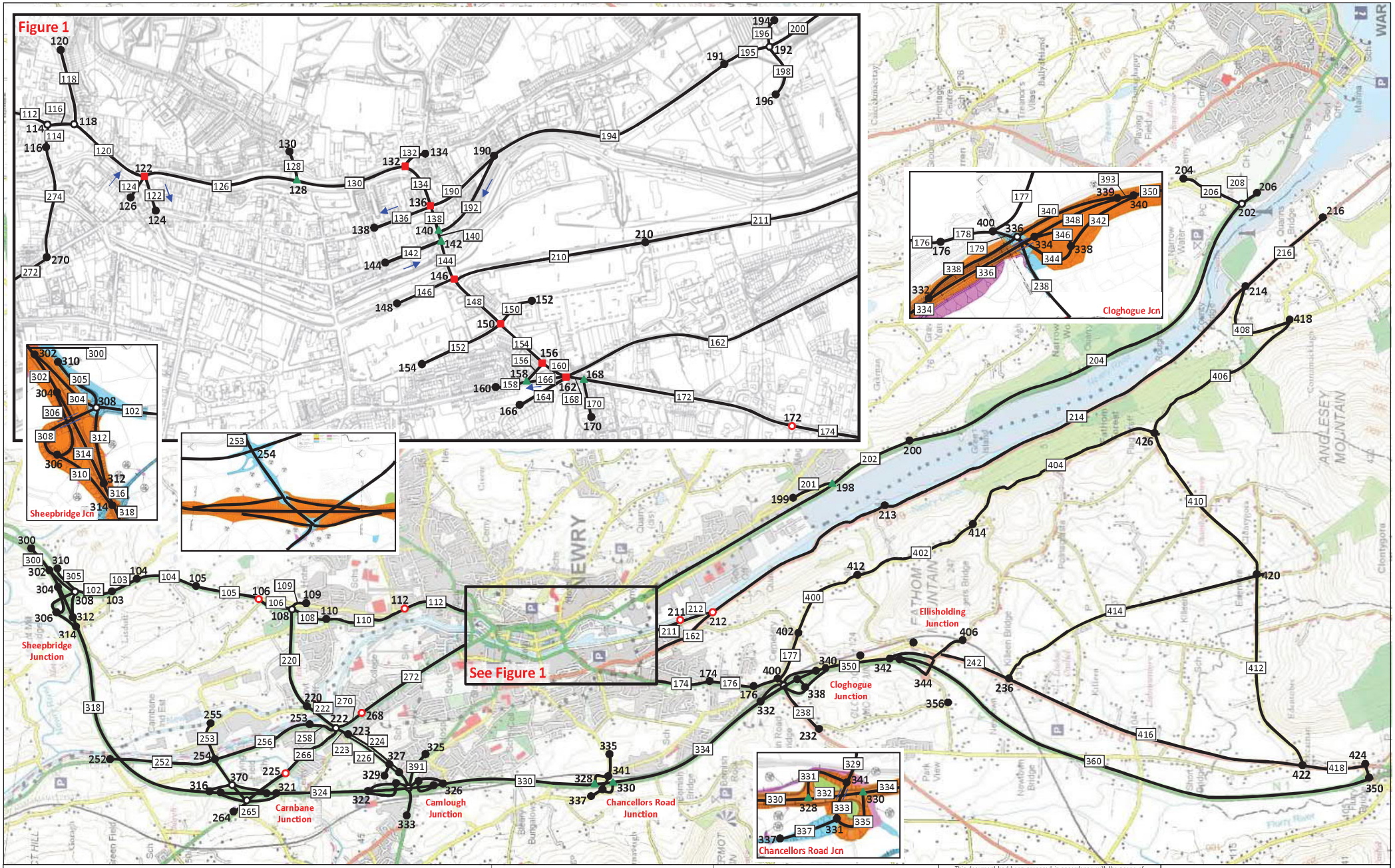
Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA OVER-CAPACITY LINKS AND JUNCTIONS CORRIDOR 4 – OPTION B	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
Client	Scale @ A3: NTS AECOM Internal Project Number: 60472927	Figure 8.6.14	



KEY

- Over-Capacity Link – 2015 Base Year
- Over-Capacity Link – 2023 Opening Year
- Over-Capacity Link – 2037 Design Year
- Over-Capacity Junction – 2015 Base Year
- Over-Capacity Junction – 2023 Opening Year
- Over-Capacity Junction – 2037 Design Year

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: DO-SOMETHING NETWORK COBA OVER-CAPACITY LINKS AND JUNCTIONS CORRIDOR 5	This document had been prepared in accordance with the scope of AECOM's appointment with its client and is subject to the terms of that appointment. AECOM accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided. Only written dimensions shall be used.	AECOM Infrastructure & Environment UK Limited Beechill House Beechill Road Belfast BT8 7RP T: +44 (0)28 9070 5111 www.aecom.com
Client	Scale @ A3: NTS AECOM Internal Project Number: 60472927	Figure 8.6.15	



KEY

- Node Point
- Roundabout
- Traffic Signals
- Priority Junction
- Speed Limit Change Point

100 Node Number
100 Link Number
Do-Minimum Link

Project Title: NEWRY SOUTHERN RELIEF ROAD	Drawing Title: GATE SENSITIVITY TEST COBA LINK AND NODE DIAGRAM DO-SOMETHING NETWORK: CORRIDOR 5		
Client	Scale @ A3: NTS	AECOM Internal Project Number: 60472927	Figure 8.9.1

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N

SCALE 1:25,000

0M 200M 500M 1000M 1500M 2000M

Project Title

NEWRY SOUTHERN
RELIEF ROAD

Client

Department for Infrastructure | An Roinn Bonneagair

Drawing Title

STAGE 1 SCHEME ASSESSMENT REPORT
CORRIDORS RECOMMENDED
FOR STAGE 2 ASSESSMENT

KEY

- Corridor 4
- Corridor 5
- CORRIDORS TAKEN FORWARD
- Corridor Study Area
- International Border

Scale @ A3
1:25,000

AECOM Internal Project Number
60472927

FIGURE 9.1.1

REV. 0

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Newry Southern Relief Road

Stage 1 Scheme Assessment Report Final
Appendix B

Project Number: 60472927

June 2017

Appendix B - Assessment Summary Tables (ASTs)

Newry Southern Relief Road - Corridor 1

Description – A 2.95km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £87.480m

Total Scheme Cost (Incl. 44% Optimism Bias) – £125.971m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
ENVIRONMENT	**Air Quality**	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Would likely attract the highest volume of traffic onto the relief road. Thus, it is reasonable to assume it would have the greatest potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, even though it would result in the highest number of sensitive receptors in close proximity. Would have no perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centreline: Centreline – 50m: 58 50-100m: 43 100-150m: 74 150-200m: 87 Total: 262	Slight Adverse – Slight Beneficial
	Cultural Heritage	Would have a Major Adverse magnitude of impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets, the southern extent of Newry Conservation Area and the setting of Cloghogue Cemetery. Corridor is not preferred as it brings any new road close to Newry and the Albert Basin and several other listed buildings at Cloghogue.	May impact upon four Industrial Heritage Record railway bridges on the GNR Main Line and may also impact upon the site of a former tobacco pipe factory at Cloghogue. Traverses a rural landscape with complex field patterns, areas of palaeoenvironmental potential and a channel associated with Newry Canal, and the southernmost extent of the Newry Area of Archaeological Potential. May impact upon the B+ listed Church of the Sacred Heart, Drumalane, and its associated B1 listed gates and walling.	Moderate Adverse
	Ecology & Nature Conservation	No direct impact upon designated ecological sites. Direct impact upon Newry River and Newry Canal minimised. Direct impact upon Cloghogue SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would not directly affect or be close to any long-established/ancient woodland.	N/A (Qualitative Assessment Only)	Moderate Adverse
	Landscape Effects	In terms of the bridge crossing, it may have less of a landscape impact as it would be within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area. However, there may be a potentially significant impact on southern views from the Dublin Road Bridge, the Albert Basin quay and promenade in Newry, through the river valley towards Carlingford Lough and Mountains. This corridor would rise up in cutting into the Ring of Gullion AONB to join into the Ellisholding Junction. The proximity of housing developments (visual receptors) close to this corridor as it climbs the western slope of the valley potentially increases the classification of visual sensitivity in this location.	N/A (Qualitative Assessment Only)	Landscape: Moderate Adverse Visual: Slight Adverse - Large Adverse
	Land Use	The number of properties at risk of demolition would be the highest of any of the corridors, which includes the loss of Newry Showgrounds. A comparatively high number of properties would also be at risk of losing private land. Would directly affect at least 7 planning applications. Would be partially within the Settlement	Number of properties at risk of demolition and associated landtake Residential Commercial (including Farms) Other TOTAL	Large Adverse

Newry Southern Relief Road - Corridor 1

Description – A 2.95km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £87.480m

Total Scheme Cost (Incl. 44% Optimism Bias) – £125.971m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment					Assessment
		Development Limit of Newry affecting and severing a major area of existing open space. Would directly affect the Newry Canal/River LLPA. Would directly affect two adjoining areas of land zoned for housing (Zoning NY 43 Drumalane Road / Fathom Line, and Zoning NY 59 Drumalane Road East). Would result in the linear loss of approximately 1.7km of agricultural land.	35	7	8	50		
	Noise & Vibration	Likely to have the most receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would have the greatest effect upon the noise environment of PROWs. Would have the steepest gradient (6%), over the longest distance. The longer the length of road at this gradient; the higher the potential there is for adverse noise impacts. Would require a significant degree of earthworks (cutting and embankments) and bridge works, thus its proximity to the more populous part of Newry would be least preferred.	Number of receptors within 300m of indicative alignment centreline:					Neutral – Large Adverse
			Centreline – 50m	50-100m	100-200m	200-300m	Total	
			58	43	161	282	544	
	Vehicle Travellers	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)					Views : Moderate – Large Beneficial Driver Stress: Slight – Moderate Beneficial
	Road Drainage & the Water Environment	Would not directly affect any designated or known shellfishery beds, nor would it directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would minimise the potential for establishment of preferential pathways and sediment release. Would be located within the Q_{100} floodplain which may affect the functionality of the road during an extreme flood event.	N/A (Qualitative Assessment Only)					Slight Adverse
	Geology & Soils	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. This area of geohazard instability would lie within this corridor. As the cause and extents of this instability is currently unknown, this corridor should be avoided from a geological perspective. Would potentially have the least impact on soils as a result of its location within urban and disturbed soil types, and the least impact on agricultural soils. Would have the greatest impact on potential contaminated soils/groundwater.	N/A (Qualitative Assessment Only)					Large Adverse
SAFETY	**Accidents**	Significant savings in the number of accidents and the number of serious and slight casualties due to the provision of a Newry Southern Relief Road to remove traffic from the heavily trafficked junctions on the urban road network within Newry City Centre, based on the application of national accident characteristics.	**Growth**	**Accidents**	**Deaths**	**Serious**	**Slight**	**Accidents PVB (Central Growth)**
			Central	202.9	0.0	14.7	258.1	£9.305m
ECONOMY	**Transport**	Significantly reduced peak and off-peak journey times on the road	**For the Opening Year:**			**Central Growth**		**TEE (Central Growth)**

Newry Southern Relief Road - Corridor 1

Description – A 2.95km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £87.480m

Total Scheme Cost (Incl. 44% Optimism Bias) – £125.971m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment		Assessment	
	Economic Efficiency	network in the 2023 year of opening compared to existing routes by avoiding the congested urban road network within Newry City Centre.	**Total Vehicle-Hours Saved (Two-Way):**	163,000	**Consumer PVB:**	£59.186m
			Peak Journey Time Change (Mins/Veh):	7.17 mins saved on strategic route Warrenpoint to / from Carrickcarnan 7.76 mins saved on strategic route Warrenpoint to / from Carnbane 5.52 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Business PVB:**	£42.612m
			Off-Peak Journey Time Change (Mins/Veh):	4.99 mins saved on strategic route Warrenpoint to / from Carrickcarnan 3.29 mins saved on strategic route Warrenpoint to / from Carnbane 1.25 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Private PVB:**	£0.138m
					ITR PVB:	£0.716m
					Emissions PVB:	-£0.199m
					Government Funding PVC:	**£70.543m**
	Reliability	Improved journey time reliability through the provision of a Newry Southern Relief Road to address acknowledged operational congestion through Newry City Centre.	N/A – Qualitative Assessment Only			
ACCESSIBILITY	**Pedestrians, Cyclists & Equestrians**	Would potentially have the greatest impact upon pedestrian facilities, crossing three alleged PROWs, (at Middlebank, Newry Embankment, and Hillhead Road), and crossing the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected, however may indirectly affect a private facility (Carlingford Horses) on the Hillhead Road. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)		Moderate Adverse – Slight Beneficial	
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however the relief of some of the traffic on the urban road network may improve access to community	N/A (Qualitative Assessment Only)		Slight Beneficial	

Newry Southern Relief Road - Corridor 1

Description – A 2.95km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £87.480m

Total Scheme Cost (Incl. 44% Optimism Bias) – £125.971m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		facilities, with a possible reduction in vehicular/pedestrian conflict due to the slight easing of congestion. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.		
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
INTEGRATION	**Transport Interchange**	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) the provision of a relief road to the south of Newry would provide an obvious benefit to the transport interchanges, particularly with regards to the potential for removal of a significant proportion of port-related HGV movements from the city centre road network.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Land-Use Planning	Conforms to policies in the RDS, RTS and RSTNTP. Specifically, the corridor would help achieve the strategic aims of the RDS (2035) and conforms to its specific regional guidance; to deliver a balanced approach to transport infrastructure. The corridor would help maximise the potential of the RSTN, by removing bottlenecks on the key road network where lack of capacity is causing congestion and improving the environment by providing bypasses, relieving the effects of heavy through traffic. The scheme is part of the Strategic Road Improvement Programme, and is currently in DfI's 10 year Forward Planning Schedule, as of April 2015. Scheme would however adversely affect a number of existing Area Plan designations.	N/A (Qualitative Assessment Only)	Moderate Adverse - Moderate Beneficial
	Other Government Policies	The scheme is supported by proposals contained within the Banbridge/Newry and Mourne Area Plan 2015 and the Newry City Masterplan, which in turn are largely in conformance with other Government Department Objectives for integrated transport.	N/A (Qualitative Assessment Only)	Moderate Beneficial

OVERALL ECONOMIC ASSESSMENT OF PROPOSED CORRIDOR 1 (INCLUDING ACCIDENT BENEFITS)	**CENTRAL GROWTH**	**PVC =**	£70.543m	**PVB =**	£111.758m	**NPV =**	£41.215m	**BCR =**	1.584

Newry Southern Relief Road - Corridor 2

Description – A 2.55km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £74.740m

Total Scheme Cost (Incl. 44% Optimism Bias) – £107.626m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
ENVIRONMENT	**Air Quality**	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 2 would likely attract the third highest volume of traffic onto the relief road, thus it is reasonable to assume the potential to improve local air quality conditions within the Newry (Urban Centre) AQMA is lessened and it would also result in the second highest number of sensitive receptors in close proximity. May have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centreline: Centreline – 50m: 19 50-100m: 58 100-150m: 110 150-200m: 74 Total: 261	Slight Adverse – Slight Beneficial
	Cultural Heritage	Would have a Major Adverse magnitude of impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets, historic woodland in Fathom Lower, and the setting of Cloghogue Cemetery. Corridor not preferred as it has the possibility of impacting Fathom House and its setting, as well as the listed church at Cloghogue.	May impact upon the B+ listed Church of the Sacred Heart, Drumalane, and its associated B1 listed gates and walling; and the B2 listed Sham Castle folly at Greenwood Park. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental potential and the possible site of the former Wellington Inn. May impact upon three Industrial Heritage Record railway bridges.	Moderate Adverse
	Ecology & Nature Conservation	Direct impact upon Carlingford Lough ASSI. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI, Maginnis Villas SLNCI and Cloghogue SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland.	N/A (Qualitative Assessment Only)	Moderate Adverse
	Landscape Effects	The bridge and embankment structure over the river /canal would make the road highly visible, and it is in proximity to many visual receptors. The steep topography within the AONB provides significant landscape constraints to this corridor. The proposed tie-in with a new roundabout at the A28 Dublin Road would have significant detrimental landscape and visual impacts on the designated Dublin Road LLPA. Potential to have a significant visual impact to the many adjacent receptors along this corridor.	N/A (Qualitative Assessment Only)	Landscape – Moderate Adverse - Large Adverse Visual – Moderate Adverse - Large Adverse

Newry Southern Relief Road - Corridor 2

Description – A 2.55km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £74.740m

Total Scheme Cost (Incl. 44% Optimism Bias) – £107.626m

<table>
<tr><th>Objective</th><th>Sub-Objective</th><th>Qualitative Impacts</th><th>Quantitative Assessment</th><th>Assessment</th></tr>
<tr><td></td><td>Land Use</td><td>13 properties would be at risk of demolition and associated landtake, which includes the loss of Cloghogue Pitch & Putt. A comparatively high number of properties would also be at risk of losing private land. Would directly affect at least 4 planning applications. Would be partially within the Settlement Development Limit of Newry. Would directly affect the Newry Canal/River LLPA and Dublin Road LLPA. Would directly affect Maginnis Villas SLNCI and Fathom Lower Woods and Grasslands SLNCI. Would result in the linear loss of approximately 1.4km of agricultural land.</td><td>Number of properties at risk of demolition and associated landtake
<table><tr><td>Residential</td><td>Commercial (including Farms)</td><td>Other</td><td>TOTAL</td></tr><tr><td>10</td><td>1</td><td>2</td><td>13</td></tr></table></td><td>Moderate Adverse</td></tr>
<tr><td></td><td>Noise & Vibration</td><td>Would have the second highest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors.
Would have the greatest effect upon the noise environment of PROWs.
Would require a significant degree of earthworks (cutting and embankments) and bridge works, thus its proximity to the more populous part of Newry would be least preferred.</td><td>Number of receptors within 300m of indicative alignment centreline:
<table><tr><td>Centreline – 50m</td><td>50-100m</td><td>100-200m</td><td>200-300m</td><td>Total</td></tr><tr><td>19</td><td>58</td><td>184</td><td>163</td><td>424</td></tr></table></td><td>Slight Adverse – Large Adverse</td></tr>
<tr><td></td><td>Vehicle Travellers</td><td>New and interesting views would be opened-up.
Currently, driver stress levels through the affected part of Newry are considered to be ‘High’, and would be expected to reduce on completion of the scheme.</td><td>N/A
(Qualitative Assessment Only)</td><td>Views : Moderate Beneficial
Driver Stress: Moderate Beneficial</td></tr>
<tr><td></td><td>Road Drainage & the Water Environment</td><td>Would not directly affect any designated or known shellfishery beds; however it would directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release.
Would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify).
The Bensons Glen Fish Hatchery may be directly affected.</td><td>N/A
(Qualitative Assessment Only)</td><td>Moderate Adverse</td></tr>
<tr><td></td><td>Geology & Soils</td><td>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. This area of geohazard instability would lie within this corridor. As the cause and extents of this instability is currently unknown, this corridor should be avoided from a geological perspective.
Would potentially have a lesser impact on soils as a result of it being partially within urban and disturbed soil types and would have the least impact on agricultural soils. Its partial location with the urban area would increase the potential to encounter contaminated soils/groundwater.</td><td>N/A
(Qualitative Assessment Only)</td><td>Large Adverse</td></tr>
</table>

Newry Southern Relief Road - Corridor 2

Description – A 2.55km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £74.740m

Total Scheme Cost (Incl. 44% Optimism Bias) – £107.626m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment					Assessment	
SAFETY	**Accidents**	Significant savings in the number of accidents and the number of serious and slight casualties due to the provision of a Newry Southern Relief Road to remove traffic from the heavily trafficked junctions on the urban road network within Newry City Centre, based on the application of national accident characteristics.	**Growth**	**Accidents**	**Deaths**	**Serious**	**Slight**	**Accidents PVB (Central Growth)**	
			Central	181.8	0.3	14.3	232.3	£8.680m	
ECONOMY	**Transport Economic Efficiency**	Significantly reduced peak and off-peak journey times on the road network in the 2023 year of opening compared to existing routes by avoiding the congested urban road network within Newry City Centre.	**For the Opening Year:**			**Central Growth**		**TEE (Central Growth)**	
			Total Vehicle-Hours Saved (Two-Way):			137,000		**Consumer PVB:**	£52.714m
			Peak Journey Time Change (Mins/Veh):			7.22 mins saved on strategic route Warrenpoint to / from Carrickcarnan 9.40 mins saved on strategic route Warrenpoint to / from Carnbane 7.17 mins saved on strategic route Warrenpoint to / from Sheepbridge		**Business PVB:**	£37.941m
			Off-Peak Journey Time Change (Mins/Veh):			5.36 mins saved on strategic route Warrenpoint to / from Carrickcarnan 5.27 mins saved on strategic route Warrenpoint to / from Carnbane 3.25 mins saved on strategic route Warrenpoint to / from Sheepbridge		**Private PVB:**	£0.287m
								ITR PVB:	-£0.628m
								Emissions PVB:	£0.162m
								Government Funding PVC:	**£60.288m**
	Reliability	Improved journey time reliability through the provision of a Newry Southern Relief Road to address acknowledged operational congestion through Newry City Centre.	N/A – Qualitative Assessment Only						
ACCESSIBILITY	**Pedestrians, Cyclists & Equestrians**	Would potentially affect two alleged PROWs, (at Middlebank, and Hillhead Road), and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall	N/A (Qualitative Assessment Only)					Slight Adverse – Slight Beneficial	

Newry Southern Relief Road - Corridor 2

Description – A 2.55km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £74.740m

Total Scheme Cost (Incl. 44% Optimism Bias) – £107.626m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		reduction in rat-running.		
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
INTEGRATION	**Transport Interchange**	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) the provision of a relief road to the south of Newry would provide an obvious benefit to the transport interchanges, particularly with regards to the potential for removal of a significant proportion of port-related HGV movements from the city centre road network.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Land-Use Planning	Conforms to policies in the RDS, RTS and RSTNTP. Specifically, the corridor would help achieve the strategic aims of the RDS (2035) and conforms to its specific regional guidance; to deliver a balanced approach to transport infrastructure. The corridor would help maximise the potential of the RSTN, by removing bottlenecks on the key road network where lack of capacity is causing congestion and improving the environment by providing bypasses, relieving the effects of heavy through traffic. The scheme is part of the Strategic Road Improvement Programme, and is currently in DfI's 10 year Forward Planning Schedule, as of April 2015. Scheme would however adversely affect a number of existing Area Plan designations.	N/A (Qualitative Assessment Only)	Slight Adverse - Moderate Beneficial
	Other Government Policies	The scheme is supported by proposals contained within the Banbridge/Newry and Mourne Area Plan 2015 and the Newry City Masterplan, which in turn are largely in conformance with other Government Department Objectives for integrated transport.	N/A (Qualitative Assessment Only)	Moderate Beneficial

OVERALL ECONOMIC ASSESSMENT OF CORRIDOR 2	CENTRAL GROWTH	PVC =	£60.288m	PVB =	£99.156m	NPV =	£38.868m	BCR =	1.645

Newry Southern Relief Road - Corridor 2

Description – A 2.55km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £74.740m

Total Scheme Cost (Incl. 44% Optimism Bias) – £107.626m

Objective	Sub-Objective	Qualitative Impacts				Quantitative Assessment			Assessment	
(INCLUDING ACCIDENT BENEFITS)										

Newry Southern Relief Road - Corridor 3

Description – A 3.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £95.249m

Total Scheme Cost (Incl. 44% Optimism Bias) – £137.159m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
ENVIRONMENT	**Air Quality**	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 3 would likely attract the fourth highest volume of traffic onto the relief road. Thus, it is reasonable to assume the potential to improve local air quality conditions within the Newry (Urban Centre) AQMA would be lessened, though it would result in the second lowest number of sensitive receptors in close proximity. May have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centreline: Centreline – 50m: 16 50-100m: 10 100-150m: 13 150-200m: 16 Total: 55	Slight Adverse – Slight Beneficial
	Cultural Heritage	Adverse impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings including the B1 listed Fathom House and the B2 listed Sham Castle folly, non-designated heritage assets, and historic woodland at Fathom, Greenan and north of Narrow Water. Corridor is preferred, providing that impacts to the setting of sites can be minimised.	May impact upon the B2 listed Belvedere Tower, an Industrial Heritage Record railway bridge, a quay and a lock house on the Newry Canal, and historic woodland in Fathom Lower. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential and the possible site of the former Wellington Inn.	Slight Adverse
	Ecology & Nature Conservation	Direct impact upon Carlingford Lough ASSI. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI, Maginnis Villas SLNCI and Narrow Water Forest SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland, with some significant losses expected.	N/A (Qualitative Assessment Only)	Moderate Adverse
	Landscape Effects	The high level bridge structure and associated earthworks and infrastructure either side of the valley would have a significant impact upon an LLPA and Ring of Gullion AONB. There would also inevitably be a much greater zone of visual influence, and would be highly visible from a greater distance than the lower level corridors, and in turn would have a greater impact on surrounding receptors. Whether that is assessed as adverse or beneficial is a subjective assessment and would largely depend on the architectural design of the bridge structure.	N/A (Qualitative Assessment Only)	Landscape – Moderate Adverse Visual – Moderate Adverse – Large Adverse
	Land Use	12 properties would be at risk of demolition and associated	Number of properties at risk of demolition and associated landtake	Moderate Adverse

Newry Southern Relief Road - Corridor 3

Description – A 3.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £95.249m

Total Scheme Cost (Incl. 44% Optimism Bias) – £137.159m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment					Assessment
		landtake. A comparatively low number of properties would also be at risk of losing private land. Would directly affect at least 3 planning applications. Would not affect the Settlement Development Limit of Newry. Would directly affect Warrenpoint Road / Greenan Road LLPA, Maginnis Villas SLNCI and Fathom Lower Woods and Grasslands SLNCI, including affecting parcels of long-established and possibly ancient woodland. Would result in the linear loss of approximately 1.8km of agricultural land.	Residential	Commercial (including Farms)	Other	TOTAL		
			9	2	1	12		
	Noise & Vibration	Would have the second lowest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred.	Number of receptors within 300m of indicative alignment centreline:					Slight to Moderate Adverse
			Centreline – 50m	50-100m	100-200m	200-300m	Total	
			16	10	29	78	133	
	Vehicle Travellers	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)					Views : Large Beneficial Driver Stress: Moderate Beneficial
	Road Drainage & the Water Environment	Would not directly affect any designated or known shellfishery beds; however would it directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release. Would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The feeder stream to Bensons Glen Fish Hatchery would be directly affected.	N/A (Qualitative Assessment Only)					Moderate Adverse
	Geology & Soils	Would potentially have a greater impact on soils as a result of its rural location and the associated affected soil types, with a greater impact on agricultural soils. Would have a lower potential to impact on contaminated soils/groundwater.	N/A (Qualitative Assessment Only)					Slight Adverse
SAFETY	**Accidents**	Significant savings in the number of accidents and the number of serious and slight casualties due to the provision of a Newry Southern Relief Road to remove traffic from the heavily trafficked junctions on the urban road network within Newry City Centre, based on the application of national accident characteristics.	**Growth**	**Accidents**	**Deaths**	**Serious**	**Slight**	**Accidents PVB (Central Growth)**
			Central	161.6	0.2	12.5	207.5	£7.636m
ECONOMY	**Transport**	Significantly reduced peak and off-peak journey times on the	**For the Opening Year:**			**Central Growth**		**TEE (Central Growth)**

Newry Southern Relief Road - Corridor 3	**Description** – A 3.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor	**Main Constraints –** The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.	**Total Scheme Cost (Excl. Optimism Bias) – £95.249m** **Total Scheme Cost (Incl. 44% Optimism Bias) – £137.159m**

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment		Assessment	
	Economic Efficiency	road network in the 2023 year of opening compared to existing routes by avoiding the congested urban road network within Newry City Centre.	**Total Vehicle-Hours Saved (Two-Way):**	162,000	**Consumer PVB:**	£61.279m
			Peak Journey Time Change (Mins/Veh):	8.97 mins saved on strategic route Warrenpoint to / from Carrickcarnan 9.57 mins saved on strategic route Warrenpoint to / from Carnbane 7.33 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Business PVB:**	£43.427m
			Off-Peak Journey Time Change (Mins/Veh):	6.74 mins saved on strategic route Warrenpoint to / from Carrickcarnan 5.05 mins saved on strategic route Warrenpoint to / from Carnbane 3.02 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Private PVB:**	£0.346m
					ITR PVB:	-£0.688m
					Emissions PVB:	£0.173m
					Government Funding PVC:	**£76.781m**
	Reliability	Improved journey time reliability through the provision of a Newry Southern Relief Road to address acknowledged operational congestion through Newry City Centre.	N/A – Qualitative Assessment Only			
ACCESSIBILITY	**Pedestrians, Cyclists & Equestrians**	Would potentially affect one alleged PROW (at Middlebank) and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)		Slight Adverse – Slight Beneficial	
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider	N/A (Qualitative Assessment Only)		Slight Beneficial	

Newry Southern Relief Road - Corridor 3

Description – A 3.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £95.249m

Total Scheme Cost (Incl. 44% Optimism Bias) – £137.159m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.		
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
INTEGRATION	**Transport Interchange**	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) the provision of a relief road to the south of Newry would provide an obvious benefit to the transport interchanges, particularly with regards to the potential for removal of a significant proportion of port-related HGV movements from the city centre road network.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Land-Use Planning	Conforms to policies in the RDS, RTS and RSTNTP. Specifically, the corridor would help achieve the strategic aims of the RDS (2035) and conforms to its specific regional guidance; to deliver a balanced approach to transport infrastructure. The corridor would help maximise the potential of the RSTN, by removing bottlenecks on the key road network where lack of capacity is causing congestion and improving the environment by providing bypasses, relieving the effects of heavy through traffic. The scheme is part of the Strategic Road Improvement Programme, and is currently in DfI's 10 year Forward Planning Schedule, as of April 2015.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Other Government Policies	The scheme is supported by proposals contained within the Banbridge/Newry and Mourne Area Plan 2015 and the Newry City Masterplan, which in turn are largely in conformance with other Government Department Objectives for integrated transport.	N/A (Qualitative Assessment Only)	Moderate Beneficial

OVERALL ECONOMIC ASSESSMENT OF CORRIDOR 3 (INCLUDING ACCIDENT BENEFITS)	**CENTRAL GROWTH**	**PVC =**	£76.781m	**PVB =**	£112.172m	**NPV =**	£35.392m	**BCR =**	1.461

Newry Southern Relief Road - Corridor 4 (Option A)

Description – A 3.75km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £88.862m

Total Scheme Cost (Incl. 44% Optimism Bias) – £127.962m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
ENVIRONMENT	**Air Quality**	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 4 would likely attract the lowest volume of traffic onto the relief road. Thus, it is reasonable it would have the least potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, though it would result in the lowest number of sensitive receptors in close proximity. Is likely to have a perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centreline: Centreline – 50m: 9 50-100m: 15 100-150m: 14 150-200m: 7 Total: 45	Slight Adverse – Slight Beneficial
	Cultural Heritage	Major Adverse magnitude of impact upon heritage assets, including the Scheduled Newry Canal, May impact upon the setting of Narrow Water Castle demesne, the State Care and Grade A listed Narrow Water Castle and its associated listed and non-designated buildings; B1 listed Fathom House; and a listed house at Cornamucklagh. May impact upon the setting of a range of non-designated archaeological sites and Industrial Heritage Record sites, including railway bridges, a quay and canal locks associated with the Scheduled Newry Canal, and navigation beacons at Narrow Water.	May impact upon the B2 listed Belvedere Tower. Undesignated sites that may be impacted include a battle site and a group of four tree ring sites; two bridges and four sites associated with the Newry Canal in Fathom Upper; and extensive areas of historic woodland at Fathom. The corridor traverses a rural and wooded landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential, and the possible site of the former Wellington Inn.	Moderate Adverse
	Ecology & Nature Conservation	Direct impact upon Carlingford Lough ASSI. Closest proximity to Carlingford Lough SAC/SPA. Fathom Upper ASSI in close proximity. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI and Narrow Water Forest SLNCI. Largely traverses a mix of forestry and agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland and possibly ancient woodland, with some significant losses expected.	N/A (Qualitative Assessment Only)	Large Adverse
	Landscape Effects	Slight encroachment into Mourne AONB, though the corridor would have a significant impact on the Ring of Gullion AONB, resulting in significant loss of vegetation in combination with major earthworks on the western valley side. However, the road would follow contours as much as possible. The bridge crossing would have the potential to divide the river basin and indeed the overall river valley into two parts by creating a strong visual and physical barrier when viewed from the A2.	N/A (Qualitative Assessment Only)	Landscape –Large Adverse Visual – Moderate Adverse

Newry Southern Relief Road - Corridor 4 (Option A)

Description – A 3.75km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £88.862m

Total Scheme Cost (Incl. 44% Optimism Bias) – £127.962m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		The lack of receptors would minimise visual impacts over this section of the corridor.		
	Land Use	9 properties would be at risk of demolition and associated landtake. Would result in the least number of properties at risk of losing private land. Would directly affect at least 4 planning applications. Would not affect the Settlement Development Limit of Newry. Would directly affect Narrow Water Forest SLNCI and Fathom Lower Woods & Grasslands SLNCI, including affecting parcels of long-established and possibly ancient woodland. Would result in the linear loss of approximately 1.8km of agricultural land. Of all the corridors under consideration, only Corridor 4 would result in the loss of land from any DAERA – Forest Service plantation woodlands.	Number of properties at risk of demolition and associated landtake Residential: 7 / Commercial (including Farms): 2 / Other: 0 / TOTAL: 9	Large Adverse
	Noise & Vibration	Would have the lowest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred. Would have the greatest effect upon designated ecological sites.	Number of receptors within 300m of indicative alignment centreline: Centreline – 50m: 9 / 50-100m: 15 / 100-200m: 21 / 200-300m: 38 / Total: 83	Slight - Moderate Adverse
	Vehicle Travellers	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)	Views : Moderate Beneficial Driver Stress: Moderate Beneficial
	Road Drainage & the Water Environment	Would not directly affect any designated or known shellfishery beds but would be located in closest proximity to them at Narrow Water. It would also directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release. Would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The feeder stream to Bensons Glen Fish Hatchery would be directly affected.	N/A (Qualitative Assessment Only)	Moderate Adverse
	Geology & Soils	Would potentially have a greater impact on soils as a result of its rural location and affect associated soil types. Would have a greater impact on agricultural soils. Would have a lower potential impact on contaminated soils/groundwater.	N/A (Qualitative Assessment Only)	Slight Adverse
SAFETY	**Accidents**	Significant savings in the number of accidents and the number of	**Growth / Accidents / Deaths / Serious / Slight**	**Accidents PVB (Central Growth)**

Newry Southern Relief Road - Corridor 4 (Option A)

Description – A 3.75km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £88.862m

Total Scheme Cost (Incl. 44% Optimism Bias) – £127.962m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment					Assessment	
		serious and slight casualties due to the provision of a Newry Southern Relief Road to remove traffic from the heavily trafficked junctions on the urban road network within Newry City Centre, based on the application of national accident characteristics.	Central	162.2	0.1	12.1	208.5	£7.521m	
ECONOMY	**Transport Economic Efficiency**	Significantly reduced peak and off-peak journey times on the road network in the 2023 year of opening compared to existing routes by avoiding the congested urban road network within Newry City Centre.	**For the Opening Year:**			**Central Growth**		**TEE (Central Growth)**	
			Total Vehicle-Hours Saved (Two-Way):			150,000		**Consumer PVB:**	£58.353m
			Peak Journey Time Change (Mins/Veh):			8.67 mins saved on strategic route Warrenpoint to / from Carrickcarnan 9.27 mins saved on strategic route Warrenpoint to / from Carnbane 7.03 mins saved on strategic route Warrenpoint to / from Sheepbridge		**Business PVB:**	£41.461m
			Off-Peak Journey Time Change (Mins/Veh):			6.46 mins saved on strategic route Warrenpoint to / from Carrickcarnan 4.77 mins saved on strategic route Warrenpoint to / from Carnbane 2.74 mins saved on strategic route Warrenpoint to / from Sheepbridge		**Private PVB:**	£0.391m
								ITR PVB:	-£0.980m
								Emissions PVB:	£0.251m
								Government Funding PVC:	**£71.750m**
	Reliability	Improved journey time reliability through the provision of a Newry Southern Relief Road to address acknowledged operational congestion through Newry City Centre.	N/A – Qualitative Assessment Only						
ACCESSIBILITY	**Pedestrians, Cyclists & Equestrians**	Would potentially affect two alleged PROWs, (at Middlebank, and Hillhead Road), and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)					Slight Adverse – Slight Beneficial	

Newry Southern Relief Road - Corridor 4 (Option A)

Description – A 3.75km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £88.862m

Total Scheme Cost (Incl. 44% Optimism Bias) – £127.962m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.	N/A (Qualitative Assessment Only)	Slight Beneficial
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
INTEGRATION	**Transport Interchange**	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) the provision of a relief road to the south of Newry would provide an obvious benefit to the transport interchanges, particularly with regards to the potential for removal of a significant proportion of port-related HGV movements from the city centre road network.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Land-Use Planning	Conforms to policies in the RDS, RTS and RSTNTP. Specifically, the corridor would help achieve the strategic aims of the RDS (2035) and conforms to its specific regional guidance; to deliver a balanced approach to transport infrastructure. The corridor would help maximise the potential of the RSTN, by removing bottlenecks on the key road network where lack of capacity is causing congestion and improving the environment by providing bypasses, relieving the effects of heavy through traffic. The scheme is part of the Strategic Road Improvement Programme, and is currently in DfI's 10 year Forward Planning Schedule, as of April 2015. Extensive woodland loss.	N/A (Qualitative Assessment Only)	Moderate Adverse - Moderate Beneficial
	Other Government Policies	The scheme is supported by proposals contained within the Banbridge/Newry and Mourne Area Plan 2015 and the Newry City Masterplan, which in turn are largely in conformance with other Government Department Objectives for integrated transport.	N/A (Qualitative Assessment Only)	Moderate Beneficial

OVERALL ECONOMIC ASSESSMENT OF CORRIDOR 4, OPTION A (INCLUDING ACCIDENT BENEFITS)	**CENTRAL GROWTH**	**PVC =**	£71.750m	**PVB =**	£106.997m	**NPV =**	£35.246m	**BCR =**	1.491

Newry Southern Relief Road - Corridor 4 (Option B)

Description – A 5.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £82.195m

Total Scheme Cost (Incl. 44% Optimism Bias) – £118.361m

<table>
<tr><th>Objective</th><th>Sub-Objective</th><th>Qualitative Impacts</th><th>Quantitative Assessment</th><th>Assessment</th></tr>
<tr><td rowspan="4">ENVIRONMENT</td><td>Air Quality</td><td>Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve.
Corridor 4 would likely attract the lowest volume of traffic onto the relief road. Thus, it is reasonable it would have the least potential to improve local air quality conditions within the Newry (Urban Centre) AQMA, though it would result in the lowest number of sensitive receptors in close proximity.
Is likely to have a perceptible impact upon designated ecological sites.</td><td>Number of properties within 200m of indicative alignment centreline:<table><tr><th>Centreline – 50m</th><th>50-100m</th><th>100-150m</th><th>150-200m</th><th>Total</th></tr><tr><td>12</td><td>16</td><td>14</td><td>7</td><td>49</td></tr></table></td><td>Slight Adverse – Slight Beneficial</td></tr>
<tr><td>Cultural Heritage</td><td>Adverse impact upon heritage assets, including the Scheduled Newry Canal,.
May impact upon the setting of Narrow Water Castle demesne, the State Care and Grade A listed Narrow Water Castle and its associated listed and non-designated buildings; B1 listed Fathom House; and a listed house at Cornamucklagh.
May impact upon the setting of a range of non-designated archaeological sites and Industrial Heritage Record sites, including railway bridges, a quay and canal locks associated with the Scheduled Newry Canal, and navigation beacons at Narrow Water.
Corridor is preferred, providing that impacts to the setting of sites can be minimised.</td><td>May impact upon the B2 listed Belvedere Tower.
Undesignated sites that may be impacted include a battle site and a group of four tree ring sites; two bridges and four sites associated with the Newry Canal in Fathom Upper; and extensive areas of historic woodland at Fathom.
The corridor traverses a rural and wooded landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential, and the possible site of the former Wellington Inn.</td><td>Moderate Adverse</td></tr>
<tr><td>Ecology & Nature Conservation</td><td>Direct impact upon Carlingford Lough ASSI. Closest proximity to Carlingford Lough SAC/SPA. Fathom Upper ASSI in close proximity. Direct impact upon Newry River. No direct impact upon Newry Canal. Direct impact upon Fathom Lower Woods & Grassland SLNCI and Narrow Water Forest SLNCI.
Largely traverses a mix of forestry and agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor.
Would potentially affect two areas of long-established woodland and possibly ancient woodland, with some significant losses expected.</td><td>N/A
(Qualitative Assessment Only)</td><td>Large Adverse</td></tr>
<tr><td>Landscape Effects</td><td>Slight encroachment into Mourne AONB, though the corridor would have a significant impact on the Ring of Gullion AONB, resulting in significant loss of vegetation in combination with major earthworks on the western valley side. However, the road would follow contours as much as possible.
The bridge crossing would have the potential to divide the river basin and indeed the overall river valley into two parts by creating a strong visual and physical barrier when viewed from the A2.
The lack of receptors would minimise visual impacts over this section of the corridor.</td><td>N/A
(Qualitative Assessment Only)</td><td>Landscape – Large Adverse
Visual – Moderate Adverse</td></tr>
</table>

Newry Southern Relief Road - Corridor 4 (Option B)

Description – A 5.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £82.195m

Total Scheme Cost (Incl. 44% Optimism Bias) – £118.361m

<table>
<tr><th>Objective</th><th>Sub-Objective</th><th>Qualitative Impacts</th><th colspan="5">Quantitative Assessment</th><th>Assessment</th></tr>
<tr><td rowspan="4"></td><td rowspan="2">Land Use</td><td rowspan="2">11 properties would be at risk of demolition and associated landtake. Would result in the least number of properties at risk of losing private land. Would directly affect at least 4 planning applications. Would not affect the Settlement Development Limit of Newry. Would directly affect Narrow Water Forest SLNCI and Fathom Lower Woods & Grasslands SLNCI, including affecting parcels of long-established and possibly ancient woodland. Would result in the linear loss of approximately 1.8km of agricultural land. Of all the corridors under consideration, only Corridor 4 would result in the loss of land from any DAERA – Forest Service plantation woodlands.</td><td colspan="4">Number of properties at risk of demolition and associated landtake</td><td rowspan="2">Large Adverse</td></tr>
<tr><td>Residential</td><td>Commercial (including Farms)</td><td>Other</td><td>TOTAL</td></tr>
<tr><td>Noise & Vibration</td><td>Would have the lowest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m.
Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred.
Would have the greatest effect upon designated ecological sites.</td><td colspan="5">Number of receptors within 300m of indicative alignment centreline:</td><td>Slight - Moderate Adverse</td></tr>
<tr><td colspan="6">Centreline – 50m | 50-100m | 100-200m | 200-300m | Total
12 | 16 | 21 | 32 | 81</td></tr>
<tr><td></td><td>Vehicle Travellers</td><td>New and interesting views would be opened-up.
Currently, driver stress levels through the affected part of Newry are considered to be ‘High’, and would be expected to reduce on completion of the scheme.</td><td colspan="5">N/A
(Qualitative Assessment Only)</td><td>Views : Moderate Beneficial
Driver Stress: Moderate Beneficial</td></tr>
<tr><td></td><td>Road Drainage & the Water Environment</td><td>Would not directly affect any designated or known shellfishery beds but would be located in closest proximity to them at Narrow Water. It would also directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would increase the potential for establishment of preferential pathways and sediment release.
Would not be located within the Q_{100} river and surface water floodplain associated with the Newry River or the Q_{200} Sea Floodplain associated with the Newry Estuary. This is important as the road may remain functional in its entirety during such extreme events (however would require modelling to verify). The feeder stream to Bensons Glen Fish Hatchery would be directly affected.</td><td colspan="5">N/A
(Qualitative Assessment Only)</td><td>Moderate Adverse</td></tr>
<tr><td></td><td>Geology & Soils</td><td>Would potentially have a greater impact on soils as a result of its rural location and affect associated soil types. Would have a greater impact on agricultural soils. Would have a lower potential impact on contaminated soils/groundwater.</td><td colspan="5">N/A
(Qualitative Assessment Only)</td><td>Slight Adverse</td></tr>
<tr><td rowspan="2">SAFETY</td><td rowspan="2">Accidents</td><td rowspan="2">Significant savings in the number of accidents and the number of serious and slight casualties due to the provision of a Newry Southern Relief Road to remove traffic from the heavily trafficked junctions on the urban road network within Newry City Centre, based on the application of national accident characteristics.</td><td>Growth</td><td>Accidents</td><td>Deaths</td><td>Serious</td><td>Slight</td><td>Accidents PVB (Central Growth)</td></tr>
<tr><td>Central</td><td>196.5</td><td>1.2</td><td>18.7</td><td>255.6</td><td>£10.295m</td></tr>
</table>

Newry Southern Relief Road - Corridor 4 (Option B)

Description – A 5.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £82.195m

Total Scheme Cost (Incl. 44% Optimism Bias) – £118.361m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment		Assessment	
ECONOMY	Transport Economic Efficiency	Significantly reduced peak and off-peak journey times on the road network in the 2023 year of opening compared to existing routes by avoiding the congested urban road network within Newry City Centre.	**For the Opening Year:**	**Central Growth**	**TEE (Central Growth)**	
			Total Vehicle-Hours Saved (Two-Way):	169,000	**Consumer PVB:**	£67.397m
			Peak Journey Time Change (Mins/Veh):	8.32 mins saved on strategic route Warrenpoint to / from Carrickcarnan 8.92 mins saved on strategic route Warrenpoint to / from Carnbane 6.68 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Business PVB:**	£47.138m
			Off-Peak Journey Time Change (Mins/Veh):	6.12 mins saved on strategic route Warrenpoint to / from Carrickcarnan 4.43 mins saved on strategic route Warrenpoint to / from Carnbane 2.39 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Private PVB:**	£0.655m
					ITR PVB:	-£2.821m
					Emissions PVB:	£0.740m
					Government Funding PVC:	**£66.390m**
	Reliability	Improved journey time reliability through the provision of a Newry Southern Relief Road to address acknowledged operational congestion through Newry City Centre.	N/A – Qualitative Assessment Only			
ACCESSIBILITY	**Pedestrians, Cyclists & Equestrians**	Would potentially affect two alleged PROWs, (at Middlebank, and Hillhead Road), and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)		Slight Adverse – Slight Beneficial	
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however the relief of some of the traffic on the urban road network may improve access to community facilities, with	N/A (Qualitative Assessment Only)		Slight Beneficial	

Newry Southern Relief Road - Corridor 4 (Option B)

Description – A 5.30km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £82.195m

Total Scheme Cost (Incl. 44% Optimism Bias) – £118.361m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		a possible reduction in vehicular/pedestrian conflict due to the slight easing of congestion. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.		
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
INTEGRATION	**Transport Interchange**	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) the provision of a relief road to the south of Newry would provide an obvious benefit to the transport interchanges, particularly with regards to the potential for removal of a significant proportion of port-related HGV movements from the city centre road network.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Land-Use Planning	Conforms to policies in the RDS, RTS and RSTNTP. Specifically, the corridor would help achieve the strategic aims of the RDS (2035) and conforms to its specific regional guidance; to deliver a balanced approach to transport infrastructure. The corridor would help maximise the potential of the RSTN, by removing bottlenecks on the key road network where lack of capacity is causing congestion and improving the environment by providing bypasses, relieving the effects of heavy through traffic. The scheme is part of the Strategic Road Improvement Programme, and is currently in DfI's 10 year Forward Planning Schedule, as of April 2015. Extensive woodland loss.	N/A (Qualitative Assessment Only)	Moderate Adverse - Moderate Beneficial
	Other Government Policies	The scheme is supported by proposals contained within the Banbridge/Newry and Mourne Area Plan 2015 and the Newry City Masterplan, which in turn are largely in conformance with other Government Department Objectives for integrated transport.	N/A (Qualitative Assessment Only)	Moderate Beneficial

OVERALL ECONOMIC ASSESSMENT OF CORRIDOR 4 OPTION B (INCLUDING ACCIDENT BENEFITS)	**CENTRAL GROWTH**	**PVC =**	£66.390m	**PVB =**	£123.404m	**NPV =**	£57.015m	**BCR =**	1.859

Newry Southern Relief Road - Corridor 5

Description – A 2.60km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £54.123m

Total Scheme Cost (Incl. 44% Optimism Bias) – £77.937m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
ENVIRONMENT	**Air Quality**	Removal of a proportion of strategic traffic from the more densely populated parts of the city would likely result in a benefit to those sensitive receptors, as air quality may improve. Corridor 5 would likely attract the second highest volume of traffic onto the relief road. Thus, it is reasonable to assume it would have the potential to improve local air quality conditions within the Newry (Urban Centre) AQMA. It would also result in the third highest number of sensitive receptors in close proximity. Would have no perceptible impact upon designated ecological sites.	Number of properties within 200m of indicative alignment centreline: Centreline – 50m: 19 50-100m: 13 100-150m: 31 150-200m: 45 Total: 108	Slight Adverse – Slight Beneficial
	Cultural Heritage	Adverse impact upon heritage assets, including the Scheduled Newry Canal. May impact upon the setting of the Newry Canal, listed buildings, non-designated heritage assets and historic woodland. Corridor is preferred, providing that impacts to the setting of sites can be minimised.	May impact upon the B1 listed Fathom House and the B2 listed Belvedere Tower, as well as Industrial Heritage Record railway bridges, a spill weir on the Newry Canal, and historic woodland in Fathom Lower. The corridor traverses a rural landscape with complex field patterns, areas of palaeoenvironmental and archaeological potential and the possible site of the former Wellington Inn.	Moderate Adverse
	Ecology & Nature Conservation	No direct impact upon designated ecological sites. Direct impact upon Newry River and Newry Canal minimised. Direct impact upon Fathom Lower Woods & Grassland SLNCI. Largely traverses agricultural land with numerous hedgerows. Bridge crossing point is likely to be detrimental, not only as a result of habitat loss, but also fragmentation/severance of a valuable wildlife corridor. Would potentially affect two areas of long-established woodland.	N/A (Qualitative Assessment Only)	Moderate Adverse
	Landscape Effects	The bridge crossing would require a comparatively shorter and lower structure, thus could have less landscape impacts as it would be within an existing industrial estate, in close proximity to the urban fabric of the city, so it may not necessarily detract from the overall landscape character of the area. As the corridor climbs the western slope of the valley, there is again potential for significant earthworks and thus impact on the Ring of Gullion AONB. This would result in substantial scarring of the landscape in the short to medium term until vegetation can be re-established.	N/A (Qualitative Assessment Only)	Landscape – Moderate Adverse Visual – Slight to Large Adverse
	Land Use	15 properties would be at risk of demolition and associated landtake, which includes the potential losses of Gerry Brown Park (Newry Mitchels GFC ground) and/or potentially Newry Building Supplies. Kehoe Kars may also be subject to private land loss. Would directly affect at least 4 planning applications. Would be	Number of properties at risk of demolition and associated landtake Residential Commercial (including Farms) Other TOTAL	Moderate Adverse

Newry Southern Relief Road - Corridor 5

Description – A 2.60km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £54.123m

Total Scheme Cost (Incl. 44% Optimism Bias) – £77.937m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment					Assessment
		partially within the Settlement Development Limit of Newry affecting an existing area of economic development and a major area of existing open space. Would directly affect the Newry Canal/River LLPA and Fathom Lower Woods & Grasslands SLNCI (including the loss of long-established woodland). Would result in the linear loss of approximately 1.9km of agricultural land.	12	2	1	15		
	Noise & Vibration	Would have the third highest number of receptors, both within 50m, (the zone where noise levels would be greatest), and within 300m. These are primarily highly sensitive residential receptors. Would have the greatest effect upon the noise environment of PROWs. In terms of road gradient, steepest gradient (6%), over the second longest distance. The longer the length of road at this gradient; the higher the potential there is for adverse noise impacts. Would require a significant degree of earthworks (cutting and embankments) and bridge works, though as it is not located close to the more populous part of Newry, this would be preferred.	Number of receptors within 300m of indicative alignment centreline:					Slight - Moderate Adverse
			Centreline – 50m	50-100m	100-200m	200-300m	Total	
			19	13	76	123	231	
	Vehicle Travellers	New and interesting views would be opened-up. Currently, driver stress levels through the affected part of Newry are considered to be 'High', and would be expected to reduce on completion of the scheme.	N/A (Qualitative Assessment Only)					Views : Moderate Beneficial Driver Stress: Moderate Beneficial
	Road Drainage & the Water Environment	Would not directly affect any designated or known shellfishery beds, nor would it directly affect Carlingford Lough ASSI. Bridge crossing point and alignment would minimise the potential for establishment of preferential pathways and sediment release. Would be located within the Q_{100} floodplain which may affect the functionality of the road during an extreme flood event (However, would require modelling to verify).	N/A (Qualitative Assessment Only)					Slight Adverse
	Geology & Soils	Would potentially have less impact on soils as a result of its being partially within urban and disturbed soil types and the least impact on agricultural soils. Its partial location within the urban area would increase the potential to encounter contaminated soils/groundwater (particularly within Greenbank Industrial Estate).	N/A (Qualitative Assessment Only)					Slight Adverse
SAFETY	**Accidents**	Significant savings in the number of accidents and the number of serious and slight casualties due to the provision of a Newry Southern Relief Road to remove traffic from the heavily trafficked junctions on the urban road network within Newry City Centre, based on the application of national accident characteristics.	**Growth**	**Accidents**	**Deaths**	**Serious**	**Slight**	**Accidents PVB (Central Growth)**
			Central	199.7	-0.2	13.8	254.0	£8.938m
ECONOMY	**Transport**	Significantly reduced peak and off-peak journey times on the road	**For the Opening Year:**			**Central Growth**		**TEE (Central Growth)**

Newry Southern Relief Road - Corridor 5

Description – A 2.60km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £54.123m

Total Scheme Cost (Incl. 44% Optimism Bias) – £77.937m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment		Assessment	
	Economic Efficiency	network in the 2023 year of opening compared to existing routes by avoiding the congested urban road network within Newry City Centre.	**Total Vehicle-Hours Saved (Two-Way):**	134,000	**Consumer PVB:**	£50.284m
			Peak Journey Time Change (Mins/Veh):	6.58 mins saved on strategic route Warrenpoint to / from Carrickcarnan 7.19 mins saved on strategic route Warrenpoint to / from Carnbane 4.98 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Business PVB:**	£36.828m
			Off-Peak Journey Time Change (Mins/Veh):	4.44 mins saved on strategic route Warrenpoint to / from Carrickcarnan 2.76 mins saved on strategic route Warrenpoint to / from Carnbane 0.72 mins saved on strategic route Warrenpoint to / from Sheepbridge	**Private PVB:**	£0.091m
					ITR PVB:	£0.935m
					Emissions PVB:	-£0.256m
					Government Funding PVC:	**£43.790m**
	Reliability	Improved journey time reliability through the provision of a Newry Southern Relief Road to address acknowledged operational congestion through Newry City Centre.	N/A – Qualitative Assessment Only			
ACCESSIBILITY	**Pedestrians, Cyclists & Equestrians**	Would potentially affect one alleged PROW (at Middlebank) and cross the Ring of Gullion Waymarked Way. The proposed high off-road cycle and walking greenway to be developed along Middlebank would be indirectly impacted in terms of setting, but would not be directly affected. Would impact on existing and proposed National Cycle Networks / Sustrans proposals. No known equestrian facilities would be directly affected. Would impact on the setting/amenity of the Ship Canal as an angling facility. Likely significant reduction in traffic on Kilmorey Street and overall reduction in rat-running.	N/A (Qualitative Assessment Only)		Slight Adverse – Slight Beneficial	
	Community Severance	Significant volumes of traffic would continue to be drawn into the city from all directions; however 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. The benefit of relieving some traffic and slight easing of congestion may also be experienced throughout the wider network of urban	N/A (Qualitative Assessment Only)		Slight Beneficial	

Newry Southern Relief Road - Corridor 5

Description – A 2.60km S2/WS2 + 1 single carriageway to link the A2 Warrenpoint Road to the A1/N1 Belfast Dublin Corridor

Main Constraints – The majority of traffic currently passing through Newry converges in the centre of the city, resulting in considerable congestion.

Total Scheme Cost (Excl. Optimism Bias) – £54.123m

Total Scheme Cost (Incl. 44% Optimism Bias) – £77.937m

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
		roads which have become heavily used routes by traffic wishing to avoid/bypass the 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 community severance. It may also serve to encourage journeys into the city by those previously deterred by the high levels of traffic on the city roads.		
	Access to Public Transport	Access to the local road network would be maintained for local Ulsterbus services linking the surrounding towns and villages. The Corridor would likely result in reduction in delays for public transport services through separation of local and strategic traffic to a certain degree. There would be no long-term impact upon rail services.	N/A (Qualitative Assessment Only)	Slight Beneficial
INTEGRATION	**Transport Interchange**	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) the provision of a relief road to the south of Newry would provide an obvious benefit to the transport interchanges, particularly with regards to the potential for removal of a significant proportion of port-related HGV movements from the city centre road network.	N/A (Qualitative Assessment Only)	Moderate Beneficial
	Land-Use Planning	Conforms to policies in the RDS, RTS and RSTNTP. Specifically the corridor would help achieve the strategic aims of the RDS (2035) and conforms to its specific regional guidance; to deliver a balanced approach to transport infrastructure. The corridor would help maximise the potential of the RSTN, by removing bottlenecks on the key road network where lack of capacity is causing congestion and improving the environment by providing bypasses, relieving the effects of heavy through traffic. The scheme is part of the Strategic Road Improvement Programme, and is currently in DfI's 10 year Forward Planning Schedule, as of April 2015.	N/A (Qualitative Assessment Only)	Slight Adverse - Moderate Beneficial
	Other Government Policies	The scheme is supported by proposals contained within the Banbridge/Newry and Mourne Area Plan 2015 and the Newry City Masterplan, which in turn are largely in conformance with other Government Department Objectives for integrated transport.	N/A (Qualitative Assessment Only)	Moderate Beneficial

OVERALL ECONOMIC ASSESSMENT OF CORRIDOR 5 (INCLUDING ACCIDENT BENEFITS)	**CENTRAL GROWTH**	**PVC =**	£43.790m	**PVB =**	£96.819m	**NPV =**	£53.029m	**BCR =**	2.211

NSRR Stage 1, AST Summary Table

Objective	Sub-Objective	**Corridor 1** Scheme Cost (Incl. 44% Opt Bias): £125.971m	**Corridor 2** Scheme Cost (Incl. 44% Opt Bias): £107.626m	**Corridor 3** Scheme Cost (Incl. 44% Opt Bias): £137.159m	**Corridor 4 Option A** Scheme Cost (Incl. 44% Opt Bias): £127.962m	**Corridor 4 Option B** Scheme Cost (Incl. 44% Opt Bias): £118.361m	**Corridor 5** Scheme Cost (Incl. 44% Opt Bias): £77.937m
Engineering	**Comparative Assessment Score**	14	14	21	24	21	32
Environment	**Air Quality**	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial	Slight Adverse – Slight Beneficial
	Cultural Heritage	Moderate Adverse	Moderate Adverse	Slightly Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
	Ecology & Nature Conservation	Moderate Adverse	Moderate Adverse	Moderate Adverse	Large Adverse	Large Adverse	Moderate Adverse
	Landscape Effects	Landscape: Moderate Adverse Visual: Slight Adverse - Large Adverse	Landscape: Moderate Adverse - Large Adverse Visual: Moderate Adverse - Large Adverse	Landscape: Moderate Adverse Visual: Moderate Adverse to Large Adverse	Landscape: Large Adverse Visual: Moderate Adverse	Landscape: Large Adverse Visual: Moderate Adverse	Landscape: Moderate Adverse Visual: Slight Adverse to Large Adverse
	Land Use	Large Adverse	Moderate Adverse	Moderate Adverse	Large Adverse	Large Adverse	Moderate Adverse
	Noise & Vibration	Neutral – Large Adverse	Slight Adverse – Large Adverse	Slight Adverse to Moderate Adverse	Slight - Moderate Adverse	Slight - Moderate Adverse	Slight - Moderate Adverse
	Vehicle Travellers	Views: Moderate – Large Beneficial Driver Stress: Slight – Moderate Beneficial	Views: Moderate Beneficial Driver Stress: Moderate Beneficial	Views: Large 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	Slight Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Slight Adverse
	Geology & Soils	Large Adverse	Large Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse
Safety	**Accidents PVB (Central Growth)**	£9.305m	£8.680m	£7.636m	£7.521m	£10.295m	£8.938m
Economy	**Transport Economic Efficiency**	Present Value of Benefits (PVB) = £111.758m	Present Value of Benefits (PVB) = £99.156m	Present Value of Benefits (PVB) = £112.172m	Present Value of Benefits (PVB) = £106.997m	Present Value of Benefits (PVB) = £123.404m	Present Value of Benefits (PVB) = £96.819m
		Government Funding PVC = £70.543m	Government Funding PVC = £60.288m	Government Funding PVC = £76.781m	Government Funding PVC = £71.750m	Government Funding PVC = £66.390m	Government Funding PVC = £43.790m
Accessibility	**Pedestrians, Cyclists & Equestrians**	Moderate Adverse – Slight Beneficial	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	Slight Beneficial
	Access to Public Transport	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
Integration	**Transport Interchange**	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
	Land-Use Planning	Moderate Adverse - Moderate Beneficial	Slight Adverse - Moderate Beneficial	Moderate Beneficial	Moderate Adverse - Moderate Beneficial	Moderate Adverse - Moderate Beneficial	Slight Adverse - Moderate Beneficial
	Other Government Policies	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
Overall Economic Assessment	**BCR**	1.584	1.645	1.461	1.491	1.859	2.211
	Net Present Value (NPV)	£41.215m	£38.868m	£35.392m	£35.246m	£57.015m	£53.029m

Highlighted text indicates best conforming corridor

Newry Southern Relief Road

Stage 1 Scheme Assessment Report Final
Appendix C

Project Number: 60472927

June 2017

Appendix C - Cultural Heritage

GAZETTEER OF HERITAGE ASSETS

Y = Within corridor option – initial assessment of potential impact.

S = Within 1km of corridor option – initial assessment of potential setting impact.

N = No initial assessment of potential physical or setting impact.

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
DOW 046:500 & ARM 029:500	Newry Canal Reach 1A	NEWRY CANAL (Co. Armagh) This number covers the portion of Newry Canal in Co. Armagh - c.f. DOW 046:500 for the portion in Co. Down. The Canal is an IHR site [IHR 172], given an SMR no. as part of the scheduling process. NEWRY CANAL (Co. Down) This number covers the portion of Newry canal that is in Co. Down - ARM 029:500 covers the portion in Armagh. This is an IHR site which has been given an SMR no. as part of the scheduling process. An archaeological evaluation was carried out on works situated at the former entrance to a canal basin on the Newry Canal. The area was covered with modern overburden up to 1.7m deep immediately overlying subsoil. Once this was cleared, it was obvious that the majority of the entrance to the canal basin had been removed previously. Only a small portion of the basal course remained [ADS, 2006].	Scheduled	Modern, c18th/c19th	J0962223407	Various	Y	Y	Y	Y	Y
HB16/11/019A	Narrow Water Castle	1820 - 1839 Narrow Water Castle, Newry Road, Warrenpoint, Co Down BT34 3LE. This imposing mid 19th C Tudor Revival-style mansion (designed by Thomas Duff of Newry, 1830s), is set within an	Listed A	Modern, 19th century	J1234 1971	Narrow Water	N	N	N	S	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		attractive informally landscaped demesne. It retains all of its original external character, and the splendid internal detailing survives intact. Along with the servant's accommodation (HB16/11/019B), Gardener's House and walled garden (HB16/11/020), Stable yard (HB16/11/021), ice house (HB16/11/043), Steward's House (HB16/11/044) old farmyard (HB16/11/045) and gate screen (HB16/11/018), it forms an important and substantial group of buildings.									
HB16/29/017A	Church	1900 - 1919 Church of the Sacred Heart (RC) Adj. to 134 Dublin Road, Newry, Co Down. An important basilica plan 20th century church in a Hiberno-Romanesque style, an architectural landmark set on a prominent elevated site. High quality contemporary interior, with fine detailing, relatively unaltered.	Listed B+	Modern, 20th century	J0820 2390	Drumalane	Y	Y	N	N	N
HB16/30/014A	Convent	1800 - 1819 Convent of Mercy Home Avenue, Newry, Co Down, BT34 2DL Double pile mid-Georgian classically styled house survives in virtually original condition. Garden and setting are also of interest. It is of historical interest in being the residence of Needham Thompson, a well-known local figure, before transfer to the convent.	Listed B+	Modern, 19th century	J0885 2557	Ballynacraig	S	N	N	N	N
HB16/11/019B	Former Servant's Accommodat-ion to Narrow Water Castle	1700 - 1719 Former Servant's Accommodation to Narrow Water Castle Warrenpoint Road, Newry, Co Down, BT34 2PN. This building was known as Mount Hall and is believed to have been erected by Francis Hall in 1707. It was the main house prior to the erection of Narrow Water Castle, built by Roger Hall in 1835 to designs by Thomas Duff. Duff re-modelled the exterior of Mount Hall to complement the new house. Internally it was converted to servants'	Listed B1	Modern, early 18th century	J1233 1974	Narrow Water	N	N	N	S	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		accommodation. This, the earliest building on the site, re-modelled in the 19th C in the Tudor style, is both of historical and architectural interest.									
HB16/13/005	Fathom House	1720 - 1739 Fathom House, 45 Fathom Line, Fathom Park, Newry, Co Armagh, BT35 8QN . A well-proportioned, early 18thC symmetrical house, occupying a magnificent maturely planted site overlooking the Newry River/ canal. The interior is believed to be little altered, retaining most of the original features. Along with its ruinous stable block and belvedere (HB16/13/029), it forms a pleasing and important architectural group.	Listed B1	Modern, 18th century	J0967 2302	Fathom Lower	N	S	S	S	Y
HB16/29/007A	House	1800 - 1819 Ivybrook Lodge, 20 Drumalane Road, Newry, Co Down, BT35 8AP The original house comprises a rectangular two-storey (+ basement + attic)/ two-bay block. The large symmetrical two-storey (+ basement + attic)/ three-bay extension abuts the rear (east-facing) wall of the earlier house and comprises the principal rooms and main façade, reversing the orientation of the building. This building embraces both informal and formal architecture, which makes an interesting combination. The original plan forms survive, with minor modern alterations, along with many associated features. The building has historical links with John Mitchel and William Hill Irvine, and therefore is of interest in both a national and local context.	Listed B1	Modern, 19th century	J0836 2540	Drumalane	S	N	N	N	N
HB16/29/009	House	1800 - 1819 Laurel Hill, 2 Dublin Road, Newry, Co Down, BT35 8DA. Three-bay / two-storey (+ basement) house with central fanlit door to ground floor. This building has a number of	Listed B1	Modern, 19th century	J0825 2551	Lisdrumliska	S	N	N	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		interesting features, notably the front windows at eaves level, margined glazing, entrance steps and fanlit doorway. It probably retains most of its internal configuration and fixtures. It is enhanced by its mature planted setting.									
HB16/29/010	Mill, two-storey building, mill house and chimney	1860 - 1879 Drumalane Mill, Drumalane Road, Newry, Co Down, BT35 8AL. A granite multi-storey/ multi-bay flax spinning mill with ancillary buildings. Buildings 1-5 and the chimney are of interest but buildings 6 and 7 are of no special architectural or historical interest. Of note is the main block which is well proportioned and executed and has undergone minimal alteration. Features of particular note are the vaulted fireproof ceilings, end stairwell, cast-iron panelled toilets on the façade. The contrasting scale and materials of the other buildings contribute to the whole, particularly when viewed from the canal.	Listed B1	Modern, 19th century	J0842 2545	Lisdrumliska	Y	N	N	N	N
HB16/29/017 C	Gates and Walling	1900 - 1919 Gates and Walling at Church of the Sacred Heart (RC) Adj. to 134 Dublin Road, Newry, Co Down. Pair of cast and wrought iron gates with granite piers and flanking walls. These gates, piers and walls provide a plain entrance into the church complex, which is a mature landscape and an attractive setting for the church. The gates are executed in a similar style and materials to the rest of the buildings in the group and remain intact and good condition.	Listed B1	Modern, 20th century	J0813 2386	Drumalane	Y	Y	N	N	N
HB16/30/014B	Chapel	1920 - 1939 Chapel at Convent of Mercy (RC) Home Avenue, Newry, Co Down, BT34 2DL. Rectangular former nave church in a simple modern style with chancel and side chapel. This nicely detailed church has a barrel vaulted roof and attractive stained glass windows.	Listed B1	Modern, 20th century	J0885 2557	Ballynacraig	S	N	N	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		Despite its deconsecration, the building stills retains its special interest and is of group value with the adjacent convent.									
HB16/10/001	House	1800 - 1819 The Sham Castle, Greenwood Park , Warrenpoint Road, Newry, Co Down, BT34 2PF. This castle stood in the demesne of Greenwood Park, a short distance SE of the main house which was demolished before WW2. It is shown on the 1834 OS 6" map. The estate belonged to Major Ross Thompson in the early 1800s and it was probably the Thompson family who erected this folly. It is described in an 1846 travelogue as *"a picturesque quadrangular tower, completely shrouded with ivy, and surmounted by battlements, on which a few guns are mounted. ... Although the building has an ancient air about it, it is comparatively modern and has no historical associations – nothing save the simple, yet abundant interest of its own beauty to recommend it"*. A gardener's cottage (HB16/10/030) survives in the former demesne, as does a gate lodge (HB16/10/025) and the main gate screen (HB16/10/024). Primary Sources: 1. Bradshaw's Newry Directory (1819). 2. PRONI OS maps 1st Edition (1834), Co Down Sheet 50. 3. PRONI 1st Valuation book (c.1835), VAL 1B/389. 4. Information from owner in 1999. Secondary sources: 1. P. Byrne, 'Handbook to Carlingford Bay' (Newry, 1846), p.69.	Listed B2	Modern, 19th century	J1015 2336	Greenan	N	Y	S	N	N
HB16/11/018	Entrance Screen, Narrow Water Demesne	1820 - 1839 Entrance Screen Narrow Water Demesne, Warrenpoint Road, Newry, Co Down, BT34 2PN. This gate screen leading into Narrow Water Castle Demesne was designed by Newry architect, Thomas Duff. It is	Listed B2	Modern, 19th century	J1259 1943	Narrow Water	N	N	N	S	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		constructed in local materials and designed to complement the original Narrow Water Castle (directly opposite), with decorative stepped and embattled coping and arrow loop openings.									
HB16/11/018	Gates	1820 - 1839 Entrance Screen Narrow Water Demesne, Warrenpoint Road, Newry, Co Down, BT34 2PN. This gate screen leading into Narrow Water Castle Demesne was designed by Newry architect, Thomas Duff. It is constructed in local materials and designed to complement the original Narrow Water Castle (directly opposite), with decorative stepped and embattled coping and arrow loop openings.	Listed B2	Modern, 19th century	J0950 2287	Fathom Lower	N	N	N	S	N
HB16/11/020	Former Gardener's House Narrow Water Castle	1800 - 1819 Former Gardener's House, Narrow Water Castle ,Newry Road, Warrenpoint, Newry, Co Down, BT34 2PN. Although somewhat altered in the recent past, this building is still of strong character and, with the walled garden, forms part of the overall estate grouping.	Listed B2	Modern, 19th century	J1238 1995	Narrow Water	N	N	N	S	N
HB16/11/021	Stable Yard at Narrow Water Castle	1800 - 1819 Stable Yard at Narrow Water Castle, Newry Road, Warrenpoint, Newry, Co Down. Two attractive and well-proportioned stable blocks in enclosed cobbled yard of value as part of the Narrow Water demesne. They retain their external character and, although internally subdivided, some historic detail remains.	Listed B2	Modern, 19th century	J1236 1978	Narrow Water	N	N	N	S	N
HB16/13/029	Belvedere Tower	1760 - 1779 Belvedere, Fathom Park ,Fathom Line, Newry, Co Armagh. A large and impressive belvedere looking N over the Clanrye valley situated on the hillside of Fathom Park. See also	Listed B2	Modern, 18th century	J0950 2287	Fathom Lower	N	S	Y	Y	Y

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		Fathom House (HB16/13/005).									
HB16/30/015	Church	1780 - 1799 St. Mary's Chapel (RC), Upper Chapel Street, Newry, Co Down, BT34 2EL. Plain rendered T-plan chapel. Although much altered this chapel merits listing because of its age and its unusual layout even though its original fabric has been compromised by extensive alterations. Most alterations have been carried out within an appropriate manner so that its historic character is preserved.	Listed B2	Modern, 18th century	J0899 2544	Ballynacraig	S	N	N	N	N
HB16/10/024	Main gate screen	1800 - 1819 Gates to Greenwood House, Warrenpoint Road, Newry, Co Down, BT34 The setting of these attractive cast iron gates is now entirely compromised by extensive modern housing development and their original relationship to Greenwood House ceased on its demolition.	Not listed - Record Only	Modern, 19th century	J1008 2348	Creeve	N	Y	S	N	N
HB16/10/025	Gate lodge	1860 - 1879 Gate lodge and outbuildings Greenwood Park 60 Warrenpoint Road, Newry, Co Down, BT34 2PN. One of the few remaining buildings associated with Greenwood Park, but it has been much altered and retains little of architectural interest.	Not listed - Record Only	Modern, 19th century	J1018 2321	Greenan	N	Y	S	N	N
HB16/10/030	Gardener's cottage	1820 - 1839 House at 43 Greenan Road, Newry, Co Down, BT34 2PZ. This attractive small house has been sympathetically repaired and retains much of its original character and appearance. One of the few remaining fragments of the Greenwood Park Estate, it is of some architectural and	Not listed - Record Only	Modern, 19th century	J1088 2298	Greenan	N	Y	S	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		historic interest.									
HB16/11/043	Ice House Narrow Water Demesne	1800 - 1819 Ice House Narrow Water Demesne, Warrenpoint, Newry, Co Down. This interesting structure forms an integral part of the estate.	Not listed - Record Only	Modern, c18th/c19th	J1263 2009	Narrow Water	N	N	N	S	N
HB16/11/044	Steward's House, Narrow Water Demesne	1820 - 1839 Steward's House, Narrow Water Demesne, Warrenpoint, Newry, Co Down. Although derelict, this house and yard form a small but important element of the overall Narrow Water Demesne.	Not listed - Record Only	Modern, 19th century	J1228 2000	Narrow Water	N	N	N	S	N
HB16/11/045	Farmyard, Narrow Water Demesne	1880 - 1899 Farmyard, Narrow Water Demesne, Warrenpoint, Newry, Co Down. An attractive, substantially unaltered late 19th C farmyard enclosed by outbuildings and erected as a single entity and of some value within the overall estate.	Not listed - Record Only	Modern, 19th century	J1231 2007	Narrow Water	N	N	N	S	N
HB16/29/007B	Gate Lodge	1860 - 1879 Gate Lodge Ivybrook Lodge, 20 Drumalane Road, Newry, Co Down, BT35 8AP. One-storey granite gate lodge associated with Drumalane House (otherwise known as Ivybrook Lodge; HB16/29/007A). Although of some group value when taken with Ivybrook Lodge, its refurbishment has greatly diminished its original character.	Not listed - Record Only	Modern, 19th century	J0834 2550	Drumalane	S	N	N	N	N
HB16/29/017 B	Parochial House	1900 - 1919 Parochial House, 134 Dublin Road, Newry, BT35 8QT. Multi-gabled, two-storey house, all in rock-faced granite ashlar throughout. This building, built of similar materials to the church and gates, and in a reserved style, has been	Not listed - Record Only	Modern, 20th century	J0818 2394	Drumalane	Y	Y	N	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		subject to inappropriate alterations and is not of special architectural or historic interest.									
13900201	Beacon	1870 - 1890 Freestanding light beacon, built c. 1880, one of a pair. Circular-plan, tapering shaft, conical roof. Ashlar granite roof, projecting eaves corbel string. Uncoursed rubble granite walling. Pointed arch window openings to upper stage, ashlar granite dressings, flush sills, painted timber casements. Segmental-headed entrance door opening located above high water mark, ashlar granite dressings, dressed granite threshold step, painted timber vertically-sheeted door, wrought-iron approach ladder. Located at edge of deep water channel, surrounded by water at high tide. This lighthouse beacon not only fulfils a practical navigational function, but also makes an interesting contribution to the lough at this point. It exhibits high quality masonry construction.	Listed (ROI)	Modern, 19th century	J 12848 18753	Cornamucklagh	N	N	N	S	N
13900202	Beacon	1870 - 1890 Freestanding light beacon, built c. 1880, one of a pair. Circular-plan, tapering shaft, conical roof. Ashlar granite roof, projecting eaves corbel string. Uncoursed rubble granite walling. Shallow pointed arch window openings, rock-faced ashlar granite dressings, flush sills, windows missing. Segmental-headed entrance door opening on north-west side, painted sheet-steel security door fitted over opening, square granite threshold step. Set in boggy ground, fields to south-west, Carlingford Lough to north-east. This lighthouse beacon not only fulfils a practical navigational function, but also makes an interesting contribution to the lough at this point. It exhibits high quality masonry	Listed (ROI)	Modern, 19th century	J 12709 18969	Cornamucklagh	N	N	N	S	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		construction.									
139000203	House	1910 - 1930 Detached three-bay two-storey house, built c. 1920. Slightly projecting flat-roofed single-storey entrance porch flanked by full-height canted bay windows, single-storey pitched roof wing to east. Pitched slate roof to main house and wing, clay ridge tiles, terracotta finials to gables on main block, unpainted smooth rendered chimneystacks with small corbelled caps; mitred hipped roofs to canted bays, terracotta decorative finials; moulded cast-iron gutters on profiled eaves corbel brackets to main house and wing, cast-iron downpipes. Painted smooth rendered walling, string course at first floor. Square-headed window openings, painted stone sills, painted timber plain-glazed sliding sash windows. Square-headed entrance door opening in projecting porch, painted timber four-panel door with raised lozenge bolection-moulded panels set in door screen with plain glazed sidelights and overlights, approached by steps. Set in landscaped grounds, painted smooth render and roughcast boundary wall, set back gate sweep, painted wrought-iron flat-bar entrance gates, high hedge behind boundary wall to road. This substantial house is well-maintained and has retained its original timber sliding sash windows and entrance doorcase. The decorative terracotta finials used on the roof enliven the appearance, as does the corbelled arrangement of the eaves gutters.	Listed (ROI)	Modern, 20th century	J 12284 18886	Cornamucklagh	N	N	N	S	N
CA	Newry Conservation	The foundation of Newry is traced to the establishment of the Cistercian Monastery in 1144 where tradition has it St.	Conservation Area				S	N	N	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
	Area	Patrick planted the yew trees from which the town derives its name. The monks' choice of location was on the high ground east of the Clanrye River. Later development on the valley floor was influenced by the advantage to trade and communication offered by the river. The sacking of Newry in 1689 effectively raised the medieval fabric of the town and gave rise to the town as we now find it. The original Conservation Area derived its strength and character from the merits of the individual buildings within it, rather than as a coherent piece of urban design in its own right. Since then, the area has been extended twice. In 1992, the boundary was extended southward to incorporate the historic commercial spine of Hill Street/John Mitchel Place; the original 12th century settlement and areas abutting the canal/river. In 2001, the area was extended northwards to incorporate the historical significance of the Newry Canal to the town.									
D-041	Narrow Water Castle demesne	NARROW WATER CASTLE, Co. Down (REGISTERED SITE – AREA PLAN NEWRY & MOURNE 16). The present house was built during the years 1831 to 1837 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 Italian Garden, notable for its impressive grass terraces, balustrading, cut stone steps and urns. Horizontal ground was once filled with flower beds, remembered in photographs but now grassed. Early 20th century photographs also show the wild garden in the Pleasure Grounds to the north-west of the house, said to	Register of Parks, Gardens and Demesnes of Special Historic Interest	Modern, 19th century		Narrow Water	N	N	N	S	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		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 glasshouses have gone. The Head Gardener's House (or Steward's House) is very impressively large (listed HB 16/11/20). 18th century outbuildings are listed (HB 16/11/21). Two gate lodges survive, Castle Gate and Tudor Lodge by Duff (listed HB 16/11/23) and contemporary with the house. However, Duff's Newry Gate has gone and the earlier rear gate. SMR: DOWN 51:38 enclosure. The south-east corner of the demesne is a golf course. Private.									
ARM029:007	Rath	Only the faintest remains of the site are now visible. A low platform raised barely 0.3m above the natural ground level can just be identified with the vestigial remains of a ditch around the south. A field boundary cuts a chord across the north side of the site, and to the north of this there are no visible remains. The present diameter is c.39m E-W. This agrees closely with the dimensions for the site indicated on the OS 6" Map of 1863 and the "Fort" shown on the preceding 1835 edition.	SMR	Early Christian	J0727022340	Newtown	N	N	S	S	S
ARM029:017	Non-antiquity	Grid ref. J0735 2184 - J0740 2220. This site is shown on the OS 6" maps marked "Danes Cast" but this designation was incorrect, as fieldwork and research have revealed that there was, in fact, no earthwork here, the site having been in a garden.	SMR	Uncertain	J0736022000	Killeen	S	N	S	S	S

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
ARM029:020	Tree ring	No information or description available. Designed landscape feature.	SMR	Modern, c18th/c19th	J0980022500	Fathom Lower	N	N	S	Y	N
ARM029:021	Tree ring	One of a group with ARM 029:020,022 & 023. No information or description available. Designed landscape feature.	SMR	Modern, c18th/c19th	J0988022370	Fathom Lower	N	N	S	Y	N
ARM029:022	Tree ring	One of a group of landscape features including ARM 029:020,021 & 023. No information or description available.	SMR	Modern, c18th/c19th	J0992022250	Fathom Lower	N	N	S	Y	N
ARM029:023	Tree ring	One of a group with ARM 029:020,021 & 022. No information or description available	SMR	Modern, c18th/c19th	J0999022120	Fathom Lower	N	N	S	Y	N
ARM029:025	Enclosure	OLD FORT, THE OLD FORT On a level terrace on the steep north-east side of Fathom Mountain, commanding an extensive view over the Newry River below. An "old fort" is remembered in this area, but there are no visible remains, and much building debris now occupies the site.	SMR	Uncertain	J0944022420	Fathom Lower	N	N	S	S	S
ARM029:027	A.P. site	Probably not an antiquity - no description available.	SMR	Uncertain	J0698021090	Newtown	S	N	S	S	S
ARM029:029	A.P. site	Probably not an antiquity - no description available.	SMR	Uncertain	J0710021580	Newtown	S	N	S	S	S
ARM029:030	A.P. site	Probably not an antiquity - no description available.	SMR	Uncertain	J0713021640	Newtown	S	N	S	S	S
ARM029:031	A.P. site	Probably not an antiquity - no description available.	SMR	Uncertain	J0722021640	Newtown	S	N	S	S	S
ARM029:033	Tower house	TOWER-HOUSE According to Paterson, there was an "old castle at Fathom" held by the O'Neills and temporarily by Elizabeth I. It was demolished 1730 in building canal and was roughly in position of the first lock.	SMR	Late-med	J1000020000	Fathom Upper	N	N	N	S	N
ARM029:038	Burial site	CIST BURIALS: BOYLE'S FORT. Found at ARM 029:007 - no information or description	SMR	Prehistoric, uncertain	J0720022300	Newtown	S	N	S	S	S

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
		available.									
ARM029:039	Enclosure	NOT PRECISELY LOCATED.	SMR	Uncertain	J0700021000	Newtown	S	N	S	S	S
ARM029:042	Battle site	BATTLE SITE, 1600 This is the site of an ambush on an English Column led by Lord Deputy Mountjoy, by Hugh O'Neill on 14th October 1600. No visible remains (all above ground features removed).	SMR	Post-med, c17th	J0990022200	Fathom Lower	N	N	S	Y	N
DOW051:021	Cashel - Greenan Wood	CASHEL On the N slope of Greenan Mt. with excellent views W-N-NE. The slope is very overgrown in places. The site is cut N-S by a stone wall and is extremely overgrown. The interior is 27m N-S and slopes to N. The outer face of the enclosing bank is revetted at S. It is low and worn, 0.45m above the interior, 0.82m above the exterior, and 4m wide. At highest, it was 1.1m externally. It is composed mostly of stones with some earth. There are some stones scattered on the inside. There are no ditch remnants, nor a discernible entrance.	SMR	Early Christian	J1123023330	Greenan	N	N	S	N	N
DOW051:028	Rath	RATH The site has excellent views N-SE. It is ringed with thorns and sits proud of the field, particularly at NE. The interior, 25.6m N-S x 23.3m E-W is level. The bank survives SW-NE at varying heights. There is some exterior revetting NW-N which may not be original, as the bank is quite straight here. At NE, it is 0.5m high internally, 1.16m externally & 2.4m wide. There is an area of higher ground joining the site at SE in a roughly triangular shape, 1m high, 6m long, and 4m wide. There are no ditch remains.	SMR	Early Christian	J1125022520	Greenan	N	N	S	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
DOW051:033	Rath	RATH On a swell with good views NE-E-S. The site has a lane curving round SE-W and is ringed by a thick, high hedge. The interior circumference is planted with firs. The interior, 35m N-S, is used as a garden with a vegetable patch at NW. There is no real upstanding bank above the interior and it is difficult to define due to the hedge. At W, it is 0.1-0.15m above the interior. The site sits proud of the exterior, 1.6m high at W and NE. There is no ditch remnant amd the original entrance may be at S, where there is a modern gate.	SMR	Early Christian	J1185021770	Aghnamoira	N	N	S	N	N
DOW051:062	Enclosure	ENCLOSURE On top of a hill with panoramic views all round. This natural height seems to have been used for defensive purposes. At W, where the ground falls steeply down, a scarp has been built, 7.2m wide and 1m high, which curves round to the edge of slope to N. It continues for c.22m before petering out and seems to curve to SW and continues, very patchily in this direction. The scarp is grass-covered, but there are some stones visible. The whole hill has been lazy-bedded and is now very overgrown, which both act to obscure remains.	SMR	Uncertain	J1185021460	Aghnamoira	N	N	S	N	N
DOW051:044	Narrow Water Castle	NARROW WATER CASTLE This castle, protecting the entrance to a part of Carlingford Lough, is thought to have been built by the English c1560. After James II's defeat in 1691, it was confiscated and granted to the Halls. It is a tower 11.2m x 10.1, standing 3 storeys and an attic high. The entrance is defended by a machicolation. The tower stands within a rectangular bawn, c.36m square with walls 0.6m thick & 2m high internally, but more on the outside where it rises from the shore. There is a modern gateway through the bawn at N.	State Care	Late-med	J1256019390	Narrow Water	N	N	N	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
LH002-001001	Children's burial ground	The following description is derived from both the published 'Archaeological Inventory of County Louth' (Dublin: Stationery Office, 1986) and the 'Archaeological Survey of County Louth' (Dublin: Stationery Office, 1991). In certain instances, the entries have been revised and updated in light of recent research. Date of upload/revision: 17 July 2007 Situated on E side of a natural ridge to the SW of the Newry River and consisting of a sub-rectangular low platform of stones (max. dims. 20m N-S, 17m E-W, H 0.35m). It is reputedly the site of the monastery of Killansnamh which is said to have stood opposite Narrow Water Castle (CLAJ 1908, 73). About 150 years ago (i.e. c. 1837) some remains of the abbey were still to be seen and it was customary to inter unbaptised infants there. (CLAJ 1914, 232).	RMP (ROI)		J12430 19109	Cornamucklagh	N	N	N	S	N
00062:095:00	Bridge	GNR Main Line Belfast - Border	IHR		J07532452	Lisdrumliska	S	S	N	N	N
00062:096:00	Mile post	GNR Main Line Belfast - Border	IHR		J07612440	Lisdrumliska	S	S	N	N	N
00062:098:00	Bridge	GNR Main Line Belfast - Border	IHR		J08102381	Carrivemaclone	Y	Y	N	N	N
00062:099:00	Bridge	GNR Main Line Belfast - Border	IHR		J08272347	Cloghoge	S	Y	S	S	N
00062:100:00	Bridge	GNR Main Line Belfast - Border	IHR		J08412303	Cloghoge	Y	Y	S	S	Y
00062:102:00	Bridge	GNR Main Line Belfast - Border	IHR		J08552252	Fathom Lower	Y	N	Y	Y	Y
00062:103:00	Bridge	GNR Main Line Belfast - Border	IHR		J08552195	Fathom Lower	Y	N	Y	Y	Y

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
00062:104:00	Bridge	GNR Main Line Belfast - Border	IHR		J08172152	Killeen	S	N	S	S	Y
00172:041:00	Victoria Lock	Newry Canal	IHR		J10842082	Fathom Upper	N	N	S	Y	N
00172:042:00	Dock House	Newry Canal	IHR		J10852072	Fathom Upper	N	N	S	Y	N
00172:049:00	Albert Basin		IHR		J08592574	Lisdrumliska	S	N	N	N	N
00172:093:00	Quay	Newry Canal	IHR		J10892073	Fathom Upper	N	N	S	Y	N
00172:096:00	Spill weir	Newry Canal	IHR		J09392374	Cloghoge	N	S	N	N	Y
00172:039:00	Canal Locks	Newry Canal	IHR		J09982278	Fathom Lower	N	N	Y	S	S
00172:094:00	Quay	Newry Canal	IHR		J09862285	Fathom Lower	N	N	Y	S	S
00172:095:00	Quay	Newry Canal	IHR		J09762305	Fathom Lower	N	S	S	N	S
00172:113:00	Lock House	Newry Canal	IHR		J09852295	Fathom Lower	N	S	S	N	S
00172:097:00	Culvert	Newry Canal	IHR		J08562553	Lisdrumliska	S	N	N	N	N
00172:112:00	Pump House	Newry Canal	IHR		J10792082	Fathom Upper	N	N	S	Y	N
00172:114:00	Lock	Newry Canal	IHR		J08752570	Lisdrumliska	Y	N	N	N	N
00172:115:00	Lock House	Newry Canal	IHR		J08702570	Lisdrumliska	Y	N	N	N	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
00478:021:00	Former train station	GNR Branch Line; Goraghwood-Warrenpoint	IHR		J12471948	Narrow Water	N	N	N	S	N
00478:030:00	Bridge	GNR Branch Line; Goraghwood-Warrenpoint	IHR		J08752556	Ballynacraig (Newry UD; Over The Newry River)	S	N	N	N	N
00601:000:00	Tobacco pipe manufactory		IHR		J08502349	Cloghoge	S	S	S	S	N
00607:000:00	Bridge		IHR		J11751946	Fathom Upper	N	N	N	Y	N
03580:000:00	Corn mill site		IHR		J12701939	Narrow Water	N	N	N	S	N
03699:000:00	Spinning mills		IHR		J08462546	Lisdrumliska / Drumalane	S	N	N	N	N
07546:000:00	Navigation beacon		IHR		J12471932	Narrow Water	N	N	N	S	N
DH648	Defence heritage	Defence heritage, Newry. Prepared demolition scheme.	DH				S	N	N	N	N
WT895	Historic woodland	Long-established woodland (Planted mixed) (77ha).	Woodland Trust Old Woods		J107205	Fathom Upper	N	N	N	Y	N
WT896	Historic woodland	Ancient Woodland (3) (Scrub) (2ha)	Woodland Trust Old Woods		J099222	Fathom Lower (Main Portion)	N	S	Y	Y	S
WT904	Historic woodland	Long-established woodland (Parkland) (4ha)	Woodland Trust Old Woods		J122198	Narrow Water	N	N	N	S	N
WT905	Historic woodland	Long-established woodland (Parkland) (11ha)	Woodland Trust Old		J125196	Narrow Water	N	N	N	S	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
			Woods								
WT906	Historic woodland	Long-established woodland (Planted mixed) (1ha)	Woodland Trust Old Woods		J123195	Narrow Water	N	N	N	S	N
WT907	Historic woodland	Long-established woodland (Planted mixed) (68ha)	Woodland Trust Old Woods		J113208	Narrow Water	N	N	S	S	N
WT940	Historic woodland	Long-established Woodland (1ha)	Woodland Trust Old Woods		J094229	Fathom Lower (Main Portion)	N	S	Y	Y	Y
WT943	Historic woodland	Long-established Woodland (1ha)	Woodland Trust Old Woods		J093233	Fathom Lower (Main Portion)	N	S	Y	Y	Y
WT944	Historic woodland	Long-established woodland (Semi-natural broadleaved) (1ha)	Woodland Trust Old Woods		J103231	Greenan	N	Y	S	N	N
WT946	Historic woodland	Long-established woodland (Semi-natural broadleaved) (5ha)	Woodland Trust Old Woods		J106230	Greenan	N	N	S	N	N
WT947	Historic woodland	Lost Long-established Woodland (4ha)	Woodland Trust Old Woods		J107226	Greenan	N	N	S	N	N
CH-01	Cloghoge cemetery	Cloghoge cemetery, off Flagstaff Road	AP Analysis		J 08377 23836	Cloghoge	S	S	N	N	N
CH-02	Area of palaeoenvironmental potential	Area of palaeoenvironmental potential, Barracric Road.	AP Analysis		J 08512 23041	Cloghoge	Y	N	Y	Y	Y
CH-03	Possible site	Mounds in strip fields, Brogies Road.	AP Analysis		J 08618 23216	Cloghoge	Y	N	Y	Y	N

SMR No.	Description	Long description	Type	Date	Grid Ref	Townland	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5
CH-04	Possible site	Meeting point of boundaries and stands of trees, west of Hillhead Road.	AP Analysis		J 08720 23839	Cloghoge	Y	Y	N	N	N
CH-05	Possible site	Complex field boundaries and stands of trees, west of Hillhead Road.	AP Analysis		J 08533 24246	Cloghoge	Y	N	N	N	N
CH-06	Possible site	Channel associated with Newry Canal, culvert and paired line of trees, east of Drumalane Road and west of Albert Basin.	AP Analysis		J 08709 24663	Cloghoge	Y	N	N	N	N
CH-07	Possible site	Three circular stands of trees, between Hillhead Road and Drumalane Road.	AP Analysis		J 08746 24403	Drumalane	Y	N	N	N	N
CH-08	Possible site	Area of rough ground, Cloghoge Heights.	AP Analysis		J 08166 24071	Cloghoge	N	Y	N	N	N
CH-09	Possible site	Complex field boundaries, Hillhead Road/Flagstaff Road.	AP Analysis		J 09087 23663	Cloghoge	N	Y	N	N	Y
CH-10	Possible site	Marked 'stones' on OS 1st ed (1829-1835). Area now built over/under private back garden.	Historic Map Analysis		J 08443 23687	Cloghoge	N	Y	N	N	N
CH-11	Possible site	Possible site of Wellington Inn, marked on OS 1st ed (1829-1835). Now a field S of Barracric Road.	Historic Map Analysis		J 08530 22473	Cloghoge	N	Y	Y	Y	Y

Newry Southern Relief Road

Stage 1 Scheme Assessment Report Final
Appendix D

Project Number: 60472927

June 2017

Appendix D - Ecology

Table 1: Summary of individual woodland blocks describing local habitats and management (Site numbers refer to Figure 7.4.2)

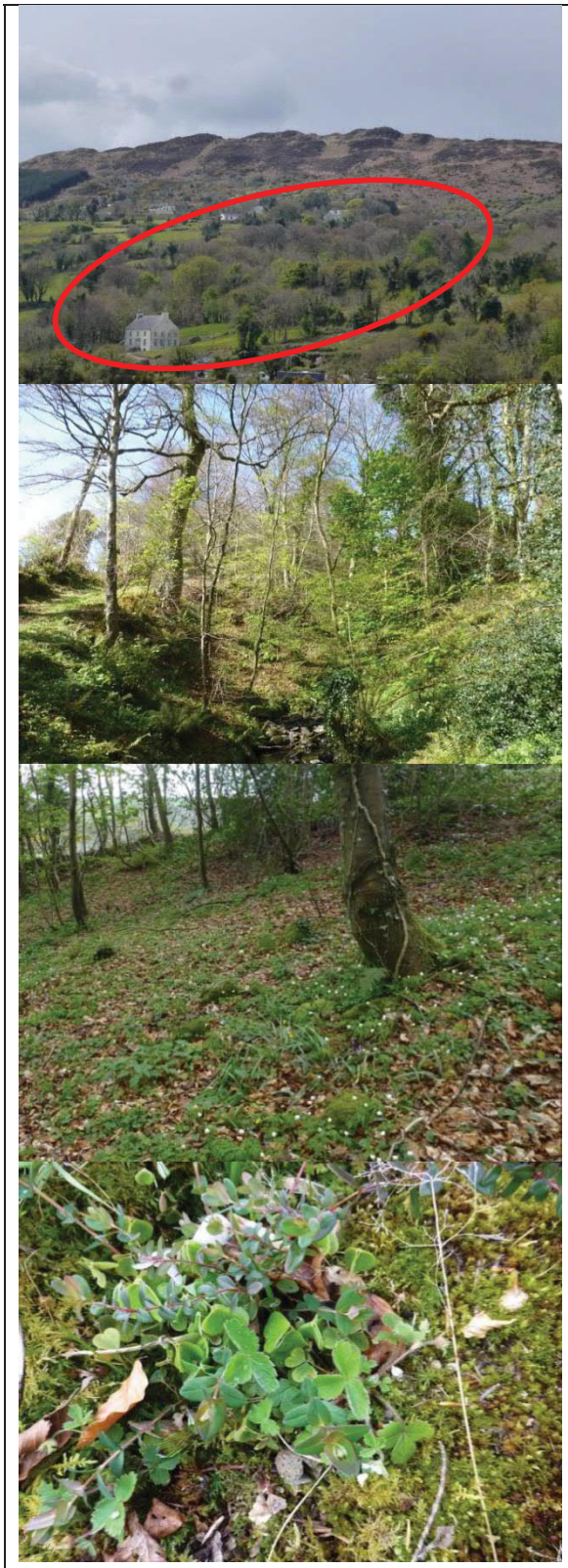
Site Number: WT943 (Woodland Trust), also most northern parcel of Fathom Lower Woods and Grassland SLNCI (Long-established woodland).

This site consists of semi-natural woodland with predominantly native trees and shrubs which have not obviously been planted and have likely regenerated naturally. Several mature (veteran) beech trees may be planted in origin. Ground flora is diverse with a dense carpet of ancient woodland species.

Tree species:
Ash *Fraxinus excelsior;*
Beech *Fagus sylvatica;*
Birch *Betula sp.*;
Hazel *Corylus avellana;*
Sycamore *Acer pseudoplatanus;*
Wild cherry *Prunus avium.*

Ground Flora (Ancient woodland species):
Bluebell *Hyancinthoides non-scripta;*
Common Dog-violet *Viola riviniana;*
Herb-robert *Geranium robertianum;*
Honeysuckle *Lonicera periclymenum;*
Ivy *Hedera helix;*
Lesser celandine *Ranunculus ficaria;*
Lords and ladies *Arum maculatum;*
Nipplewort *Lapsana communis;*
Opposite-leaved golden saxifrage *Chrysosplenium oppositifolium;*
Ramsons *Allium ursinum;*
Wood anemone *Anemone nemorosa.*

Other notable species:
Greater Stitchwort *Stellaria holostea.*



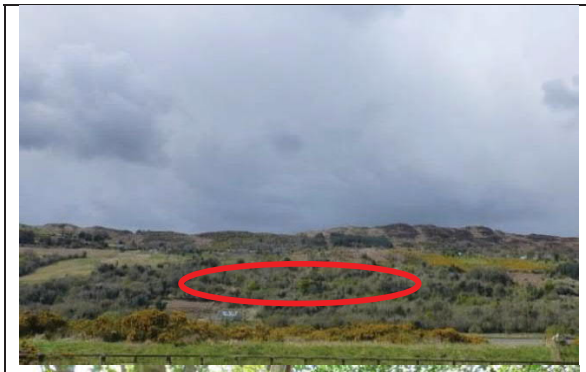
Site number: WT940 (Woodland Trust), also central parcel of Fathom Lower Woods and Grassland SLNCI (Long-established woodland).

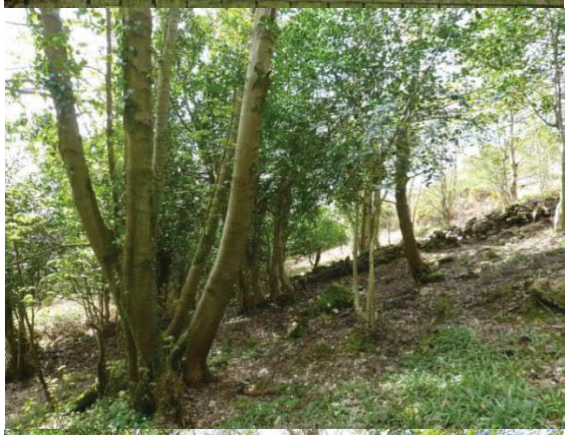
Several large veteran beech trees which are likely plantation in origin, particularly along the southern boundary of the site. Other areas are potentially semi-natural in origin woodland stands consisting predominantly of native trees and shrubs that have not obviously been planted and have arisen from natural regeneration. Ground flora is particularly diverse with a dense carpet of ancient woodland species. This area is grazed by livestock in the western section near the Flagstaff Road.

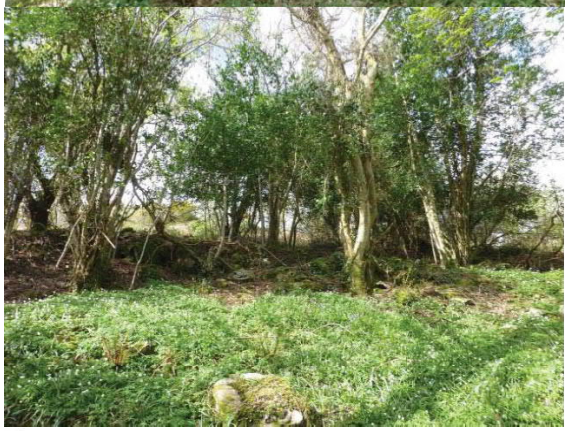
Tree species:
Ash *Fraxinus excelsior;*
Beech *Fagus sylvatica;*
Birch *Betula sp.*;
Hazel *Corylus avellana;*
Holly *Ilex aquifolium;*
Sycamore *Acer pseudoplatanus;*
Wild cherry *Prunus avium.*

Ground Flora (Ancient woodland species):
Barren strawberry *Potentilla sterilis;*
Bluebell *Hyancinthoides non-scripta;*
Foxglove *Digitalis purpurea;*
Hard fern *Blechnum spicant;*
Herb-robert *Geranium robertianum;*
Honeysuckle *Lonicera periclymenum;*
Lesser celandine *Ranunculus ficaria;*
Lords and ladies *Arum maculatum;*
Opposite-leaved golden saxifrage *Chrysosplenium oppositifolium*;
Pignut *Conopodium majus;*
Primrose *Primula vulgaris;*
Ramsons *Allium ursinum;*
Wood anemone *Anemone nemorosa;*
Wood sorrel *Oxalis acetosella.*

Other notable species:
Common sorrel *Rumex acetosa;*
Hart's tongue *Phyllitis scolopendrium;*
Perforate St. John's wort *Hypericum perforatum.*







Site Number: WT896 (Woodland Trust), also within most southern parcel of Fathom Lower Woods and Grassland SLNCI (Ancient Woodland).

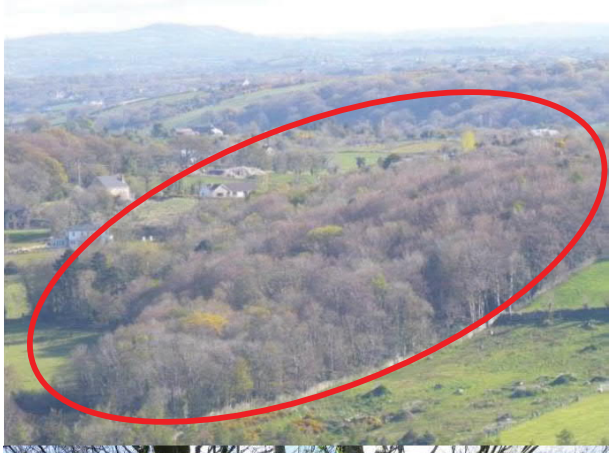
Semi-natural woodland stands consisting predominantly of native trees and shrubs that have not obviously been planted, which have arisen from natural regeneration. Original tree rings may have been present, associated with archaeological features. Currently all trees are of relatively recent origin. The tree rings include semi-mature specimens. Ground flora included ancient woodland indicators. Between the tree rings, more open habitat occurs, dominated by bracken, blackthorn and bramble, and scattered stands of pioneer trees such as birch and hazel.

Tree species:
Ash *Fraxinus excelsior;*
Birch *Betula sp.*;
Hawthorn *Crataegus monogyna;*
Hazel *Corylus avellana;*
Holly *Ilex aquifolium;*
Rowan *Sorbus aucuparia;*
Sycamore *Acer pseudoplatanus;*
Wild cherry *Prunus avium.*

Ground Flora (Ancient woodland species):
Bluebell *Hyancinthoides non-scripta;*
Lesser celandine *Ranunculus ficaria;*
Wood anemone *Anemone nemorosa.*

Other notable species:
Blackthorn *Prunus spinose;*
Bramble *Rubus fruticosus*.

Mammals:
Red Squirrel *Sciurus vulgaris;*
Badger *Meles meles.*



Site number: WT946 (Woodland Trust), also within Maginnis Villas SLNCI (Ancient Woodland).

Likely a long-established plantation dominated by beech *Fagus sylvatica*, of which numerous mature specimens occur throughout. Cattle grazing was evident throughout the site, leading to a relatively open habitat with sparse understorey vegetation. Ground flora was species-rich with numerous ancient woodland indicators.

Tree species:
Ash *Fraxinus excelsior;*
Beech *Fagus sylvatica;*
Birch *Betula sp.*;
Hazel *Corylus avellana*;
Holly *Ilex aquifolium;*
Sycamore *Acer pseudoplatanus.*

Ground Flora (Ancient woodland species):
Bluebell *Hyancinthoides non-scripta;*
Common Dog-violet *Viola riviniana;*
Lesser celandine *Ficaria verna;*
Lords and ladies *Arum maculatum;*
Opposite-leaved golden-saxifrage *Chrysosplenium oppositiffolium;*
Pignut *Conopodium majus;*
Ramsons *Allium ursinum;*
Wood anemone *Anemone nemorosa;*
Wood sorrel *Oxalis acetosella.*

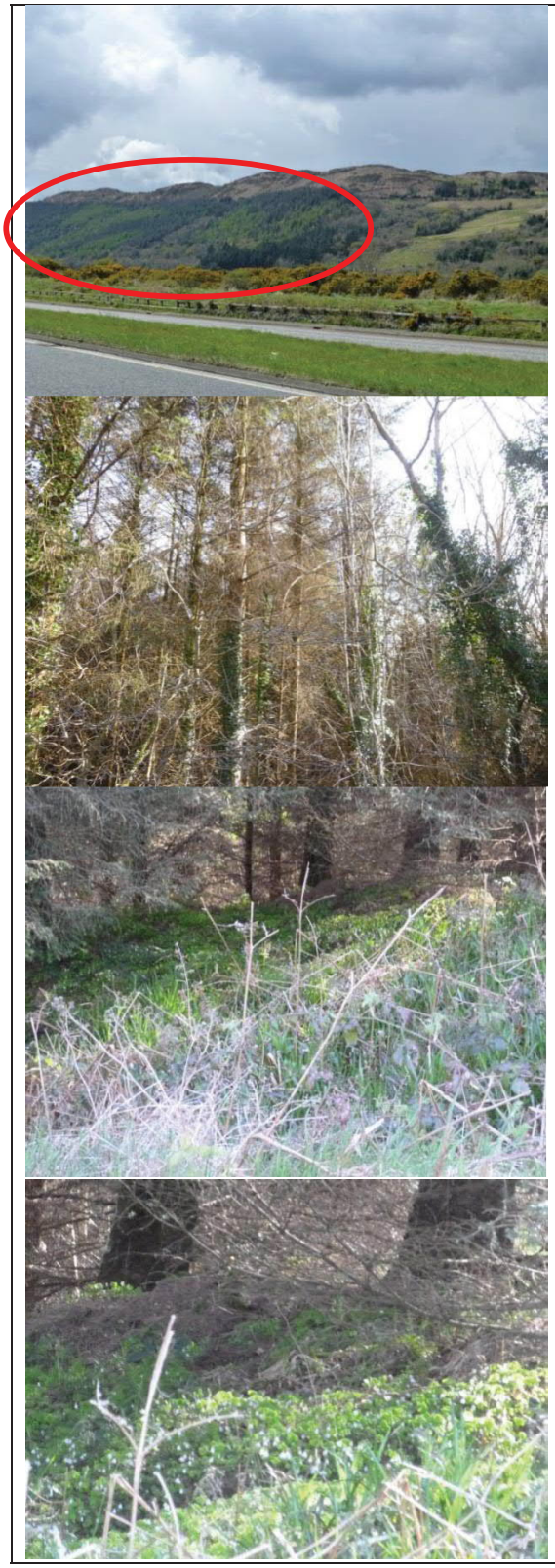
Site Number: WT947 (Woodland Trust), also within Maginnis Villas SLNCI (Long-established Woodland).

Semi-natural woodland stands consisting predominantly of native trees and shrubs. This habitat is currently regenerating woodland with scattered stands of pioneer trees such as birch, sycamore, hawthorn and hazel. It is thought any mature trees on this site may have been felled and the area may have been farmed for a period of time, before being abandoned and recolonised by woodland species. Ground flora is dominated by dense stands of bracken and bramble, which largely shade-out other species. Some woodland ground flora does remain but this is somewhat restricted.

Tree species:
Ash *Fraxinus excelsior;*
Birch *Betula sp.*;
Hazel *Corylus avellana*;
Holly *Ilex aquifolium;*
Sycamore *Acer pseudoplatanus*.

Ground Flora (Ancient woodland species):
Bluebell *Hyancinthoides non-scripta;*
Common Dog-violet *Viola riviniana;*
Lesser celandine *Ficaria verna;*
Wood anemone *Anemone nemorosa.*

Other notable species:
Bracken *Pteridium aquilinum;*
Bramble *Rubus fruticosus.*



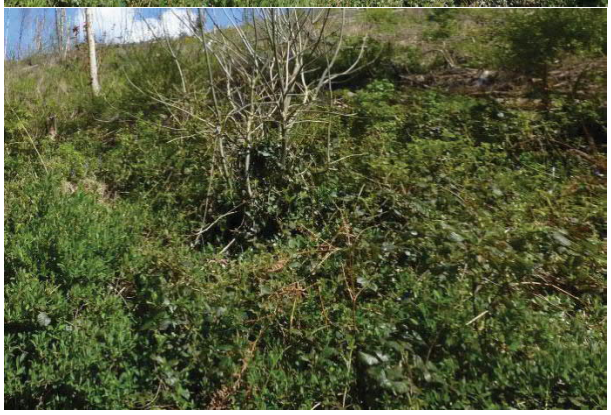
Site Number: WT895 (Woodland Trust).

Long-established Woodland stands in ancient woods that have been converted to coniferous plantations. The site is dominated by non-native conifers, however some native trees do occur, particularly around the woodland edges and where larch plantations create less shading. This area is relatively species-poor due to dense stands of conifers; however ancient woodland flora remain in isolated areas, particularly around the edges of the plantations.

Tree species:
Ash *Fraxinus excelsior;*
Birch *Betula sp.*;
Douglas fir *Pseudotsuga menziesii;*
Hazel *Corylus avellana*;
Holly *Ilex aquifolium;*
Larch *Larix sp.*;
Norway spruce *Picea abies;*
Sycamore *Acer pseudoplatanus*.

Ground Flora (Ancient woodland species):
Bilberry *Vaccinium myrtillus*
Greater wood-rush *Luzula sylvatica*
Wood anemone *Anemone nemorosa*
Wood sorrel *Oxalis acetosella*

Other notable species:
Bracken *Pteridium aquilinum;*
Bramble *Rubus fruticosus*.



Site Number: WT907 (Woodland Trust), Long-established Woodland, part of Narrow Water forest SLNCI.

Clear-felled area now dominated by pioneer species such as sycamore, birch and ash. This was originally conifer plantation and therefore ground flora is relatively restricted. Additionally, following clearance, the area has been colonised by tall ruderal vegetation, such as wild raspberry, rosebay willow-herb and foxglove. Ancient woodland species are recovering in places but are still relatively restricted.

Tree species:
Ash *Fraxinus excelsior;*
Birch *Betula sp.*;
Sycamore *Acer pseudoplatanus.*

Ground Flora (Ancient woodland species):
Bluebell *Hyancinthoides non-scripta;*
Foxglove *Digitalis purpurea;*
Honeysuckle *Lonicera periclymenum;*
Ivy *Hedera helix;*
Wood avens *Geum urbanum.*

Other notable species:
Rosebay willow-herb *Chamerion angustifolium;*
Raspberry *Rubus idaeus;*
Bracken *Pteridium aquilinum;*
Bramble *Rubus fruticosus;*
Common sorrel *Rumex acetosa;*
Cow parsley *Anthriscus sylvestris.*

Site number: WT907 (Woodland Trust), also within Narrow Water Forest SLNCI (Long-established Woodland)

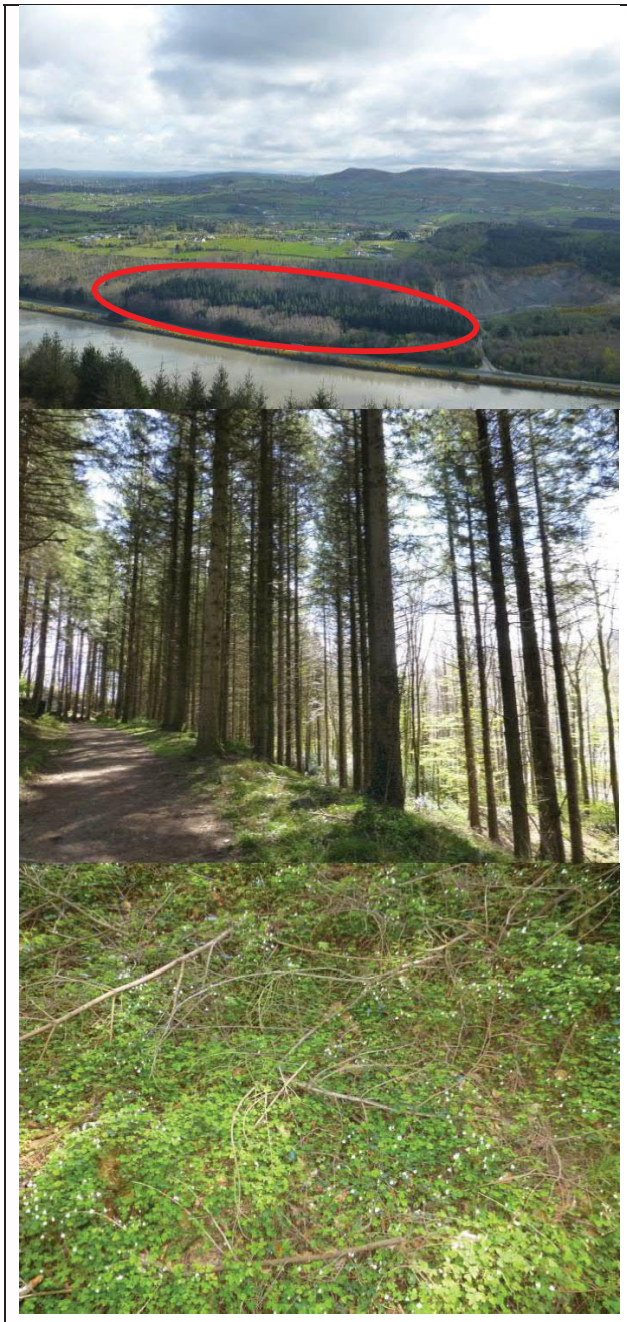
Newly-planted broadleaf plantation. Dense understorey vegetation of bramble and non-native shrubs which significantly restricts ancient woodland ground flora.

Tree species:
Ash *Fraxinus excelsior;*
Birch *Betula sp.;*
Oak Quercus sp.

Ground Flora (Ancient woodland species):
Bluebell *Hyancinthoides non-scripta;*
Foxglove *Digitalis purpurea;*
Honeysuckle *Lonicera periclymenum;*
Ivy *Hedera helix;*
Lesser celandine *Ficaria verna.*

Other notable species:
Brambles *Rubus fruticosus;*
Bracken *Pteridium aquilinum.*

Non-native and invasive species:
Buddleja *Buddleja davidii*;
Cherry laurel *Prunus laurocerasus;*
Giant hogweed *Heracleum mantegazzianum;*
Rhododendron *Rhododendron ponticum* .



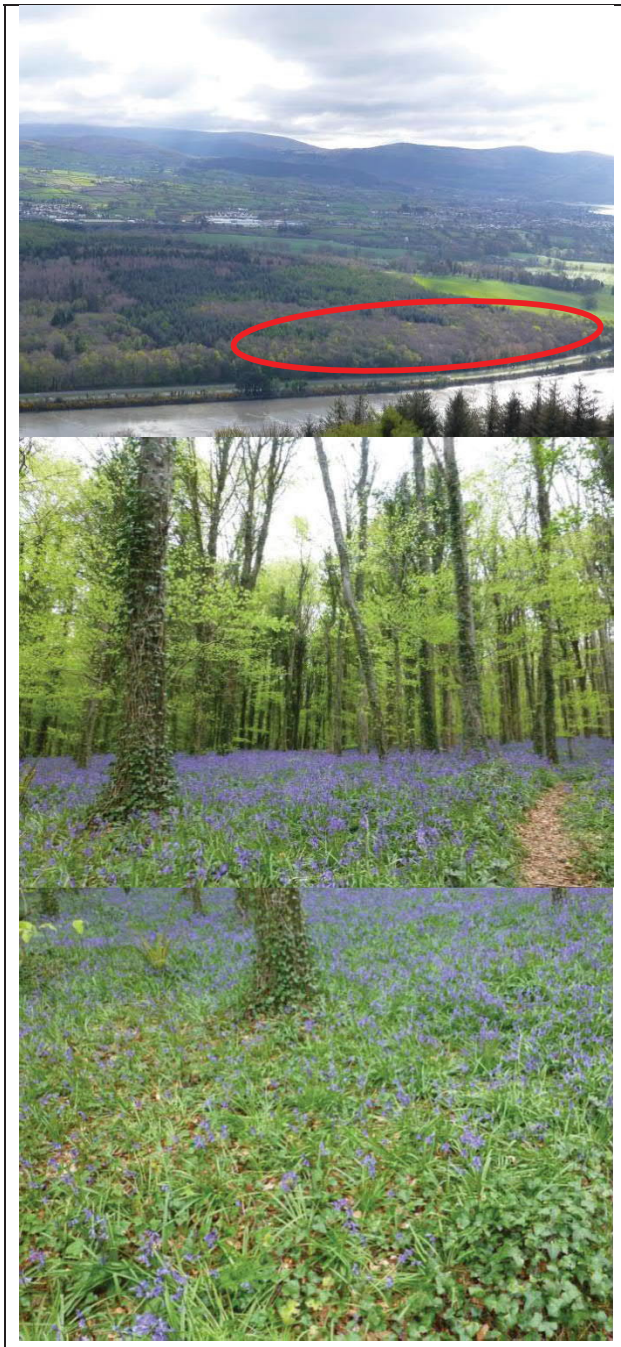
Site number: WT907 (Woodland Trust), also within Narrow Water Forest SLNCI (Long-established Woodland).

The evergreen conifer plantations create dense shade, restricting ground flora. Understorey vegetation is also sparse with few species surviving the dense shade. Ancient woodland indicator species do remain, including on the edge of this habitat and in areas where tree growth is less dense.

Tree species:
Douglas fir *Pseudotsuga menziesii;*
Norway spruce *Picea abies;*
Pine species *Pinus sp.;*
Western hemlock *Tsuga heterophylla* **.**

Ground Flora (Ancient woodland species):
Honeysuckle *Lonicera periclymenum;*
Wood avens, *Geum urbanum;*
Wood sorrel *Oxalis acetosella.*

Other notable species:
Wood sage *Teucrium scorodonia.*

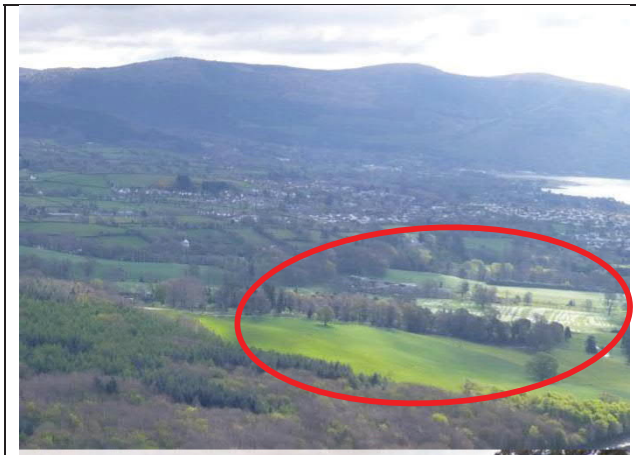


Site Number: WT907 (Woodland Trust), also within Narrow Water Forest SLNCI (Long-established Woodland).

Some stands are relatively mature, such as the beech woods, however these form a dense even-age stand indicating its plantation origins. The ground flora is almost exclusively restricted to bluebells and ivy and therefore has restricted biodiversity.

Tree species:
Beech *Fagus sylvatica;*
Sycamore *Acer pseudoplatanus.*

Ground Flora (Ancient woodland species):
Bluebells *Hyancinthoides non-scripta;*
Ivy *Hedera helix.*



Site Number: WT904 (Woodland Trust), long-established Woodland part of Narrow Water Castle grounds.

Parkland habitat in the grounds of the Narrow Water Castle. Large areas grazed by cattle. Woodland flora restricted as mostly open grassland habitat.

Tree species:
Ash *Fraxinus excelsior;*
Beech *Fagus sylvatica;*
Oak *Quercus sp.;*
Sycamore *Acer pseudoplatanus.*

Ground Flora (Ancient woodland species):
Bluebells *Hyancinthoides non-scripta;*
Ivy *Hedera helix;*
Lesser celandine *Ficaria verna;*
Wood anemone *Anemone nemorosa.*

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