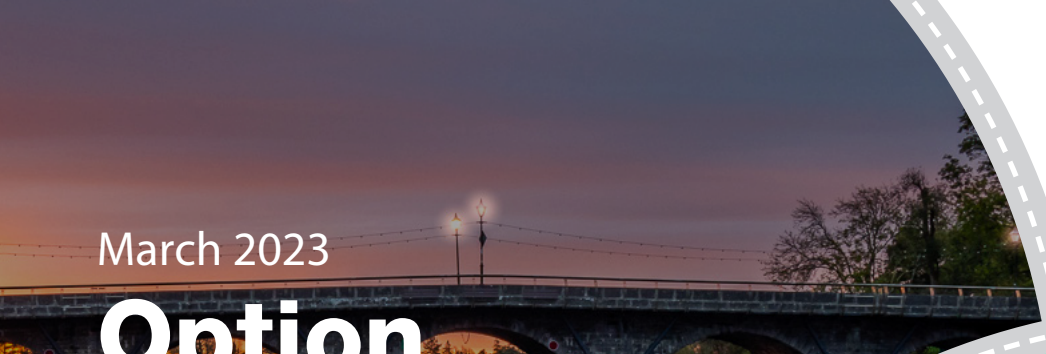
Carrick-on-Shannon to Dromod

March 2023

Option Selection Report



An Roinn Iompair
Department of Transport

Tionscadal Éireann
Project Ireland
2040

Comhairle Chontae Liatroma
Leitrim County Council

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Bonneagar Iompair Éireann
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ARUP

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Volume 2 Main Report

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1 Introduction

1.1 General

Leitrim County Council appointed Arup in March 2020 to undertake consultancy services for the N4 Carrick-on-Shannon to Dromod Project in accordance with Phase 1 – 4 of the Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG)[1]. The purpose of this Phase 2 Option Selection Report is to identify a Preferred Option Corridor that allows for a sustainable transport solution over the existing N4 corridor extents under consideration; whilst also providing efficient connectivity to the Northern and Western Regions.

The N4 Carrick-on-Shannon to Dromod Project is being implemented in accordance with TII's PMGs[1] and the Project Appraisal Guidelines (PAG). These guidelines provide a framework for the management, development and delivery of national road and public transport capital projects. The PMGs[1] divide the evolution and progression of a project into an eight-phase process (Phase 0 – 7 inclusive) as illustrated in Plate 1.1 below.

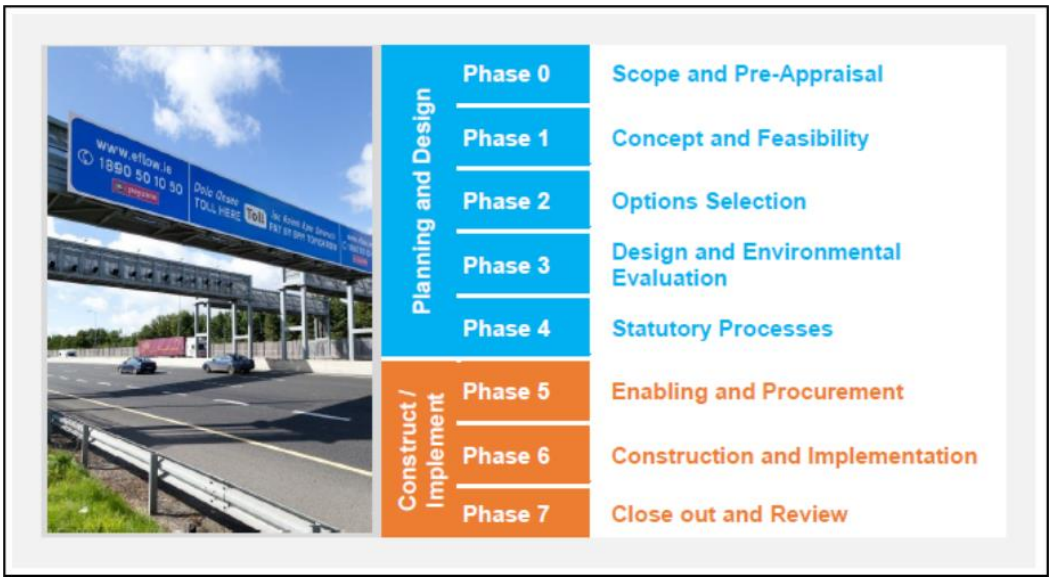

Plate 1.1 TII PMG Project Phases

Following the completion of the Phase 1 Concept and Feasibility Studies in June 2020, Phase 2 of the project was progressed through 2021 and early 2022 culminating in the completion of this Option Selection Report.

[1] TII 2020. Project Management Guidelines PE-PMG-02041, December 2020. These guidelines have since been updated in July 2022 and the updates do not affect the content of this report. Available from: https://www.tiipublications.ie/library/PE-PMG-02041-04.pdf

1.2 Overview of the Proposed Project

The planning, design, implementation and safe operation of national roads in Ireland is the responsibility of TII under Section 17 of the Roads Act, 1993. Working in partnership with the Department of Transport, the National Transport Authority (NTA) and local authorities, TII strives to provide sustainable transport infrastructure and services, delivering better quality of life, supporting economic growth and respecting the environment.

The national primary route N4, Dublin to Sligo is a strategic corridor from Dublin to the northwest and is approximately 198km in length. It is recognised as being of particular importance in enhancing accessibility to some of the most peripheral areas in the northwest (including Leitrim / Roscommon / Sligo and Donegal) and west of the River Shannon.

The N4 forms part of the EU TEN-T comprehensive network providing a strategic link between Dublin and Sligo - with Sligo being identified as a regional centre in the 2021-2030 National Development Plan[2] and the National Planning Framework (NPF)[3]. The N4 connects directly with the N5 and N6 national primary routes which also form part of the EU TEN-T comprehensive network. The N4 is defined as part of the TEN-T comprehensive network for reasons of national and international importance. Such a designation carries a requirement to be a high-quality road to serve an important role in long-distance freight and passenger traffic. It also is required to integrate the main urban and economic centres, interconnect with other transport modes and connect peripheral regions.

The Northern and Western Region encompasses eight counties Galway, Mayo, Sligo, Roscommon, Leitrim, Cavan, Monaghan and Donegal. It is predominantly rural, with Galway being the only city, with the towns of Sligo, Athlone and Letterkenny serving the rural hinterland.

Accessibility and mobility within the region, i.e. the ease with which people can get around for leisure, education and work, have a direct effect on the region's economic competitiveness as well as the attractiveness of the region as a favourable living, working and visiting environment. People moving to, from or between workplaces, and the movement of commodities and products are important components of the regional economy. An attractive, effective transport infrastructure system is necessary to attract and retain skilled labour to the region and thus stem the population loss in the region.

Significant lengths of the N4 have been improved / upgraded to dual carriageway in the recent past. With these upgrades, especially the opening of the N4 Dromod Roosky Bypass, and the N4 Collooney to Castlebaldwin dual carriageway, Carrick-on-Shannon has become a bottleneck for long distance, strategic and regional

[2] Department of Public Expenditure and Reform. 2021. National Development Plan 2021-2030. Available from: https://www.gov.ie/en/publication/774e2-national-development-plan-2021-2030/
[3] Department of Housing Planning and Local Government, 2018. Project Ireland 2040, National Planning Framework. Available from: https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

traffic. Carrick-on-Shannon remains the only regional strategic centre on the N4 between Dublin and Sligo which has not been bypassed to date.

The section of the N4 under consideration is approximately 20km long, comprising both rural sections (approx. 16km combined length) and urban sections (4.2km combined length). The proposed project will commence at an appropriate tie-in point on the existing N4 in the townland of Drumharlow, north of Carrick-on-Shannon to Faulties townland, south of Aghamore. The main towns and villages along the route are Cortober, Carrick-on-Shannon, Drumsna and Aghamore. The town of Carrick-on-Shannon and the town of Cortober are separated by the River Shannon and for the purposes of this report, where Carrick-on-Shannon is referenced, it is taken to mean the towns of both Carrick-on-Shannon and Cortober.

This section of the N4 traverses two local authority boundaries, with the section west of the River Shannon within Roscommon County Council (RCC) and the section east of the River Shannon within the boundary of Leitrim County Council (LCC). A Section 85 agreement has been entered into by both local authorities, which appoints LCC as the Lead Local Authority and Sponsoring Agency of the project. Transport Infrastructure Ireland (TII), acting as the Approving Authority, have appointed Roscommon National Roads Regional Office (RNRRO) to project manage the delivery of the project. The study area as shown in Figure 4.1.1.1 represents the anticipated study area within which alternatives and options will be developed.

1.3 Previous Studies

1.3.1 N4 Carrick-on-Shannon Bypass

In 2001 Leitrim County Council appointed M.C. O'Sullivan and Company Ltd (MCOS) to provide engineering consultancy services for an N4 Carrick-on-Shannon Bypass Project.

The study area considered for this project extended over an area of approximately 6km in diameter centred on the town of Carrick-on-Shannon and the town of Cortober. The studies culminated in the production of a Constraints Study report, a Route Selection Report and the identification of a preferred route corridor, which was a 6.3km bypass generally to the north of Carrick-on-Shannon (refer to Plate 1.2). It included an at-grade junction with the R280 Regional Road.

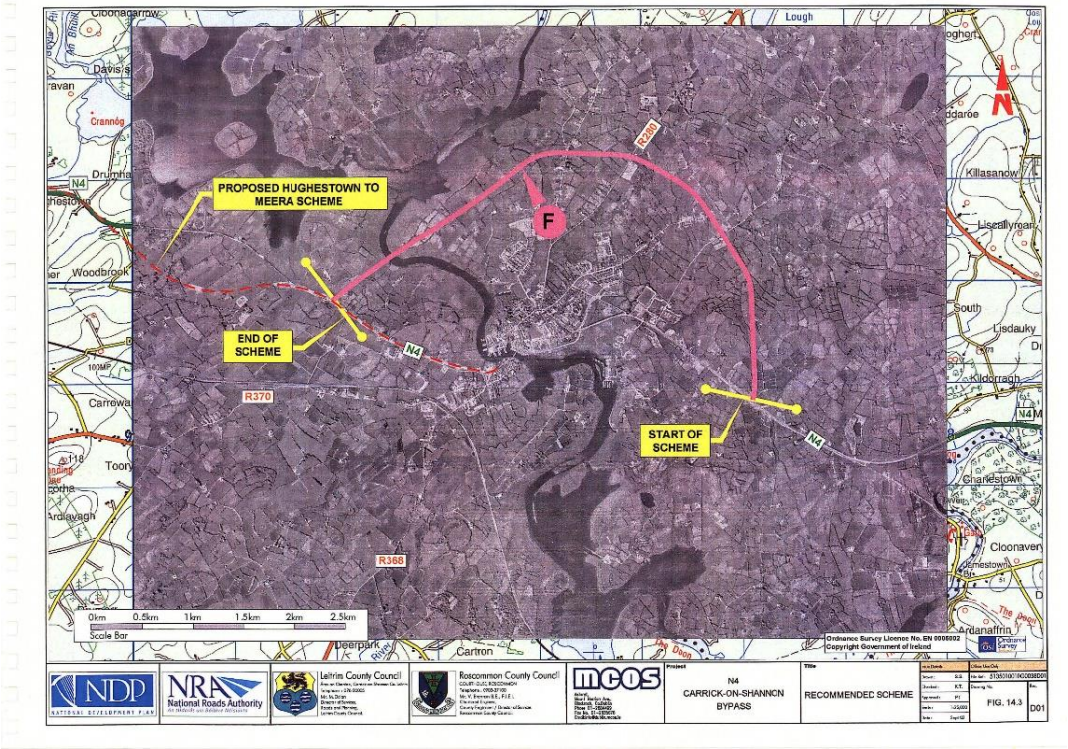

Plate 1.2 N4 Carrick-on-Shannon Bypass Previous Route 2002 (Pink Line)

1.3.2 N4 Carrick-on-Shannon to Dromod Project

In February 2009 Leitrim County Council appointed Roughan & O'Donovan Consulting Engineers (ROD) to provide engineering consultancy services for the N4 Carrick-on-Shannon to Dromod Project.

The study area was considerably extended and incorporates the existing N4 road section from Carrick-on-Shannon to the northern tie-in of the N4 Dromod Roosky Bypass, which opened in 2007. This commission culminated in the production of a route corridor selection report which identified the preferred route corridor as shown on Plate 1.3. The preferred route corridor is currently reserved in the Leitrim County Development Plan 2015-2021.

Due to unprecedented financial constraints brought on by the 2008 Irish economic recession, the project was suspended in 2012. In the intervening years, laws, regulations, and policies have developed and changed; in addition to changes in how we live and work. In this context the preferred route corridor identified for a road based transport solution may no longer be the optimum transport solution however, it will also be reviewed as part of this project.

This northern corridor, which is currently reserved in the Leitrim County Development Plan 2015-2021, has been in the public domain for the past 10 years, and as such, the perception was that any future project would also select a northern corridor for a bypass should a bypass form part of any preferred transport solution.

Plate 1.3 N4 Carrick-on-Shannon to Dromod Preferred Route 2012

1.4 Adjacent Project

1.4.1 N4 Mullingar to Longford (Roosky)

Westmeath County Council is working in partnership with Longford County Council and in association with Transport Infrastructure Ireland, to develop a scheme along a section of the N4 between Mullingar and Longford (Roosky). This 52km section of the N4 is a single carriageway road that passes through or close to several settlements, including Ballinalack, Rathowen, Edgeworthstown, Longford and Newtownforbes. This project terminates at the eastern end of the Dromod Roosky Bypass, with the N4 Carrick-on-Shannon to Dromod Project commencing at the western end of the Dromod Roosky Bypass.

Again, as noted above, the N4 serves a vast geographical area and provides a strategic function in terms of connecting the West and Northwest regions of Ireland to the Midlands and the east of the country. Many businesses in these areas depend on the N4 corridor for access to both national and international markets. The main aims of this project are to deliver on policy and improve road safety.

Co-ordination meetings are taking place between the two project teams to discuss overlaps and interfaces between the two projects such as the transport modelling, rail assessment and environmental studies.

1.5 Development of the Project

1.5.1 Phase 0 Scope and Pre-Appraisal

As shown in Plate 1.1, TII projects are broken into phases. The first phase of the project is Phase 0 which involves the preparation of a scoping document, namely the Project Appraisal Plan (PAP), which sets out the proposed approach to the appraisal of a project in advance of any significant data collection being undertaken. Phase 0 PAP was completed by Roscommon National Roads Regional Office (RNRRO), in accordance with TII PAG Unit 2.1 (October 2016)[4], on behalf of Leitrim County Council in July 2018. The PAP was submitted by TII to the Department of Transport, Tourism and Sport (DTTaS) Strategic Research and Analysis Division (SRAD) for review. A review of the PAP was undertaken by SRAD who confirmed in July 2018 that the PAP was compliant with the Public Spending Code and the Common Appraisal Framework.

The Phase 0 Project Brief for the N4 Carrick-on-Shannon to Dromod Project was completed by RNRRO on behalf of Leitrim County Council in January 2019 and submitted to TII for approval alongside the request to proceed to Phase 1. The approval to proceed to Phase 1 was granted by TII in July 2019.

1.5.2 Phase 1 Concept and Feasibility

Phase 1 commenced with the appointment of Arup in March 2020. The purpose of Phase 1 is to gain a better understanding of the issues and constraints and to assist in planning the direction of further studies. The project aim is to identify, evaluate, and resolve the transportation issues in Carrick-on-Shannon, its environs, and the broader national road network – in particular the N4 corridor over the extents defined above. To this end, it was necessary during Phase 1 to first identify the transportation issues, then establish the project objectives, and thereafter determine an appropriate sustainable solution which meets these project objectives. To achieve this outcome, it is necessary to assess possible and sustainable solutions which include alternative transport modes and infrastructural options within the study area. “Alternatives”, in the context of project appraisal in accordance with the requirements of the TII Project Appraisal Guidelines, refer to a specific transport mode (road, rail, bus, air, etc.) or demand management proposals (fiscal, control, ITS measures, etc) which could address the need for an intervention and “options” refer to the specific road measures that may be developed as part of the road alternative.

The Phase 1 studies include a detailed examination of conditions on the existing national route. These studies identify numerous transportation issues in the study area, including:

- Carrick-on-Shannon is the social and economic focal point in the study area and region as a whole; however, the N4 passes through Carrick-on-Shannon and

[4] The current TII PAG Unit 2.1 at the time of undertaking Phase 0 of the project was October 2016. Those guidelines make reference to a Project Appraisal Plan (PAP) which is now referred to as a Strategic Assessment Report in the current guidelines.

crosses the River Shannon on the only bridge crossing in Carrick-on-Shannon. This hinders the economic and cultural development of the town, generates noise and air quality issues and creates an unsafe environment for urban life.

- The cross-section on the River Shannon bridge is extremely sub-standard and this results in considerable congestion and safety issues in the heart of the town where the streets serve both a social function as well as a transport function.
- There are 197 direct accesses on the section of the N4 under consideration which includes 113 farm accesses, 58 domestic accesses and 24 commercial accesses which create conflict points and comprise safety.
- Empirical journey time measurements recorded average journey speeds within the section of the N4 under consideration at 65km/h for weekday peak and inter peak periods, dropping to 57km/h during the Friday PM peak. These journey speeds are significantly below the National Planning Framework target of 90km/h for inter-urban roads and impact on regional accessibility which in turn restrains economic growth of the Northwest Region.
- A relatively low demand exists for rail at stations along the Sligo-Dublin corridor within, and close to, the study area which is likely reflective of the limited number of services available and dispersed population within the study area, which fosters an unsustainable dependency on the private car.
- There are a very limited number of bus services available in the study area with only one route serving the entire section of the N4 under consideration (BÉ route 23) again which fosters dependency on the private car.

The results of the Phase 1 studies determine that a strong justification for the advancement of the N4 Carrick-on-Shannon to Dromod Project to Phase 2 exists. A number of feasible transportation measures meriting more rigorous assessment were identified, including public transport alternatives, demand management solutions and road improvements options.

The N4 Carrick-on-Shannon to Dromod Project is currently at Phase 2, the output from which is the publication of this Option Selection Report (OSR). The structure of the OSR is set out in Section 1.9 and generally follows the process of Phase 2.

1.6 Project Objectives

After identifying and assessing the existing transportation problems in the study area, the objectives of the N4 Carrick-on-Shannon to Dromod Project were defined. These are framed in accordance with the Department of Transport (DoT) publication Common Appraisal Framework for Transport Projects and Programmes (October 2019)[5] (V02 in effect at time of the development of the Project Objectives)

[5] Department of Transport, Tourism and Sport, 2019. Common Appraisal Framework for Transport Projects and Programmes, July 2019 This was updated October 2021 and the update does not change the project objectives. Available at: https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework
An additional appendix dated 7 March 2022 containing interim guidance on the alignment of land transport investment proposals with the National Investment Framework for Transport in Ireland (NIFTI) was published in April 2022. This additional appendix is addressed in Section 1.7.

and Unit 3.0 of the TII Project Appraisal Guideline (PAG)[6]. They are summarised in the section below.

The project objectives have also been reviewed in the context of the National Planning Framework (NPF) and its National Strategic Outcomes (NSOs). While not all objectives align directly with an NSO, nor is each NSO covered by a project objective, reference to an NSO is added to a project objective below where appropriate.

Economy

- To provide a reliable transport system over the N4 corridor extents under consideration and to contribute to efficient connectivity between the Northern and Western Regions with Dublin and the Eastern and Midland Regions to balance regional development (NSO 2, 3)
- To provide a solution that offers good value for money and reduces the cost of travel (NSO 1)
- To provide opportunities to enhance the future tourism and economic prospects of Carrick-on-Shannon and the wider northwest regions of Roscommon, Leitrim, Sligo and Donegal (NSO 3)

Safety

- To reduce the potential for collisions and severity of collisions by providing a safer travelling environment for all road users over the N4 corridor extents under consideration supporting the RSA Road Safety Strategy 2021 – 2030
- To reduce the potential for conflict with vulnerable road users within built-up areas of Carrick-on-Shannon, Cortober and Aghamore (NSO 1)

Environment

- To provide opportunities to enhance the local amenity and heritage value of the area (NSO 7)
- To ensure consideration of sustainable development principles and measures to minimise the effects on the environment to support the government's Climate Action Plan (NSO 4, 8)
- To minimise impacts on designated Natura 2000 sites in the vicinity of the study area (NSO 7)
- To minimise the impact to local watercourses and associated flood plains, in particular the River Shannon (NSO 9)
- The proposed scheme will seek to reduce noise and air impacts in the various settlements along the corridor (NSO 4)

[6] TII, 2016. Project Appraisal Guidelines for National Roads Unit 3.0 – Project Brief PE-PAG-02012, October 2016. Available from: https://www.tiipublications.ie/library/PE-PAG-02012-01.pdf

Accessibility and Social Inclusion

- Improve accessibility to key facilities, such as employment, education, transport and healthcare to satisfy transport demand for all trip types for all modes of transport on the national road transport network (NSO 10)
- To provide opportunities to enable the successful creation of place making and generation of a vibrant community in Carrick-on-Shannon (NSO 3, 5)
- Facilitate the enhancement of sustainable travel and improved connectivity to public transport opportunities (NSO 4)
- To improve connectivity across the River Shannon and in turn support social and economic development within this regional strategic town and its hinterland (NSO 2, 5)

Integration

- To support sustainable growth in Carrick-on-Shannon through the creation of an attractive environment to encourage sustainable trips (NSO 1, 4)
- To achieve the goals of the TEN-T comprehensive network by providing high quality links which will contribute to enhancing social cohesion within Ireland and across the EU, further supporting the integration of all transport modes within the wider region, integrating with regional public transport facilities (NSO 2)
- To support the integration objectives to balance the social and economic development in the Northwest Region as set out in national and regional policies (NSO 2)

Physical Activity

- To enable walking and cycling opportunities in a safer environment for the communities along the corridor (NSO 4)
- To create a healthy environment conducive to active travel for the communities along the corridor (NSO 3)

Once the existing problems were defined and the project objectives established, it was then possible to proffer preliminary potential solutions for appraisal.

1.7 Alignment with NIFTI Investment Priorities

The National Investment Framework for Transport in Ireland (NIFTI) establishes a set of Investment Priorities, in addition to Modal and Intervention Hierarchies, which serve to guide land transport investment. In accordance with the interim guidance issued by the Department of Transport in March 2022, it is necessary to consider and demonstrate how project objectives are strategically aligned with the NIFTI Investment Priorities. A qualitative assessment of how each project objective relates to the four NIFTI Priorities is outlined in Table 1 below.

Table 1 Alignment of Project Objectives with NIFTI Investment Priorities

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
Economy	E1: To provide a reliable transport system over the N4 corridor extents under consideration and to contribute to efficient connectivity between the Northern and Western Regions with Dublin and the Eastern and Midland Regions to balance regional development. E2: To provide a solution that offers good value for money and reduce the cost of travel. E3: To provide opportunities to enhance the future tourism and economic prospects of Carrick-on-Shannon and the wider northwest regions of Roscommon, Leitrim, Sligo and Donegal.	Strongly aligns with *Mobility of People and Goods in Urban Areas* The current N4 is part of the TEN-T comprehensive network, but this section of the corridor is stymying sustainable transport measures in the urban areas of Carrick-on-Shannon and Cortober, which is dependent on a transport solution which releases the existing streets for more sustainable modes.	Any amount of new construction would have a negative impact on the Decarbonisation priority. To mitigate this any potential solution must seek to enable active travel and public transport usage, whilst also maximising reuse of the existing infrastructure and assets, to achieve the NIFTI priority of ensuring the resilience of the most strategically important parts of the network.
		Strongly aligns with *Protection and Renewal* The transport solution will seek to reuse and upgrade the existing national road asset to the largest degree possible with an aim to minimise unnecessary journey length and thus offer value for money.	
		Strongly aligns with *Enhanced Regional and Rural Connectivity* The E1 and E3 objectives seek to provide connectivity to the northwest region and address the bottleneck caused by the River Shannon bridge crossing, thus fostering economic competition and efficiency, as well as ensuring reliable access to amenities and essential services.	
		Moderately aligns with *Decarbonisation* A reliable transport system by its nature will provide the most appropriate solution for each trip. As such, a holistic transport solution will be sought to enable sustainable modes as an attractive option.	

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
Safety	S1: To reduce the potential for collisions and severity of collisions by providing a safer travelling environment for all road users over the N4 corridor extents under consideration supporting the RSA Road Safety Strategy 2021-2030. S2: To reduce the potential for conflict with vulnerable road users within built-up areas of Carrick-on-Shannon, Cortober and Aghamore.	Strongly aligns with *Mobility of People & Goods in Urban Areas* Safety Objective S2 seeks a reduction of potential for conflict with vulnerable road users. This aligns with the priority of delivering sustainable mobility objectives of urban settlement plans as safe movement by all is only possible when conflicts are removed in the towns and villages.	Any amount of new road construction provided to meet the objective of significantly reducing the number of conflict points would have a negative impact on the Protection and Renewal priority. To mitigate this any potential solution must seek to repurpose the existing infrastructure to the fullest extent to provide safe active travel measures.
		Moderately aligns with *Protection and Renewal* The existing N4 has almost 200 private direct accesses onto it and is the singular piece of infrastructure for all modes across the River Shannon. As such, the reuse of the existing N4 at the River Shannon bridge crossing may be incompatible with the resolution of the conflict points and associated conflict points within the urban areas of Carrick-on-Shannon and Cortober, as some new infrastructure may be required. The potential for upgrade and renewal of the existing N4 over the project is high and therefore has the potential to strongly align with the NIFI priorities and represents a key enabler in enhancing active travel provision and the rationalisation and removal of many conflict points.	
		Strongly aligns with *Enhanced Regional and Rural Connectivity* The proposed transport solution will seek to address the existing safety deficiencies of the multiple accesses, thereby facilitating safe, accessible, reliable and efficient travel on the network connecting the regions.	

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
		Moderately aligns with *Decarbonisation* Supportive of the investment priority to decarbonise through the project's commitment to provide safer conditions for active travel, which is necessary to promote modal shift to sustainable transport alternatives.	
Environment	Env 1: To provide opportunities to enhance the local amenity and heritage value of the area. Env 2: To ensure consideration of sustainable development principles and measures to minimise the effects on the environment to support the government's Climate Action Plan. Env 3: To minimise impacts on designated Natura 2000 sites in the vicinity of the study area. Env 4: To minimise the impact to local watercourses and associated floodplains, in particular the River Shannon. Env 5: The proposed scheme will seek to reduce noise and air impacts in the various settlements along the corridor.	Strongly aligns with *Mobility of People & Goods in Urban Areas* Any proposed transport solution seeks to reduce traffic and associated air quality impacts, plus noise levels in urban areas. This will help restore the attractiveness and vitality of these areas for urban living and sustainable mobility.	Mitigation is already included in the environmental objectives as maximising the reuse of the existing infrastructure and assets along theN4 could minimise conflict with the *Protection and Renewal* and *Decarbonisation* priorities. Any new construction in the vicinity of the settlements to reduce air and noise impacts will seek to mitigate those impacts by enabling active travel and public transport in the settlements.
		Moderately aligns with *Protection and Renewal* These objectives seek to provide opportunities to enhance local amenity, reduce noise and air quality impacts on sensitive receptors, minimise impacts on local watercourses, ecological sites and floodplains. The proposed transport solution may involve the construction of new infrastructure which could result in moving the traffic away from the urban areas thus delivering on the project objectives. It could also seek to reutilise or repurpose the existing infrastructure. Alignment with this NIFTI priority would then be achieved through renewing and repurposing the existing asset both in the urban areas and on sections of upgraded infrastructure.	
		Strongly aligns with *Enhanced Regional and Rural Connectivity* Objectives to reduce traffic related impacts on the human environment are inextricably linked to enhancing regional and rural connectivity as once the conflicts are resolved, connectivity is possible. There are numerous existing conflicts between these two entities along the N4 corridor through	

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
		the urban area of Carrick-on-Shannon, Cortober and also a multitude of residential and agricultural accesses in the rural areas. If these conflicts are resolved, then connectivity is enhanced.	
		Moderately aligns with *Decarbonisation* Reducing traffic related impacts on existing communities is an integral element in enabling more sustainable development and sustainable mobility patterns to thrive in such areas – a key necessary step in decarbonisation. Support of the Climate Action Plan is wholly supportive of this NIFTI priority.	
Accessibility and Social Inclusion	A&S 1: Improve accessibility to key facilities, such as employment, education, transport, and healthcare to satisfy transport demand for all trip types for all modes of transport on the national road transport network. A&S 2: To provide opportunities to enable the successful creation of place making and generation of a vibrant community in Carrick-on-Shannon. A&S 3:Facilitate the enhancement of sustainable travel and improved	Strongly aligns with *Mobility of People and Goods in Urban Areas* Enhanced accessibility for all communities currently severed by the N4 in particular Carrick-on-Shannon and Cortober, thus ensuring easier, safer access to community facilities and amenities, especially for vulnerable road users.	No further mitigation is required.
		Strongly aligns with *Protection and Renewal* Improving accessibility among existing communities enables a potential for renewal of Carrick-on-Shannon and Cortober as places for living and sustainable mobility – becoming vibrant communities.	
		Strongly aligns with *Enhanced Regional and Rural Connectivity* A&S1 explicitly states its aim to reduce social exclusion and this will be achieved by enhancement and improvement in access to key facilities and seeks to remove the current stifling of connectivity in the local area as well as regionally.	

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
	connectivity to public transport opportunities. A&S 4: To improve connectivity across the River Shannon and in turn support social and economic development within this regional strategic town and its hinterland.	Strongly aligns with *Decarbonisation* The improvement of accessibility of active modes and sustainable travel are critical to achieving decarbonisation targets. In addition, by creating vibrant communities within which the community want to stay as set out in A&S 2, decarbonisation will be facilitated through reduced number of journeys and journey distance, further contributing to decarbonisation.	
Integration	I1: To support sustainable growth in Carrick-on-Shannon through the creation of an attractive environment to encourage sustainable trips. I2: To achieve the goals of the TEN-T Comprehensive network by providing high quality links which will contribute to enhancing social cohesion within Ireland and across the EU, further supporting the integration of all transport modes within the wider region, integrating with regional public transport facilities.	Strongly aligns with *Mobility of People and Goods in Urban Areas* I2 aims to support mobility of people and goods both in the urban areas and wider regions through integration with other sustainable transport modes which aligns with this NIFTI priority. Strongly aligns with *Protection and Renewal* I2 seeks to enable a renewal of Carrick-on-Shannon for sustainable mobility whilst also promoting the improvement and optimisation of the existing N4 to a high-quality link serving the regions. Strongly aligns with *Enhanced Regional and Rural Connectivity* The integration objectives seeks an improvement and optimisation of the existing N4 to a high-quality link which may support enhanced connectivity as well as provide opportunities to better regional public transport connectivity for busses.	To offset the impacts of new road construction on *Decarbonisation* priority, the existing N4 will be optimised and reused to the maximum extent to ensure minimal additional kilometres are travelled in the final scheme, thus minimising operational carbon emissions increase. New construction will be targeted specifically in areas to promote sustainable mobility for shorter trip lengths.

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
	I3: To support the integration objectives to balance the social and economic development in the Northwest Region as set out in national and regional policies.	Moderately aligns with *Decarbonisation* The TEN-T policy aims to promote efficient, safe and environmentally friendly mobility via the provision of a high-quality strategic road for the N4. This has the potential to lead to additional new road construction, but this should also be viewed in the context of the enabling of more sustainable modes by the segregation of strategic trips from local trips both in the urban settlements and the rural area, hence why is moderately aligns with the NIFTI priority for decarbonisation.	
Physical Activity	PA1: To enable walking and cycling opportunities in a safer environment for the communities along the corridor. PA2: To create a healthy environment conducive to active travel for the communities along the corridor.	Strongly aligns with *Mobility of People & Goods in Urban Area* Both Physical Activity Objectives support the enhancement of walking and cycling opportunities which subsequently fundamentally align with the aim of the EU's Transport Policy to promote a mobility that is efficient, safe, secure, and environmentally friendly. An Active Travel solution along the N4 corridor and along desire lines between population centres, community facilities and employment centres can significantly enhance sustainable mobility choices and uptake through provision of an attractive, integrated network.	Not applicable.
		Strongly aligns with *Protection and Renewal* Both Physical Activity Objectives aim to support active travel to safely cater for sustainable trips. As the existing desire line along the existing N4 connecting communities does not make safe provision for active travel, especially in the rural areas, every effort will be made to protect and renew/reuse the existing N4 to maximum extent for active travel.	

Criteria	Project Specific Objective	Alignment with NIFTI Investment Priority	Mitigation where not aligned
		Strongly aligns with *Enhanced Regional and Rural Connectivity* Both Physical Activity Objectives aim to ensure that a sustainable alternative to private car transport is delivered as an integral component of the scheme. To provide a meaningful alternative capable of attracting significant mode share, active travel networks need to be safe, connected, and inclusive. The Physical Activity objectives will align with the NIFTI Investment Priority by enhancing connectivity indicated by modelled desire lines at a local and regional level to other communities along the N4 corridor and to key employment zones.	
		Moderately aligns with *Decarbonisation* An improvement of accessibility of active modes is critical to achieving decarbonisation targets.	

1.8 Purpose of the Option Selection Report

This Option Selection Report represents the primary deliverable for Phase 2. The purpose of Phase 2 is to identify a suitable study area for the examination of alternatives and options, to identify key constraints within that study area, to develop feasible transportation alternatives and options and to carry out a systematic assessment of these alternatives and options leading to the selection of a preferred solution. The purpose of the Option Selection Report is to document each step in the analysis during Phase 2 of the project, recording the assessments and decisions undertaken in order to identify and make a recommendation on the preferred solution.

The Option Selection assessments and reporting structure aligns with the TII Project Management Guidelines and follows the three-stage process outlined below:

- **Stage 1 – Preliminary Options Assessment**. A number of feasible alternatives and options which respond to the transportation problems identified are developed in accordance with TII PAG and a multi-criteria analysis is carried out under the assessment criteria of Engineering, Environment and Economy.
- **Stage 2 – Project Appraisal Matrix**. The alternatives and options advanced from Stage 1 are further evaluated by undertaking a full cost benefit analysis and multi-criteria analysis of the quantifiable and non-quantifiable impacts under the headline criteria of, Economy, Safety, Environment, Accessibility & Social Inclusion, Integration and Physical Activity.
- **Stage 3 – Preferred Option**. After the completion of Stage 2, a preferred option for the project will be selected based on the multi-criteria analysis and a Project Appraisal Balance Sheet (PABS) will be prepared for the preferred option only.

1.9 Structure of the Report

This Option Selection Report comprises of four separate volumes, namely:

- Volume 1 – Executive Summary
- Volume 2 – Main Report
- Volume 3 – Figures
- Volume 4 – Appendices

Volume 2 comprises nine separate chapters, as follows:

- Chapter 1 – *Introduction.*
- Chapter 2 – *Identification of Need,* presents the justification for the progression of the project in terms of its strategic fit within transport development policy at European, national, regional and local levels, together with an exploration of the existing transport deficiencies which further support the urgent need to advance the project.
- Chapter 3 – *Traffic Assessment and Intervention Required*, provides an overview of the scope and methodology adopted for the transport modelling

undertaken to inform alternative and option appraisal and selection. This chapter also examines the various factors relevant to informing the most appropriate level of intervention required.

- Chapter 4 – *Constraints Study,* defines the study area identified for the project and presents an overview of the principal artificial, natural and external parameter constraints identified and mapped.
- Chapter 5 – *Consideration of Alternatives and Options*, discusses the range of options and alternatives considered as part of the Phase 2 process, including both feasible and non-feasible alternatives and options.
- Chapter 6 – *Stage 1 Alternatives Assessment*, describes the initial comparative assessment of Alternatives carried out under the headings of Environment, Engineering and Economy.
- Chapter 7 – *Stage 1 Option Corridors Assessment*, describes the initial comparative assessment of Option Corridors carried out under the headings of Environment, Engineering and Economy.
- Chapter 8 – *Stage 2 Project Appraisal*, provides detail on how the alternatives and option corridors retained from Stage 1 were further developed, identifies any new options/alternatives introduced following Stage 1 and sets out the basis for the more detailed Stage 2 appraisal process. It presents a summary of the detailed comparative multi-criteria analysis undertaken to inform the recommendation of the preferred transport solution under the headings of Economy, Safety, Environment, Accessibility & Social Inclusion, Integration and Physical Activity.
- Chapter 9 – *Stage 3 Preferred Transport Solution and Project Appraisal Balance Sheet*, identifies the preferred transport solution and the Project Appraisal Balance Sheet (PABS) provides a concise summary of the expected impacts and benefits of the proposed development in consideration of the objectives of the project. Following this a third public display was held in May 2022 to inform the public of the Preferred Transport Solution.

1.10 Project Operational Goals and Design Strategies

As discussed in Section 1.6 above, the project objectives centre around the six criteria, Economy, Environment, Accessibility and Social Inclusion, Physical Activity, Integration and Safety.

The overall transport solution is to be developed to satisfy the project objectives and is assessed against the following performance targets, which are developed to ensure that the project objectives are achieved:

- Congestion relief in Carrick-on-Shannon to enable “Place Making” thereafter
- Improve accessibility to the Northwest Region
- Reduction in vehicular collisions
- Improve journey time reliability

The design strategy is based on the assessment of various alternatives and options. To assess the most viable transport solution, the design team have assessed both the natural and physical constraints to the project in addition to all external parameters potentially impacting the project.

The environmental assessment is conducted and compiled by Arup with input and assistance from the following specialist environmental sub-consultants:

- Biodiversity (Scott Cawley Ltd.)
- Hydrology (Hydro Environmental Ltd.)
- Landscape and Visual (Brady Shipman Martin)
- Planning (Coakley O'Neill)
- Archaeology, Cultural and Architectural Heritage (Irish Archaeological Consultancy (IAC))
- Material Assets - Agriculture (Curtin Agricultural Consultants Ltd.)
- Noise and Vibration (AWN Consulting Ltd.)
- Human Beings (Optimize Consultants Ltd.)
- Traffic (Systra)
- Valuation (Lisney)
- Human Health (Corporate Health Ireland)

2 Identification of Need

2.1 Introduction

The N4 forms part of the Trans-European Network for Transport (TEN-T) comprehensive network providing a strategic link between Dublin and Sligo, which is designated as a regional centre in both the National Development Plan and National Planning Framework. The N4 connects directly with the N5 and N6 national primary routes which also form part of the EU TEN-T comprehensive network for reasons of national and international importance. Such a designation carries a requirement to be a high-quality road to serve an important role in long-distance freight and passenger traffic. It also is required to integrate the main urban and economic centres, interconnect with other transport modes and connect peripheral regions.

The N4 carries both long-distance traffic to and from the east of the country to the northwest of the country and significant regional and inter-urban traffic flows between Mullingar, Longford, Carrick-on-Shannon, Boyle, and Sligo and also provides regional connections to the towns of Elphin (R368), Frenchpark (R370) and Leitrim Village onto Manorhamilton (R280).

The section of the N4 under consideration falls within two local authority administrative areas with the River Shannon acting as the boundary. The area to the west of the River Shannon lies within County Roscommon and to the east of the River Shannon within County Leitrim. Leitrim County Council is acting as the Lead Authority and are progressing the scheme with Roscommon County Council.

There is currently one crossing point of the River Shannon at Carrick-on-Shannon via a narrow masonry arch bridge, dating from 1846, which is sub-standard in terms of alignment and cross-section. The section of the N4 under consideration passes through both rural and urban environments, is approximately 20km long and extends from Drumharlow townland west of Carrick-on-Shannon to Faulties townland south of Aghamore.

Significant lengths of the N4 have been improved / upgraded to dual carriageway cross-section in the recent past. With these upgrades, especially the opening of N4 Dromod to Roosky Bypass, and the N4 Collooney to Castlebaldwin dual carriageway, Carrick-on-Shannon has become a bottleneck for long-distance and regional traffic. Carrick-on-Shannon remains the only regional strategic centre on the N4 between Dublin and Sligo which has not been bypassed to date.

There are sections of poor alignment along the built-up areas on the approaches to Carrick-on-Shannon and at Aghamore. There are frequent junctions with local roads and direct frontage accesses which contribute to a high number of accidents in the area.

The need for the N4 Carrick-on-Shannon to Dromod Project is supported in terms of policy from European to national to local level, which is outlined in sections 2.1, 2.3, 2.4 and 2.5 below.

2.2 European Policy

2.2.1 Trans-European Transport Network (TEN-T)

The TEN-T networks are a set of road, rail, air and water transport networks in Europe. The N4 corridor forms part of the TEN-T comprehensive network connecting Dublin to the west and northwest of the country as shown in Plate 2.2.1.

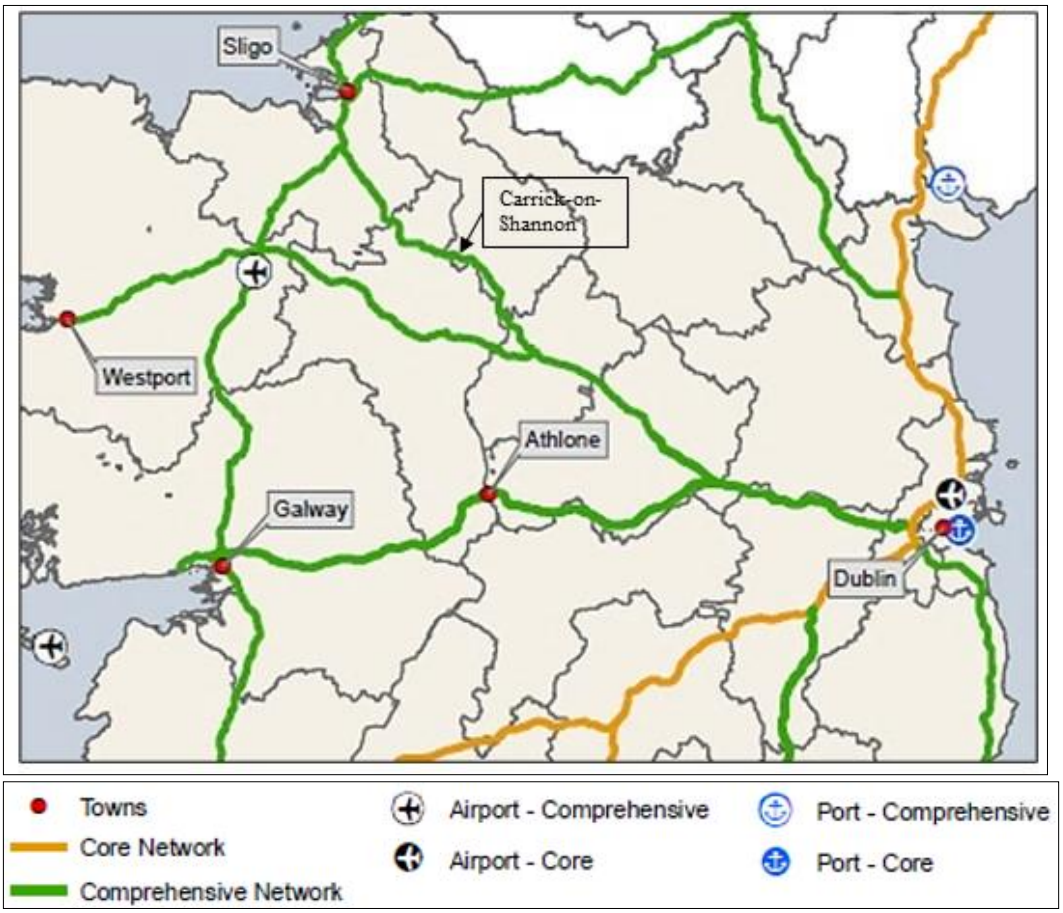

Plate 2.2.1 TEN-T Network connecting Dublin to the West and Northwest

Regulation (EU) Number 1315/2013 sets out the requirements for high quality roads that shall form part of the TEN-T road network, both core (2030)[1] and comprehensive (2050)[2], and states under Article 17(3), the following:

"High-quality roads shall be specially designed and built for motor traffic, and shall be motorways, express roads or conventional strategic roads".

Article 10 of the EU Directive No. 1315/2013 sets out the general priorities in the development of the comprehensive network and states:

"In the development of the comprehensive network, general priority shall be given to measures that are necessary for:

[1] The TEN-T Core network is targeted for completion by 2030
[2] The TEN-T Comprehensive network is targeted for completion by 2050

a) Ensuring optimal integration of the transport modes and interoperability within transport modes;

b) Bridging missing links and removing bottlenecks, particularly in cross-border sections;

c) Promoting the efficient and sustainable use of the infrastructure and, where necessary, increasing capacity"

The N4 is part of the comprehensive TEN-T network. Improvements to the TEN-T comprehensive network would enhance growth to the northwest, thus helping achieve the goal of increased regional connectivity to the northwest.

2.3 Strategic Fit and Priority within the National Road Programme

The National Roads Authority was formally established as an independent statutory body under the Roads Act 1993 with effect from 1 January 1994. The Minister for Transport, Tourism and Sport signed the order for the merger of the National Roads Authority (NRA) with the Railway Procurement Agency (RPA) to establish a single entity called Transport Infrastructure Ireland (TII). The NRA has been known as TII since 1 August 2015. TII's primary function, under the Roads Act 1993, is to secure the provision of a safe and efficient network of national roads. For this purpose, it has overall responsibility for the planning, supervision of construction, and road network maintenance on national roads.

In terms of road development, the objective of TII's capital expenditure programme is to improve the safety and efficiency of the national road network to make it fit for freight, business and social travel. Developing, maintaining, and operating the national road network in a safe, cost effective and sustainable manner generates an improved quality of life and national economic competitiveness.

The three strategic priorities for TII are summarised as follows:

- *Priority 1 – Asset management, Network Rehabilitation and Network Operations;*
- *Priority 2 – National Secondary Roads Improvements, Bottleneck Improvement Projects, safety Projects and Traffic Management projects; and*
- *Priority 3 – Network Improvement Projects.*

In the above context, it is again noted that the N4 forms part of the Trans-European Transport Network (TEN-T) comprehensive network providing a strategic link between Dublin and Sligo.

2.4 National Policy

The N4 Carrick-on-Shannon to Dromod Project demonstrates compliance with transport and planning policies in the various policy documents, set out below. At a national level, the following policy documents have relevance to the project.

2.4.1 Project Ireland 2040

Project Ireland 2040 is the government's long-term overarching strategy to make Ireland a better country for all and to build a more resilient and sustainable future. The *National Investment Framework for Transport in Ireland (NIFTI)*[3] provides the following graphic to demonstrate the hierarchy of *Project Ireland 2040* strategies and plans.

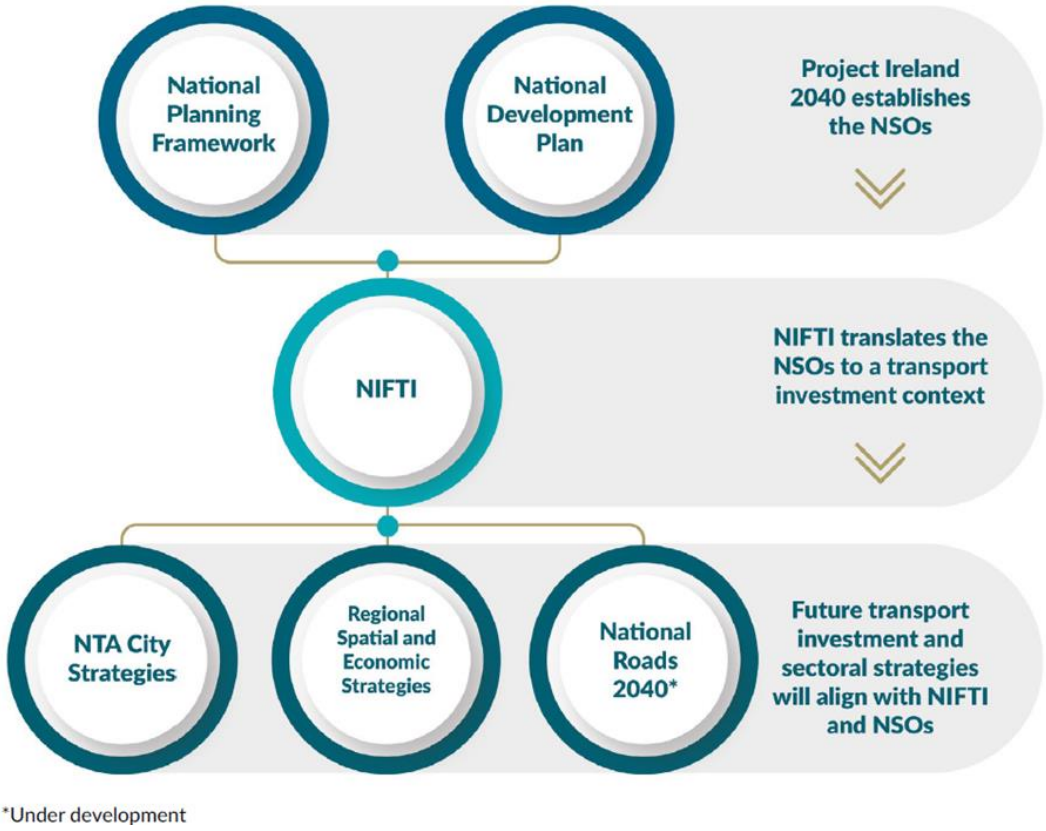

Plate 2.4.1 NIFTI Hierarchy of Project Ireland 2040 Strategies and Plans

2.4.2 Project Ireland 2040 (National Planning Framework)

The National Planning Framework (NPF)[4] was published by the Government on 16 February 2018. It sets out a strategic planning and development strategy for Ireland and all its regions up to 2040, setting a high-level framework for the co-ordination of a range of national, regional and local authority policies and activities, planning and investment, both public and private.

It is the ambition of the NPF to create a single vision with a shared set of goals for every community across the country. These goals are expressed in the Framework as 'National Strategic Outcomes' (NSOs). Whilst all ten NSOs are applicable to this project in so far as they are interlinked and achievable once linked, of note in

[3] Department of Transport, 2021. National Investment Framework for Transport in Ireland, December 2021. Available from: https://www.gov.ie/en/publication/cfae6-national-investment-framework-for-transport-in-ireland-nifti/
[4] Government of Ireland, 2018. Project Ireland 2040, National Planning Framework. Available from: https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

this instance is NSO 2 which seeks 'Enhanced Regional Accessibility. In this regard, Section 1.3 of the Framework states the following in relation to enhanced regional accessibility:

"A co-priority is to enhance accessibility between key urban centres of population and their regions. This means ensuring that all regions and urban areas in the country have a high degree of accessibility to Dublin, as well as to each other."

Under Enhanced Regional Accessibility, the NPF includes the following objective:

"***Accessibility to the North-West*** *– Upgrading northern sections of the N4 and N5 routes and sections of the N3/M3 national primary route*"

In addition, under this NSO there are specific objectives in relation to inter-urban roads:

- *Maintaining the strategic capacity and safety of national roads network including planning for future capacity enhancements*
- *Improving average journey times targeting an average interurban speed of 90kph*

The N4 National Primary Route is a strategic corridor from Dublin to the northwest and border counties which is of particular importance in enhancing accessibility to some of the most peripheral areas in the northwest (including Leitrim, Roscommon, Sligo and Donegal) and west of the River Shannon.

In this context, improvements to the N4 corridor would facilitate development in the northwest of the country and help achieve the goal of enhanced regional accessibility, as set out in the NPF. In the context of the achievement of NSO 2 of the NPF, a need for the N4 Carrick-on-Shannon to Dromod Project is established at national policy level.

The Plan also identifies the impact Brexit may have on this area and states:

"*Better accessibility between the four cities and to the Northern and Western region will enable unrealised potential to be activated as well as better preparing for potential impacts from Brexit*"

2.4.3 National Development Plan (2021 - 2030)

The National Development Plan 2021-2030 (NDP)[5] will drive Ireland's long term economic, environmental, and social progress across all parts of the country over the period of the plan.

As the constituent parts of Project Ireland 2040, the NDP is fully aligned with the delivery of the outcomes and objectives of the NPF (outlined in Section 2.3.2). It sets out under corresponding Strategic Investment Priorities, investment priorities

[5] Department of Public Expenditure and Reform, 2021. National Development Plan 2021-2030, October 2021. Available from: https://www.gov.ie/en/publication/774e2-national-development-plan-2021-2030/

over the next ten years that will underpin the successful implementation of each of the NSOs in the NPF.

Through NSO 2 (i.e. Enhanced Regional Accessibility), the NDP seeks to "*…enhance intra-regional accessibility through improving transport links between key urban centres of population and their respective regions, as well as improving transport links between the regions*."

In terms of National Road projects, it is stated that the focus of many is "*to ensure a high degree of accessibility for all regions and urban areas, to other regional centres and to our cities, developing and supporting regional connectivity…*"

Within this list, the NDP includes the N4 Carrick-on-Shannon to Dromod Project. With respect to this, it is stated that *"Under the revised NDP, the National Roads programme will continue to provide for improved connectivity across the years 2021-2030. The Department and Transport Infrastructure Ireland are working to continue to provide continued protection and renewal of the existing National Roads network as well as progressing new National Road projects which will improve compact growth and regional connectivity across the country. Accordingly, there will be significant investment in the national road network across the next 10 years."*

The N4 Carrick-on-Shannon to Dromod Project will therefore contribute to the NDP's National Strategic Objectives of Enhanced Regional Accessibility and Compact Growth, connecting communities and encouraging economic activity. It will also lead to the improvement of transport links by providing better journey times and reliability as well as safer routes for road users.

2.4.4 National Investment Framework for Transport in Ireland 2021

NIFTI[3] is the Department of Transport's high-level, strategic framework for future investment in the land transport network. The purpose of NIFTI is to support the delivery of the NPF[4]. This new framework replaces the previous Strategic Investment Framework for Land Transport (SIFLT), which was published by the Department of Transport in 2015.

NIFTI states that *"future transport investment will have to demonstrate alignment with NIFTI and, by extension, support the delivery of the NPF and the National Strategic Outcomes (NSOs)."*

NIFTI commits to investing in the delivery of *"… a safe and sustainable and transport network which supports prosperous communities, promotes balanced development and helps to realise our climate change goals."*

To deliver future investment in a sustainable manner, NIFTI promotes the most appropriate solution to a given problem or opportunity. It sets out a clear order of progression for developing this solution from both a modal hierarchy, i.e. active travel, public transport followed by private car, and an intervention hierarchy i.e. maintain, optimise, improve existing infrastructure before building new infrastructure, and does recognise that new infrastructure may be the appropriate solution where higher priority interventions do not achieve the objectives. The four

NIFTI Investment Priorities which identify what the Government will invest in are shown on Plate 2.4.2, noting that they are of equal importance:

- Mobility of People & Goods in Urban Areas
- Protection and Renewal
- Decarbonisation
- Enhanced Regional & Rural Connectivity

Plate 2.4.2 NIFTI Investment Priorities

The N4 Carrick-on-Shannon to Dromod Project would contribute to all of these priorities, particularly those of enhancing regional and rural connectivity and mobility of people in urban areas.

These priorities are supplemented by Modal and Intervention Hierarchies which set out how to approach projects, with the initial focus being on alternative modes such as Active Travel and public transport before provision for private vehicles, and thereafter ensuring that the maximum use is achieved with the existing asset before building new infrastructure.

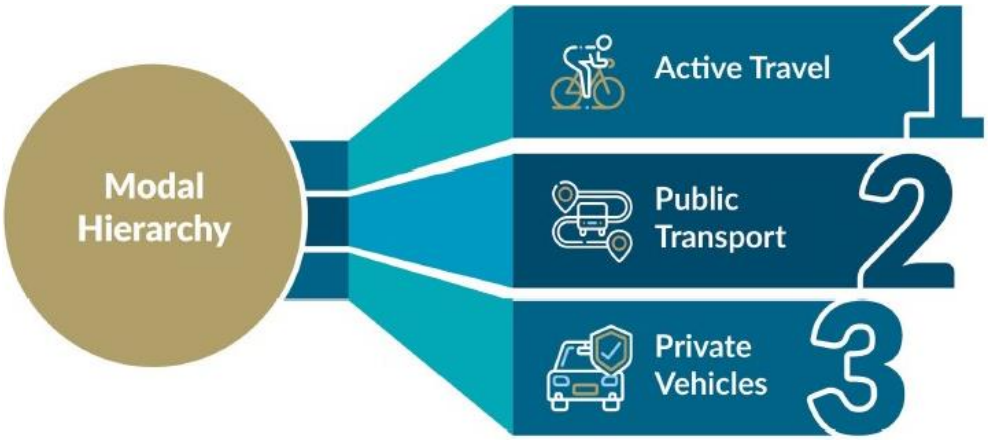

Plate 2.4.3 NIFTI Modal Hierarchy

Plate 2.4.4 NIFTI Intervention Hierarchy

2.4.5 Programme for Government 2020

The Programme for Government 2020[6] was published on 29 October 2020 and aims to address the issues that arose during the Covid-19 pandemic and outlines the Government's immediate approach to *"..recover our economy, rebuild our society, renew our communities, and respond to the challenges we face both nationally and internationally."*

The Programme states that the Government will *"...continue the investment programme in public transport to improve our bus, light rail, commuter, and inter-city rail network across our country."*

The Programme also commits to maintaining the existing road network to a high standard and funding safety improvements. In relation to transport infrastructure it sets out a commitment to *"..continue to invest in new roads infrastructure to ensure that all parts of Ireland are connected to each other."*

[6] Department of the Taoiseach, 2020. Programme for Government: Our Shared Future. Available from: https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/

In terms of regional development, it recognises that balanced regional development is critical to reducing pressure on the Greater Dublin area and, in this regard, there is a commitment in the Programme to *"Ensure sufficient investment in the local and regional road network to maintain roads to a proper standard, deal with road safety challenges, and improve regional accessibility*" and to *"Prioritise public transport projects that enhance regional and rural connectivity, in line with the National Planning Framework, for additional funding in the lifetime of a reviewed and extended National Development Plan."*

The Programme is relevant to this project as it sets out a series of commitments relating to the maintenance and improvement of transport infrastructure so as to improve regional connectivity and funding safety improvements.

We are committed to maintaining the existing road network to a high standard and funding safety improvements.

We will continue to invest in new roads infrastructure to ensure that all parts of Ireland are connected to each other.

The N4 Carrick-on-Shannon to Dromod Project aligns with the Programme in so far as its key project objectives are to improve safety along this section of the N4 and enhance regional connectivity.

2.4.6 Climate Action Plan 2023

The Climate Action Plan, 2023[7] was published in December 2022 by the Government and is the second annual update to Ireland's Climate Action Plan 2019 and implements the carbon budgets and sectoral emissions ceiling agreed in July 2022. This Plan is a roadmap for the actions required to halve emissions by 2030 and to reach net zero by 2050. The objective of this Plan is to reduce Ireland's greenhouse gas emissions across key areas including Electricity, Buildings, Transport, Agriculture, Enterprise and Services and Waste and the Circular Economy.

The challenge presented by the transport sector is reflected in that it represented 15.7% of the country's total GHC emissions in 2021 and has been the fastest growing source of such emissions over the past three decades. Without significant changes in travel patterns, modal share, and technology, a growth in current transport activity and demand will further diminish our national competitiveness, quality of life, and decarbonisation goals.

The proposed pathway for addressing this issue in the transport sector is focused on *"…"…reducing the use of private passenger cars, a modal shift to transport modes with lower energy consumption (e.g., public transport, walking and cycling) while accelerating the electrification of road transport (e.g., increased use of electric and low-emission vehicles) and increasing biofuel blend rates."*

[7] Department of the Environment, Climate and Communications, 2022. Climate Action Plan 2023, December 2022. Available from: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

The Plan calls for a significant cut in transport emissions by 2030 through a series of measures including:

- Change the way we use our road space
- Reduce the total distance driven across all car journeys by 20%
- Walking, cycling and public transport to account for 50% of our journeys
- Nearly 1 in 3 private cars will be Electric Vehicles
- Increase walking and cycling networks

In terms of N4 Carrick-on-Shannon to Dromod Project, the alternatives being considered as part of the option selection process seek to develop a better-connected transportation network for all users, and improvement in safety which could serve to encourage a shift towards more sustainable travel. Furthermore, through reduction in vehicle numbers within settlement areas the proposed project will support the plan by reducing transportation impacts on localised air quality in towns and villages.

2.4.7 National Ports Policy 2013

The National Ports Policy was published by DTTAS in 2013[8]. The report introduces clear categorisation of the ports sector based on significance and the port governance model to be adopted by Ireland.

Dublin Port is a Tier 1 port of National Significance. Tier 1 ports are categorised as ports that:

- *are responsible for 15% to 20% of overall tonnage through Irish ports*
- *have clear potential to lead the development of future port capacity in the medium and long term, when and as required*

In order to provide resilience to the Irish trading networks following potential outcomes of the Brexit process it is important the internal linkages to Tier 1 ports are enhanced. The N4 is the primary link from Sligo, which is a Project Ireland 2040 assigned urban growth centre, as well as linking the northwest of the country to this Tier 1 port.

In addition, Sligo is identified as a 'Port of Regional Significance'. These are ports that serve an important regional purpose and/or specialised trades or maritime tourism. In this regard, the National Ports Policy recognises the importance of these ports in serving their hinterlands and in supporting balanced regional development.

The N4 provides important connectivity to the northwest of the country and to the Port of Sligo and its improvement will support their status and role under the National Ports Policy.

[8] Department of Transport, 2013. National Ports Policy. Available from: https://www.gov.ie/en/publication/4aa3cc-national-ports-policy/

2.4.8 Connecting Ireland Rural Mobility Plan 2021

The Connecting Ireland Rural Mobility Plan is a major national public transport initiative funded by the Department of Transport. Managed by the NTA, the aim of the plan is to increase public transport connectivity, particularly for people living outside the major cities and towns. Connecting Ireland proposes to expand the public transport network in rural areas and to increase service levels via the rollout of new and improved services planned on a phased basis from 2022 to 2025.

A Public Consultation Report was published in November 2021 which summarises some of the local issues outlined through feedback during the event. The report refers to requests for "*a direct link between Carrick-on-Shannon, Elphin and Strokestown*" via public transport.

The Dublin to Sligo bus route is currently served by route 23. "*A minimum service frequency of 2 hours is proposed between … and between Sligo and Dublin*".

2.4.9 National Roads 2040 (Draft)

The draft National Roads 2040 (NR2040) is TII's strategy to enable delivery of Project Ireland 2040, responding to evolving national policy and aligning to NIFTI, with a vision for the "*National Roads network to be an evolving sustainable transport system focused on safety, innovation, accessibility and mobility of people, goods, and services"*. Public Consultation on the strategy ran from 5 August to 14 October 2022. In line with NSO 2, NR2040 refers to "*Upgrading northern sections of the N4 and N5 routes*" to deliver Enhanced Regional Accessibility.

This strategy acknowledges the challenges faced by the transport sector in reaching the country's climate goal of a 50% reduction in GHG emissions by 2030. In order to achieve this goal NR2040 stresses the importance of facilitating active travel measures alongside new road infrastructure. "*While TII has a limited role in behavioural change, the provision of high quality multi modal infrastructure has an important role in enabling and encouraging a modal shift to support a reduction in carbon emissions*". Towards more urban areas it is vital to combat congestion, especially by giving road users a viable alternative to the private vehicle in the context of shorter trips, typically those under 15 minutes.

2.4.10 Road Safety Authority-Road Safety Strategy 2021 - 2030

The Road Safety Authority (RSA) Road Safety Strategy 2021 – 2030, sets targets to be achieved in terms of road safety in Ireland as well as policies to achieve these targets. Driving the adoption of the Government's Safe System approach and underpinning this 2021–2030 strategy is Ireland's long-term goal of achieving Vision Zero (i.e., zero road deaths or serious injuries) by 2050.

To ensure that the road safety interventions and activities undertaken for the 2021 – 2030 strategy continue to be effective and incorporate the latest innovations and developments in the area of road safety, the strategy will feature three phases of action plans, as follows:

- Phase 1: 2021 - 2024

- Phase 2: 2025 - 2027
- Phase 3: 2028 - 2030

50 High impact actions are set out for Phase 1, around a series of themes, including 'Safe Roads and Roadsides' and 'Safe Speeds'. The actions set out under 'Safe Roads and Roadsides' include the delivery of "*an average of 60 road safety improvement schemes, an average of four minor realignment schemes on national roads per year*" and an increase in "*the length of divided roads on the national primary network*".

The advancement of the N4 Carrick-on-Shannon to Dromod Project fundamentally aligns with this RSA strategy.

2.4.11 National Sustainable Mobility Policy 2022 and National Sustainability Mobility Policy Action Plan (2022 - 2025)

The National Sustainability Mobility Policy[9] was published by the Department of Transport on 7 April 2022. It sets out a strategic framework for the improvement of active travel and public transport measures to encourage the modal shift to more sustainable modes and "*make it easier for people to travel by more sustainable modes – be that walking, cycling or public transport. The Policy aims to support this modal shift between now and 2030 through infrastructure and service improvements, as well as demand management and behavioural change measures*" to help Ireland meet its climate action commitments and supports the National Planning Framework.

The Policy includes an action plan for the next three years framed around 10 Goals. The N4 Carrick-on-Shannon to Dromod Project supports these goals, and specifically supports Goal 1: Improve mobility safety, Goal 4: Expand availability of sustainable mobility in regional and rural areas and Goal 5: Encourage people to choose sustainable mobility over the private car by improving safety for all road users with improved walking and cycling facilities, developing "pedestrian enhancement" and proposals for cycle network and public transport improvements and the inclusion of demand management measures in the Preferred Transport Solution.

2.4.12 Our Rural Future Rural Development Policy 2021 - 2025

Our Rural Future Rural Development Policy 2021 - 2025[10] (Our Rural Future) was published in March 2021 by the Department of Rural and Community Development to provide "*a framework for the development of rural Ireland over the next five years*" to achieve the "*vision of transforming the quality of life and opportunity for people living in rural areas*". It recognises the opportunities presented by Covid-19 as "*we transition to a climate-neutral society*" for people to return to rural

[9] Department of Transport, 2022. National Sustainable Mobility Policy. Available from: https://www.gov.ie/en/publication/848df-national-sustainable-mobility-policy/
[10] Department of Rural and Community Development, 2021. Our Rural Future: Rural Development Policy 2021-2025. Available from: https://www.gov.ie/en/publication/4c236-our-rural-future-vision-and-policy-context/

communities to live, work/be educated and socialise. This will help "*sustain and increase the population of rural areas, revitalise town centres, reduce commuting times, lower transport emissions and improve the quality of life of our people."*

Chapter 5 of Our Rural Future sets of the vision for revitalising our rural towns and villages to "*support the regeneration, repopulation and development of rural towns and villages to contribute to local and national economic recovery, and to enable people to live and work in a high quality environment*". The Government will do this by "*investing in projects which support economic activity and increased footfall in our towns and villages, improve the public realm, encourage town centre living, and provide the necessary services infrastructure to support town and village regeneration and sustainable growth*". In keeping with this and "*to make our rural towns and villages better places in which to meet, live and work*", the Government published Town Centre First – A Policy Approach for Irish Towns in February 2022.

A key objective of this Project is to facilitate the enhancement of sustainable travel and improved connectivity to public transport opportunities and provide opportunities to enable the successful creation of place making and generation of a vibrant community in Carrick-on-Shannon which aligns with Our Rural Future.

2.4.13 Town Centre First – A Policy Approach for Irish Towns 2022

Town Centre First – A Policy Approach for Irish Towns[11] was published in February 2022 by the Department of Rural and Community Development as part of the implementation of Our Rural Future and is central to the vision set out by the department in the Our Rural Future policy. *It sets out the structures and funding that we will put in place at a national level and at a local level to support our towns to design, deliver and implement a plan that can reimagine each town. A plan that captures their important economic and social role in our society; a plan that recognises the importance of place making; and a plan which delivers vibrant lived-in spaces in the heart of our towns. While it is focussed on our towns, it establishes a framework and principles which can equally be applied to the development of our rural villages.*

Currently the N4 currently passes through Carrick-on-Shannon with circa 650 HCVs crossing the singular bridge over the River Shannon in the town on a daily basis. This bridge crossing also accommodates all other modes such as public transport, cycling, and walking. This bridge and approach streets are also a place at the heart of the amenity and attraction of this town, and traffic volumes at this level with this proportion of HCVs detracts totally from the sense of place. This is turn is having a negative impact on business and tourism due to traffic congestion, noise and air pollution.

The project aligns with Town Centre First as it seeks to address these issues within Carrick-on-Shannon.

[11] Department of Rural and Community Development, 2022. Town Centre First Policy2021 - 2025. Available from: https://www.gov.ie/en/publication/473d3-town-centre-first-policy/

2.5 Regional Policy

2.5.1 Regional Spatial and Economic Strategy for the Northern and Western Regional Assembly (2020)

The Regional Spatial and Economic Strategy (RSES)[12] for the Northern and Western Regional Assembly was adopted in 2020 and sets out a 12-year regional development framework to guide the development of the region. The strategy is focused on delivering effective regional development for the northern and western region and, in doing so, it seeks to ensure coordination between the City and County Development Plans of the Local Authorities in the Region.

In discussing the region, the RSES acknowledges that it has several historical challenges impacting on its competitiveness and sustainability, most notably the comparably lower level of investment in enabling infrastructures such as ports, harbours, roads, rail and utilities. Some of the key responses are set out in Section 3.7.2 and include securing enhanced investment in transport infrastructure, on which it is stated:

> *To take full advantage of the opportunities offered by the Atlantic Economic Corridor, it will be necessary to pursue the enhancement or upgrading of national roads N15 (to Letterkenny) and N17 (to Galway), as well as the strengthening of connections to the east coast via N4 (to Dublin) and N16 (to Dundalk and Belfast).*

The key town of Carrick-on-Shannon is addressed in Section 3.8.5 of the RSES, where it is acknowledged that it plays a strategic role in the region. Key future priorities include:

- *Support the development of the N4 By-Pass of Carrick-on-Shannon*

Chapter 6 of the RSES is concerned with Growth Ambition No.3 - connectivity and the development of a connected region. The purpose of this chapter of the RSES is to identify key issues relevant to the provision of transport and digital infrastructure, the key options for addressing same, and the subsequent financial implications for the next 20 years. Section 6.2 acknowledges:

> *Transport has a major impact on the quality of life, the level of community interaction, the economic prosperity and the environmental quality of the region. To enable effective regional development, it will be necessary for prioritised investment in roads and environmentally sustainable public transport that will provide for high-quality inter-regional and intra-regional connectivity to places and markets, including international accessibility*.

It is also acknowledged that the region is highly dependent upon the private car for travel to work and education, with approximately 70% of the population having commuted by private car according to the Census 2016, up from 66% in 2011. 'High-level Transport Principles' identified include:

[12] The Northern and Western Regional Assembly, 2020. Regional Spatial and Economic Strategy 2020 - 2032 (RSES). Available from: https://www.nwra.ie/rses/

- Support improved strategic and local connectivity
- Expand attractive public transport and other alternatives to car transport
- Recognise the role of the car and cater appropriately for it
- Reduce congestion; and cater to the demands associated with longer-term population and employment growth, in a sustainable manner

These principles are in turn developed through what are termed 'Priority Core Outcomes', to be delivered across the region, and including:

- *Strengthening inter-regional connectivity, through the improvement of inter-urban road and rail connectivity, with a particular emphasis on improved connectivity between the largest urban centres and access to ports and airports, for the movement of both people and goods;*
- *Protecting the capacity of inter-urban road connectivity within and around the largest cities, ports and airports, through effective traffic management and transport demand management;*
- *Strengthening public transport connectivity between the Assembly Area's city and large towns, and between the large towns, with improved services and reliable journey times;*

Section 6.3 of the RSES addresses transport investment priorities and first acknowledges that high-quality accessibility to international gateways, located both within and outside of the region, for people and internationally traded goods/services, is of fundamental importance to economic competitiveness at regional and national levels.

Section 6.3.2 focuses on the region's road network stating that both the National Planning Framework and the National Development Plan strongly acknowledge that accessibility from the northern and western region will need to be significantly improved. It further states that the national road network is a critical enabler in facilitating an island-wide sustainable national transport system and that improving and maintaining the assets of all national roads is critical and must be maintained, including the requirement to safeguard the strategic links into urban centres identified as key economic drivers in the region.

It is stated that it is not intended to establish an exhaustive list of road schemes for development over the period of the RSES. Instead, it is intended that schemes are developed in accordance with all relevant legislation and guidelines and in accordance with the RSES's objectives and priorities. The following Regional Policy Objectives (RPOs) are set out in relation to national roads:

RPO 6.5 *The capacity and safety of the region's land transport networks will be managed and enhanced to ensure their optimal use, thus giving effect to National Strategic Outcome No.2 and maintaining the strategic capacity and safety of the national roads network including planning for future capacity enhancements.*

RPO 6.7 *In accordance with National Development Plan investment commitments to progress the following schemes through pre-appraisal*

and early planning, the following projects shall be progressed through pre-appraisal and early planning in the short term and shall thereafter proceed to construction and be delivered to an appropriate level of service within the lifetime of the RSES:

- *N2 Clontibret to the Border connecting to the A5*
- *N2 Ardee to south of Castleblaney*
- *N3 Virginia Bypass*
- *N4 Carrick-on-Shannon to Dromod*
- *N13 Ballybofey Transoral Bypass*
- *N13/N14/N56 Letterkenny Bypass and Dual Carriageway to Manorcunningham.*
- *N14 Manorcunningham to Lifford*
- *N17 Knock to Collooney*

RPO 4.9 addresses the development of key towns, including Carrick-on-Shannon. It states:

> *To ensure provision is made for the expansion in accommodation, and facilities within key destination towns, such as Carrick on Shannon, Cavan, Roscommon Town and Athlone, together with necessary supporting infrastructural investments, including improvements in the public realm, transport links, accommodation, the night-time economy, and sustainable development of our natural and built economy.*

Improvements to the N4 corridor strongly align with the objectives and commitments set out in the RSES. It would facilitate development in the northwest of the country and help achieve the goal of enhanced regional connectivity, particularly given that Cortober/Carrick-on-Shannon remains the only regional strategic centre on the N4 between Dublin and Sligo which has not been bypassed to date and has become a bottleneck for long distance and regional traffic.

It is also stated in the RSES that it is a key future priority for Carrick-on-Shannon to prepare a joint Local Area Plan with Roscommon County Council to deliver an integrated framework for the future development of the urban area of Carrick-on-Shannon/Cortober within 3 years of the adoption of the strategy.

2.6 Local Policy

2.6.1 Leitrim County Development Plan 2015

Section 1.6.1 of the Leitrim County Development Plan 2015[13], addressing the County's national and regional context, highlights that Leitrim is traversed by three main arterial routes; the N4, the N16 and the N15 and that Carrick-on-Shannon is located on a 'National Transport Corridor' (the N4 and the Sligo-Dublin rail line).

[13] Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021. Available from: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan-2015-2021/County_Development_Plan_2015-2021/County-Development-Plan-2015-2022-Written-Statement.pdf

Section 2.18 of the Plan discusses transport infrastructure and acknowledges that a modern, efficient, and safe road network is vital for the future development of Leitrim. The three National Primary Routes, N15, N16 and N4 national roads, together with Regional Route R280, are highlighted as forming the principle 'trans-boundary' transport corridors within the county.

Section 4.4.6 addresses road development and sets out the following relevant policies:

> ***Policy 54*** *It is the policy of the Council to upgrade the National Primary Routes serving the County. This can be achieved by carrying out certain road improvements along these routes and in particular completing the following road schemes within the lifetime of the Plan:*
>
> - *N4 Carrick-on-Shannon to Dromod (including the Carrick-on-Shannon Bypass)*
> - *N16 Glenfarne to Glencar (including the Manorhamilton Bypass)*

It is also stated that preferred routes have been chosen for both of these routes and are detailed in Section 4.6.6 and Map 4.4, Map 4.5, Map 4.6 and 4.7 of the Plan.

> ***Policy 55*** *It is the policy of the Council to ensure that proposed developments do not prejudice the implementation of any identified/proposed road scheme, whether this relates to the construction of new roads, improvements to or widening of/or re-alignments of existing roads, particularly in relation to National and Regional roads.*
>
> ***Policy 56*** *It is the policy of the Council to preserve, free from development, proposed road realignments / improvement lines and associated corridors, where such development would prejudice the implementation of the scheme.*

The N4 national primary route is discussed in detail, as follows:

> ***N4 National Primary Route*** *The N4 was significantly upgraded in the early 1990s and the Dromod/Roosky Bypass (Class 2 Dual Carriageway) was completed in 2007. This has greatly improved access between Dublin, Leitrim and the Northwest region. The Council supports the proposed construction of the Carrick-on-Shannon to Dromod Road Scheme; and this project is currently awaiting approval to publish the Compulsory Purchase Order and the Environmental Impact Statement.*
>
> *The Council will protect and improve the carrying capacity of the existing N4 through Carrick-on- Shannon pending completion of the new bypass through conventional and innovative /traffic management initiatives.*
>
> ***Objective 30 (b)*** *It is an objective of the Council to complete the design and construct the proposed Carrick-on-Shannon bypass and to upgrade/realign it as necessary from the western end of the Dromod-Roosky By Pass at Moher/Finnalaghta townlands to link into the Carrick-on-Shannon by-pass. See Map 4.4 N4 Carrick-on-Shannon to Dromod Preferred Route.*

The N4 Carrick-on-Shannon to Dromod Project aligns with the central objectives the County Development Plan, particularly those relating to improving regional integration and connectivity.

It is of note that Leitrim County Council have commenced the preparation of a new County Development Plan.

2.6.2 Draft Leitrim County Development Plan, 2023 – 2029

The Leitrim County Development Plan was adopted on 7 February 2023 and takes effect from 21 March 2023. Acknowledging that accessibility and mobility for all sections of the community is vital for the future development of the county, the strategic aim of Chapter 8, Transport, of the Plan is as follows:

> *"To support increased use of sustainable modes of transport; the integration of spatial planning more closely with transport planning to reduce the need for travel; enhancing existing strategic transportation infrastructure in the county and regional accessibility; transitioning towards a low carbon energy efficient transport system, and the development of a safer, more efficient, effective and connected transport system within Co. Leitrim"*

The following policies are outlined:

> ***ILU POL 3*** *To support the maintenance and optimisation of the county's existing transport infrastructure to ensure its optimal use in line with National with Investment Framework for Transport in Ireland's (NIFTI's) modal hierarchy and seek to undertake appropriate traffic management measures to prioritise road users in line with the modal hierarchy.*
>
> ***ILU POL 4*** *To strengthen inter-regional connectivity, through the improvement of inter-urban road, bus and rail connectivity, with a particular emphasis on improved connectivity between the largest urban centres and access to ports and airports, for the movement of both people and goods*
>
> *ILU POL 6 New transport infrastructure projects, including blueways and greenways, that are not already provided for by existing plans/programmes, which have been subject to environmental assessment, or are not already permitted, will be subject to feasibility assessment, considering need, environmental sensitivities as identified in the SEA Environmental Report, and objectives relating to sustainable mobility. Where feasibility is established, a Corridor and Route Selection Process will be undertaken, where appropriate, in two stages: Stage 1 – Route Corridor Identification, Evaluation and Selection; and Stage 2 – Route Identification, Evaluation and Selection. This Corridor and Route Selection Process will not be applicable to national roads schemes which are required to be progressed in accordance with statutory processes and TII Publications, including the Project Management Guidelines and Project Appraisal Guidelines.*

MSSM POL 1 To support sustainable mobility, enhanced regional accessibility and connectivity within Co. Leitrim in accordance with the National Policy Outcomes of the National Planning Framework 2040 and the National Development Plan.

The Plan states an acknowledgement of the importance of county's strategic road infrastructure in providing intra and inter county movement of goods and services. In this respect, the Plan states that the Council will support TII in the progression of a series of projects (in table 8.4), including the N4 Carrick-on-Shannon to Dromond Project.

Section 8.11.2.1 of the Plan specifically address the N4 Carrick-on-Shannon to Dromod Project, and states:

"The N4 is particularly critical in terms of wider connectivity, linking the Regional Growth Centres of Sligo to Dublin in addition to the benefit of enhanced regional and national connectivity to the Key Town of Carrick-on-Shannon. The RSES, consistent with National Development Plan investment commitments, seeks to progress the N4 Carrick-on-Shannon to Dromod scheme through pre-appraisal and early planning and shall thereafter proceed to construction and be delivered to an appropriate level of service within the lifetime of the RSES. The development of a transportation solution to the existing congestion experienced in Carrick-on-Shannon on the national and regional road network is a critical element in the Transportation Strategy being pursued by this Council. A solution is needed to address transportation issues which include congestion on the main routes approaching and, within the town centre. This will be further developed in a Local Transport Plan to be prepared in tandem with the Carrick-on-Shannon/Cortober Local Area Plan which shall seek to maximise the consideration of opportunities to improve public transportation options and improved non-motorised modal shift.

Details on the Preferred Transport Solution were announced in May 2022 comprising of the following components: (1) Active Travel Component (2) Public Transport Component (3) Demand Management Measures and (4) a Road Component.

The non-road components advocate improvements to the walking and cycling infrastructure within Carrick-on-Shannon and Cortober, in addition to enhancements to local bus services and specific interventions to control demand and reduce trips, all of which would support an increase in sustainable trip making. This, in turn, could lead to a reduction in traffic levels and congestion in the town.

The road component of the Preferred Transport Solution includes the development of a new urban street in Carrick-on-Shannon, linking the Castlecara Road just south of St. Mary's GAA club to the Leitrim Road (R280) north of Lis Cara housing development, in addition to a Preferred Option Corridor in which the existing road infrastructure can be upgraded

> *or new infrastructure can be built. The corridor deviates from the existing N4 to the west of Cortober, Co. Roscommon where it progresses off-line south of the existing N4, north of the Dublin-Sligo railway line. The corridor progresses east, crossing the R368 and subsequently crossing the River Shannon in the townland of Cordrehid on the Cortober side of the River Shannon over to the townland of Attirory on the Carrick- on-Shannon side of the River Shannon. The corridor joins the existing N4 again in the townland of Lisseeghan. The corridor then progresses eastwards along the line of the existing N4 and ceases in the townland of Faulties, as announced in May 2022."*

It is also highlighted in the Plan that some of the designated cycling network within Carrick-on-Shannon is not fully integrated or segregated from traffic, with several routes also coinciding with narrow carriageways or busy junctions and thoroughfares such as the Shannon Roundabout on the N4 road. In response, the Plan states the Council will liaise with relevant stakeholders in developing a Local Transport Plan to inform the LAP for Carrick-on-Shannon/Cortober, Policy Objective MSSM OBJ 1 gives effect to this.

The N4 Carrick-on-Shannon to Dromond Project strongly aligns with and will help give effect to all of the above policies and objectives.

2.6.3 Roscommon County Development Plan, 2022 - 2028

The Roscommon County Development Plan, 2022 - 2028[14] was adopted at a Special Planning Meeting on the 8 March 2022 and took effect from 19 April 2022.

Chapter 7 of the Plan identifies the County Council's outlook in relation to *Infrastructure, Transport and Communications.* Section 7.4 relates specifically to road transportation and movement. The opening statement in this movement states:

> *Both the NPF and the RSES for the Northern and Western Region acknowledge that accessibility between centres of scale needs to be significantly improved.*

The Plan identifies the requirement for road upgrades for the future development of the county "*ensuring sufficient connectivity within the county, as well as wider regional and national connectivity, as advocated in Growth Ambition 3"*.

In this respect, it notes that "*the M6, N4, N5, N60, N61, N63 and N83 traverse the county, providing important linkages and networks within, into and out of the county"* and that national primary roads in the county equate to 85.68km in length (Table 7.1).

The Plan indicates two key National Road Projects relating to the N4 and N5. It also acknowledges continuing a programme of pavement improvement and maintenance, signage and markings and winter maintenance as per annual programme of works on an ongoing annual basis along the M6, N4 and N5.

[14] Roscommon County Council (2022) Roscommon County Development Plan, 2022-2028. Available from; https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/

In relation to the N4 specifically, Table 7.2 of the Plan states:

Route	*Proposal*	*Approximate Location*	*Timeframe 2022-2028*
N4	*N4 Carrick-on-Shannon to Dromod Road Project*	*Drumharlow townland in Roscommon to Faulties townland in Co. Leitrim*	*Co-operate with Leitrim Co. Co. (as the lead Authority) to ensure publication of Statutory Planning documentation (subject to TII approval)*

The following Infrastructure, Transport and Communications policy objectives support this proposal:

> ***ITC 7.12*** *Provide a safe and modern road network throughout the county, having regard to national and regional policies and guidelines as well as liaising with national agencies.*
>
> ***ITC 7.13*** *Support and provide for improvements to the national road network, including reserving corridors for proposed routes, free of development, so as not to compromise future road scheme.*
>
> ***ITC 7.14*** *Maintain and protect the safety, capacity and efficiency of national roads and associated junctions in accordance with the Spatial Planning and National Roads Guidelines for Planning Authorities (DECLG, 2012).*
>
> ***ITC 7.19*** *Seek to implement the Road Improvement Schemes indicated in Table 7.2.*

The Plan acknowledges that Carrick-on-Shannon has been designated as a Key Town in the *RSES.* It is further acknowledged that the settlement of Cortober in County Roscommon forms part of the wider Carrick-on-Shannon settlement and will continue to support the future overall development of the town and also that a key future priority of the *RSES* is the preparation of a Joint Local Area Plan for Carrick-on-Shannon and Cortober.

The proposed Joint LAP is to deliver an integrated framework for the future development of the settlement. Policy objectives CS 2.10 and CS 2.11 reflect this:

> ***CS 2.10*** *Support the continued growth and sustainable development of Roscommon, to act as a growth driver in the region and to fulfil its role as a Key Town and to function as the County Town.*
>
> ***CS 2.11*** *Prepare a Local Area Plan (LAP) for Roscommon, to align with the RSES and this Core Strategy.*

2.6.4 Carrick-on-Shannon Local Area Plan, 2010 - 2019

This Carrick-on-Shannon Local Area Plan, 2010[15] has a stated period of 2010 - 2019, however it is still in force. It will be replaced by the proposed joint Local

[15] Leitrim Council, 2010. Carrick-on-Shannon Local Area Plan 2010 - 2019. Available from http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Local-Area-Plan/Amendment-2-Carrick-on-Shannon-2010 - 2019/

Area Plan for Carrick-on-Shannon and Cortober as referenced in the Draft Leitrim County Development Plan 2023 - 2029.

In the town SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) in Section 1.6 of the Plan, the bypass project is identified as an opportunity to create development in the town centre. That fact that it has been delayed due to the economic downturn is seen as a weakness. The opportunities arising from the construction of the bypass are discussed further in section 2.04 on urban design.

The development of the proposed new bypass for the town as part of the upgrading of the national road network, presents major opportunities for the town. This plan is geared to maximise the benefits that will arise from this investment. This plan was informed by the previous preferred route for the N4 Carrick-on-Shannon bypass. The new road is likely to form a natural boundary to the town. It will allow the town to reconnect with the Shannon and Cortober by removing extraneous traffic. This is also being facilitated by a new footbridge (see photo 2.6a) which was completed in May 2010.

Section 2.05 addresses Transportation and states the following:

> *The Council recognises that Carrick-on-Shannon occupies a strategic position on the national primary road network being on the route of the N4 strategic radial corridor linking the Sligo Gateway to the Dublin Metropolitan Gateway via the Midlands Gateway. The Council recognises the importance of ensuring that the carrying capacity, operation efficiency, safety and significant national investment being made in National Roads should be protected.*
>
> *The only National Roads project as it applies to Carrick-on-Shannon is the N4 Carrick-on- Shannon to Dromod Road Scheme. While a preferred route had been identified, this project is under review again and Map No.8 indicates the latest constraint study area as it applies to the town boundary of Carrick-on-Shannon. The protection of the capacity of the existing national route (N4) will be maintained until such time as the new route has been developed. In the interim the Council will ensure that proposed developments do not prejudice the implementation of this Scheme.*

Section 1.04.02 relates to roads and reads as follows:

> *The limited capacity of the Shannon Bridge and the Leitrim Rd. junction still continue to act as bottlenecks in the town, causing traffic congestion. In time they are to be relieved with the construction of the proposed by-pass, the route of which is currently being re-considered (see Map No.8 showing the study area for the proposed Carrick-on-Shannon By-Pass).*
>
> *The restricted nature of the road network in the town may act as a brake on future development if new relief roads are not provided. This plan identifies key links which will facilitate ease of movement through the town.*

Map 8 of the Plan illustrates the '*Study Area for Proposed Carrick-on-Shannon By-Pass and Preliminary Road Reserve at Hartley Junction'* but noting that this map references the earlier study.

The following associated policy objectives are relevant:

> ***Policy 5.1a*** *It is the policy of the Council to construct a by-pass around the town as part of the N4 national primary route, in partnership with the NRA.* A preferred route has been identified. No new development (other than minor works or alterations to existing premises) will be allowed within the route corridor as identified in Map No. 8 without the consent of the NRA
>
> ***Policy 5.1b*** *It is the policy of the Council to ensure that proposed developments do not prejudice the implementation of the Carrick By-Pass.*
>
> ***Policy 5.1c*** *It is the policy of the Council to protect the safety, carrying capacity and efficiency of the existing (and future) N4.*
>
> ***Policy 5.1h*** *It is the policy of the Council to ensure new roads are designed and built to a standard appropriate for their role. Details of design standards are set out in Section Three of this plan.*

2.6.5 Cortober Local Area Plan, 2014

The Cortober Local Area Plan 2014[16] was prepared in conjunction with the Roscommon County Development Plan, 2014. It is still in force but will be replaced by the proposed joint Local Area Plan for Carrick-on-Shannon and Cortober as referenced in the Roscommon County Development Plan 2022 - 2028.

It is noted in the LAP that Cortober is strategically situated in close proximity to Carrick-on-Shannon and is bound to the east by the River Shannon. Among the principal land use issues identified in the area is a tendency for the developed area to sprawl, particularly towards the west, along the N4. Chapter 4 addresses 'Roads and Transport Infrastructure' where the Plan's strategic goal is to "*develop a safer, more efficient and integrated transport system that will improve the road network and other forms of transport to serve the population of Cortober*".

In section 4.1 there is discussion on the impact of the N4 in the context of existing development in the area and the potential to impact on the development of new land uses in the future.

> *The Council acknowledges that there are problems with the level of pedestrian accessibility in the area with the N4 (National Route) and its associated heavy traffic providing a barrier between several residential and commercial areas. Likewise, there is a shortfall in public footpath provision along both the R368 and R370 which is a disincentive for pedestrian access from residential areas to the Neighborhood Centre and commercial areas.*

Relevant policy objectives include:

[16] Roscommon County Council, 2014. Cortober Area Plan 2014 - 2020. Available from: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014 - 2020/2-Cortober-Area-Plan.pdf

Policy 4.1 *Ensure that all development proposals within Cortober fulfil traffic safety and car parking requirements.*

Policy 4.2 *Provide adequate pedestrian paths and cycle tracks along all main routes in the area to ensure safety and convenient access.*

Policy 4.3 *Improve the pedestrian environment in the area, provide pedestrian crossings and good quality pavements in the area.*

Policy 4.8 *Ensure the provision of a comprehensive traffic system which is compatible with the pattern of land use in the area and with through traffic.*

Policy 4.9 *Minimise the number of new accesses points onto Regional and National Routes in order to maintain traffic capacity and minimise traffic hazard.*

2.7 Project Specific Need

2.7.1 Overview

The Phase 1 (Concept and Feasibility) studies undertaken in 2020 identified numerous transportation issues on the N4 corridor as outlined in Section 1.5.2 and concluded that there was strong justification for advancing a project to provide solutions to these transportation issues.

It is necessary to consider the evolution of the N4 in the context of its function locally and nationally to fully understand the origins of the transportation issues identified above. The N4 serves as the principal internal distribution route in Carrick-on-Shannon as well as being the major route providing regional connectivity to the northwest.

The majority of early settlements in Ireland originated around our waterways as they provided a source of food and fresh water as well as forming a transport network for trading and commerce. Carrick-on-Shannon and Cortober are typical of such settlements and developed east and west of the River Shannon respectively. Mapping published as early as 1777 in George Taylor & Andrew Skinner's *"Maps of The Roads of Ireland"* illustrates the roads connecting these two towns via the river crossing of the River Shannon.

The settlements grew out from the river crossing point as the river was synonymous with trading routes and access to the transport network. Thus, from the outset the focal point was the river crossing point with the internal street network of the settlement simply extending along the road leading to the crossing point. Thereafter, as the settlement grew, some internal streets were laid out, but they all had a tendency to lead to the original principal route, thus converging back to the single river crossing point.

The expansion of Carrick-on-Shannon as a market and post town on the Dublin to Sligo mail coach road through the 1800s was supported by the completion of the new bridge across the river in the 1840s, which exists today as the N4 national primary road, plus the extension of the Midland Great Western Railway from Mullingar to Sligo. Extensive dredging works were undertaken on the River

Shannon, the Jamestown Canal was cut, the locks at Drumsna and Knockvicar were built, and new quays were constructed at Carrick-on-Shannon. This infrastructure made Carrick-on-Shannon a major trading depot for the next century.

Between 1829 and 1842 the Ordnance Survey of Ireland completed the first ever large-scale survey of the entire country. The map for Carrick-on-Shannon as seen on Plate 2.7.1 shows the growth of a linear settlement along the principal Dublin to Sligo Road, with all eventually leading back to the original crossing point of the river.

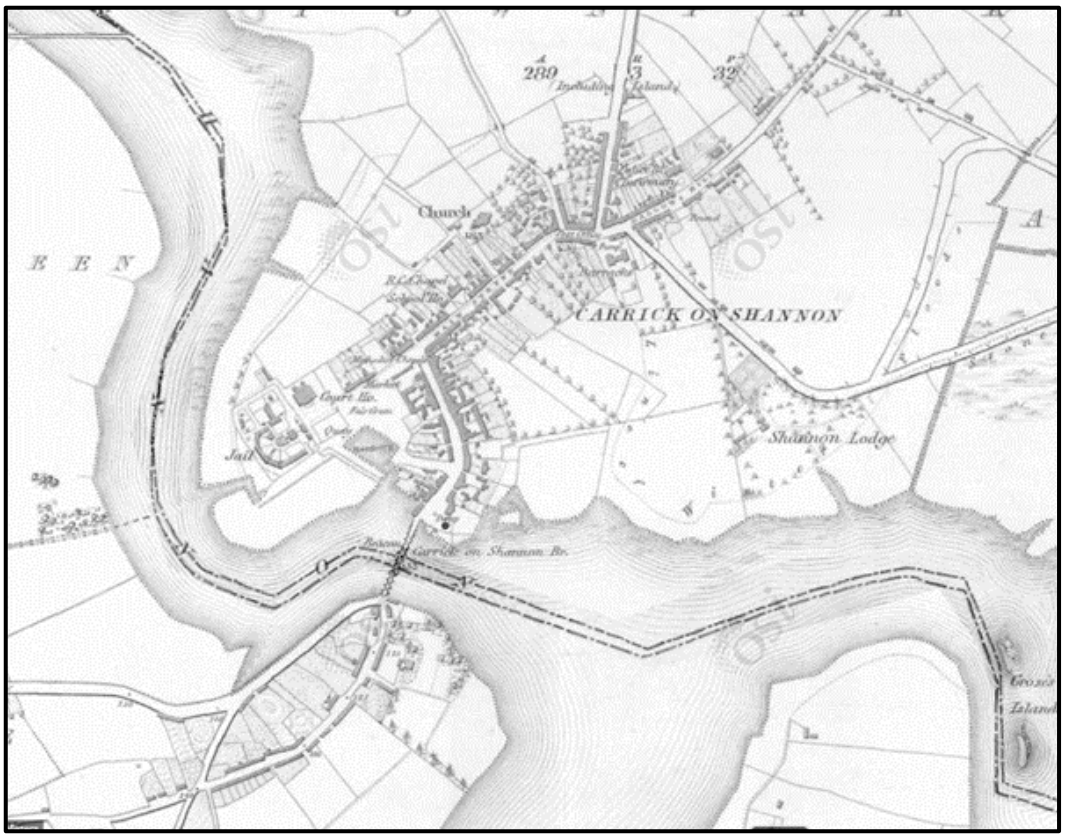

Plate 2.7.1 Extract from First Edition Six Inch Maps (1829 to 1842)

The town expanded either side of this principal axis and the regional roads to the north also experienced some growth over the next 100 years. In 1984, the Inner Relief Road was constructed and essentially provided an alternative road to the Main Street adjacent to the River Shannon, but it converged back to the single river crossing again. The Inner Relief Road subsequently was designated the N4 national primary road with the same bridge crossing of the River Shannon retained as the N4.

Since 1995, the town has turned to embrace the River Shannon with various businesses and enterprises developing along the Inner Relief Road. This was followed by the relocation of retail from the Main Street to large retail centres off the N4 in Cortober to the west and in Carrick-on-Shannon to the east of the river. Furthermore, large residential estates have been constructed in Carrick-on-Shannon since 2000 with direct access onto the N4 and regional roads which are the radials entering the town from the northeast and southwest. This transition can be seen in Plate 2.7.2 and Plate 2.7.3.

Plate 2.7.2 Extract from 2005 Aerial Mapping

Plate 2.7.3 Extract from 2005 to 2012 Aerial Mapping

The implications of continuing to build around the principal axis of the N4 is that most of the internal journeys in Carrick-on-Shannon today require passage along this single link. The radial routes that converge on Carrick-on-Shannon have been used to provide access to development that has taken place. These radial routes are then in turn connected to each other by the existing N4. This makes the N4 pivotal for internal circulation within the town, with virtually every trip either for education or retail purposes having to travel on the N4.

Plate 2.7.4 presents a graphical illustration of the existing N4 in the context of its current role in serving both a local and a national function whilst also providing the only crossing of the River Shannon. This is at the core of the transport problem which has been identified in Phase 1 and for which a solution is sought. Journeys to access education, recreation areas, retail and residential are all using the existing

N4 for a part of their journey. This is compounded by the fact that the N4 link across the river comprises a bridge dating from 1846, almost 200 years old, which is sub-standard to meet either the N4 TEN-T requirements or for use by all modes in a local context, see Plate 2.7.5. Furthermore, there is no backup and no resilience in the network as evidenced when this bridge is blocked due to an incident or accident.

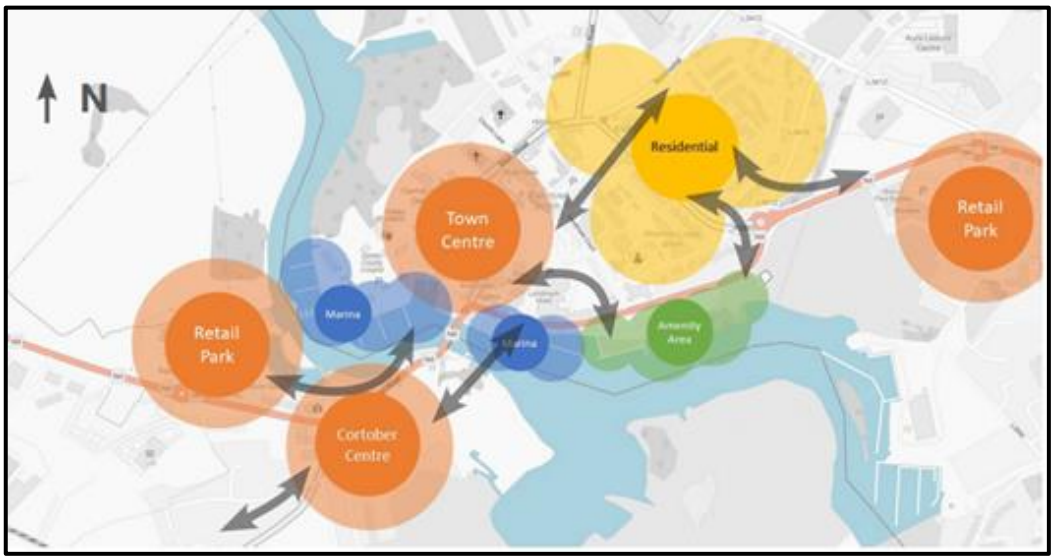

Plate 2.7.4 Existing Road and Street Layout

Plate 2.7.5 Existing River Shannon Bridge, Carrick-on-Shannon

This project needs to address the specific requirement of the N4 to be a high-quality road to serve an important role in long-distance freight and passenger traffic to connect peripheral regions and to integrate the main urban and economic centres, and includes the need for a new bridge crossing the River Shannon.

2.7.2 Existing Deficiencies on the N4 Corridor

This section of the report provides an overview of the existing deficiencies along the corridor within the study area in the context of establishing and supporting the need for the project. The overriding need for the upgrade to this section of the N4 national primary road is to remove existing deficiencies which impose significant restrictions on the efficiency and safety of the existing transport network, with the congestion within Carrick-on-Shannon and the sub-optimal infrastructure provision for the TEN-T network being the most significant deficiencies.

2.7.2.1 Efficiency of Existing N4 TEN-T

The TEN-T designation carries a requirement to be a high-quality road to deliver on its role in providing connectivity to the peripheral regions as well as interconnecting economic centres. The horizontal alignment of the existing N4 within the study area, outside of the speed restricted areas in Carrick-on-Shannon and Cortober, is made up of 19% of Band C curves which provide long sections with uncertain overtaking conditions, thus creating hazardous and uncomfortable conditions for road users and as such are not recommended due to safety issues. This sub-optimal alignment does not align with the functional requirements of the N4 as part of the TEN-T network.

There are 197 direct accesses on the N4 mainline which included 113 farm accesses, 58 domestic accesses, 24 commercial accesses and 2 pedestrian/cycle accesses. A total of 150 of these accesses occur outside of the urban area. There is a high concentration of accesses on the approaches to Carrick-on-Shannon/Cortober, a 100km/h section, and significant clusters of accesses to the south of the junction with the R201 and on the approaches to Aghamore village. In total, 52 junctions were identified along the N4 mainline within the area under consideration with 44 junctions connecting local roads and the remaining connecting regional roads. These direct accesses and junctions reduce the efficiency of the N4 as a strategic corridor in addition to presenting potential collision risks.

The majority of the N4 corridor has a speed limit of 100km/h within the study area. This reduces to 50km/h through Carrick-on-Shannon and Aghamore. There is an intermediate speed limit of 60km/h on the western side of Carrick-on-Shannon and also north and south of Aghamore. As set out in Chapter 3, journey time reliability is compromised by the congestion in Carrick-on-Shannon, again which impacts on the functionality of the TEN-T network.

The N4 currently crosses the River Shannon at Carrick-on-Shannon via a narrow masonry arch bridge, dating from 1846, which is sub-standard in terms of alignment and cross-section as seen on Plate 2.7.6. The bridge currently caters for all ‘through’ traffic, much of the local and regional traffic and non-motorised users (NMUs). It is noted that in order to avoid mounting the footpath HGVs turning onto the bridge

cross into the opposite carriageway, forcing oncoming traffic to give way, as the available carriageway width on the bridge is less than 5.8m for the extent of the river crossing.

In the period 1999 to 2017, traffic flow and the serviceability of the N4 along the section under consideration was seriously affected for extended durations. Flooding has led to the closure and associated diversion of the route on three separate occasions, with the N4 being closed for a period of 19 days in November 2009. In December 2017, the closure of the N4 immediately west of the bridge required traffic travelling west to divert via Roosky along the R371 regional road, N5 national primary road and the N61 national secondary road before re-joining the N4 at Boyle adding approximately 20km to the journey. Eastbound traffic diverted at Ardcarne along regional roads R285, R284, R280 and R299 before joining the N4 at Drumsna adding approximately 12km to the journey – refer to Plate 2.7.7. While the westbound diversion route can accommodate national road traffic in the short term the eastbound diversion route is wholly inadequate for anything other than emergencies.

The existing river crossing on the N4 is a significant deficiency on the TEN-T network and impacts all modes of transport. The fact that it is the only crossing point in the town, highlights the vulnerability of the transport network and the lack of resilience on the transport network.

Plate 2.7.6 Existing River Shannon Bridge, Carrick-on-Shannon

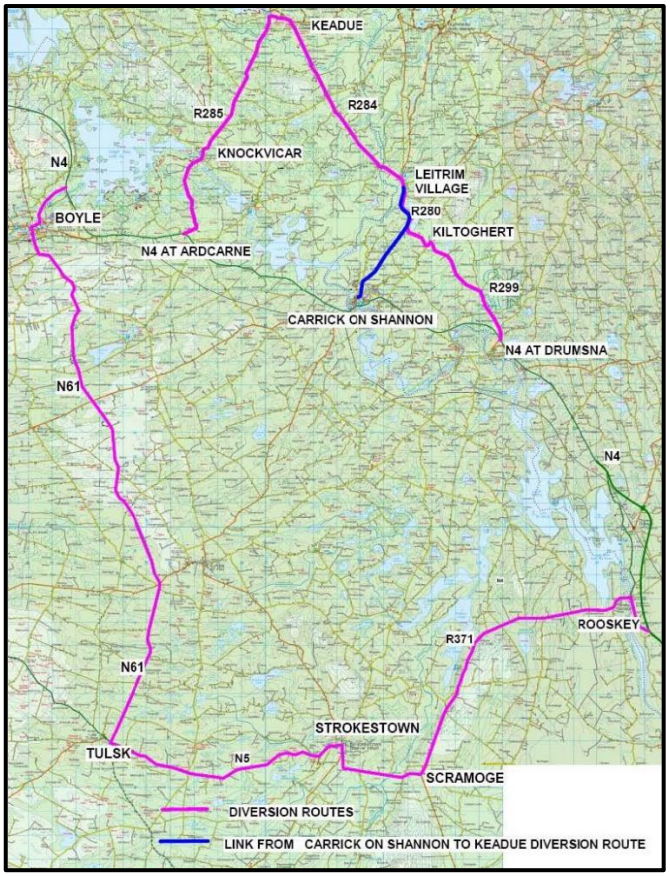

Plate 2.7.7 Diversion Route 2017

2.7.2.2 Existing Road Safety

As part of the Phase 2 Road Safety Impact Assessment (RSIA), an analysis of the collision history of this section of road for the period 1996 to 2016 was undertaken. This has identified three significant collision locations as follows:

1. Carrick-on-Shannon – The road network through Carrick-on-Shannon shows a large cluster of minor and serious collisions, as this is where the potential for conflict between road traffic, pedestrians and cyclists is highest
2. Mountcampbell (TII Site ID N04LM_139.0) – Two collisions with three fatalities and one minor injury. The three fatalities were a result of two separate head-on collisions in the townland of Mountcampbell, northwest of Drumsna, approximately only 300m apart. This section of the N4 is on a Band C curve and has a speed limit of 100km/h. This section also comprises a wide single carriageway cross-section, which is no longer permissible within the standards.
3. N4 Junction at the R201 (TII Site ID N04_137.0) – Three minor collisions

In addition, the existing road contains the following problematic road safety concerns:

- Change in carriageway cross-section from Type 2 Dual Carriageway which segregates the travel directions to two-way Type 1 Single Carriageway without the provision of a junction to demark the change in cross-section at the western end of the Dromod Bypass. This does not comply with the recommendations of Section 8.7 of TII Publication DN-GEO-03031 (Rural Link Design)
- Direct access from Annaduff GAA club grounds and the adjacent Leitrim GAA Centre of Excellence to the N4 on the 100km/h speed limit
- 50km/h speed limit and associated traffic calming measures at Aghamore
- Six roundabouts over 2.2km within the Carrick-on-Shannon 50km/h speed limit, which is an area with significant vulnerable road users
- Direct access from the Leitrim GAA County Grounds (Páirc Seán Mac Diarmada) within the 50km/h speed limit
- On street parking on the N4 at commercial premises within the 50km/h speed limit
- Zebra controlled crossings on the national primary road
- Substandard carriageway width and restricted facilities for vulnerable road users at the River Shannon bridge crossing in Carrick-on-Shannon

A more detailed analysis of existing road safety issues is presented in the Phase 2 RSIA in Appendix A.6.4.1.

2.7.2.3 Existing Conditions for Vulnerable Road Users

Pedestrians and other vulnerable road users within the study area require consideration. Collision statistics indicate pedestrian involvement in 21% of all collisions within the study area but this statistic increases to over 34% in the urban/town area of Carrick-on-Shannon, with 82 collisions between 1996 and 2016.

No pedestrian fatalities were recorded in this time, however seven individuals were seriously injured, while a further 120 sustained minor injuries.

The existing infrastructure is configured to favour the use of private cars with very little allocation of dedicated space for more sustainable modes. Currently the cycling network within the urban area is compromised by the high traffic volumes with the associated HGVs, lack of segregation from such volumes and lack of priority for active travel modes. The compounding of these circumstances disincentivises cycling and walking as a means of transport.

Access from the residential areas and hotels to the amenity parks along the River Shannon is across the existing N4 where traffic volumes exceed 16,000 vehicles on a daily basis. There are minimal crossing facilities and no signalised crossing facilities to enable vulnerable road users to cross the national primary road.

There are various initiatives underway to provide a Blueway linking Carrick-on-Shannon and Drumshanbo which will also link in Leitrim Village and Kilclare. This will enhance tourism and attract cyclists. However, the fact that there is no designated cycle network heading west or east from Carrick-on-Shannon leads to a fragmented level of provision and does not encourage the shift towards more sustainable transport for active travel trips.

Facilities for vulnerable road users outside of the urban area are disjointed and not fully connected, with alternative local roads only available on some sections of it. Furthermore, access to significant amenities such as the Annaduff GAA Club and the Leitrim Centre of Excellence have direct access off the N4 on a section of road with a speed limit of 100km/h. These facilities are close to the village of Aghamore but lack a connection which is safe for vulnerable road users.

There is an existing walking trail known as the Anthony Trollope Trail which is another popular walking route located around Drumsna. This route is more rural in nature and has no dedicated non-motorised facilities apart from the footpaths within Drumsna Village. This route crosses a section of the existing N4 in the 100km/h zone, utilising the existing N4 for approximately 150m.

2.7.2.4 Existing Public Transport

There are a limited number of rail services along the Sligo-Dublin corridor. The western rail line extending from Dublin Connolly (City Centre) to Sligo traverses the study area. This service serves several towns located along, or close to the N4 corridor, including Mullingar, Longford, Dromod, Carrick-on-Shannon, Boyle and Collooney. Plate 2.7.8 below illustrates the N4 corridor and Dublin-Sligo Rail line. This line is single track between Sligo and Maynooth.

Plate 2.7.8 Existing Rail Network

The journey time between Dublin and Sligo by rail is approximately 3 hours and there is a total of 8 daily weekday services in each direction between Dublin and Sligo, with a reduced number of services at weekends. The 2018 National Transport Authority (NTA) Heavy Rail Census provides data on the number of daily rail passengers boarding and alighting at each station with daily boarding of 48 and 95 in the northbound and southbound directions respectively, with the daily alightings of 109 and 34 in the northbound and southbound direction respectively at Carrick-on-Shannon. The relatively low demand is likely reflective of the limited number of services and dispersed population within the study area.

There are a very limited number of bus services available in the study area, with only one bus route serving the entire section of the N4 under consideration. Bus services utilising the N4 must negotiate the same traffic volumes as private cars and are subject to the same unreliability in journey time – this in turn disincentivises take up of public transport alternatives to the private car.

2.7.3 Project Specific Need Summary

The N4 Carrick-on-Shannon to Dromod Project is required to address the significant deficiencies which impact on the ability of the N4 to meet the functional requirements of the TEN-T designation as well as address the safety deficiencies which present collision risks, in particular in the urban areas as a result of prioritisation of the strategic traffic over and above the needs of the vulnerable road users. Even with such prioritisation of traffic through the urban area, it remains congested with poor journey time reliability, with the wholly sub-standard and outdated singular River Shannon bridge crossing contributing to considerable delay. Outside of the urban area, the project is necessary to address the horizontal

alignment which is also a significant safety concern when coupled with the proliferation of direct private accesses and junctions onto the national road within the study area.

As set out in Chapter 1, Section 1.2, accessibility and mobility within the region have a direct effect on the region's economic competitiveness as well as the attractiveness of the region. As set out in Section 2.5.1 above, the RSES states that transport has a major impact on the quality of life, the level of community interaction, the economic prosperity and the environmental quality of the region. Effective regional development is dependent on having high-quality inter-regional and intra-regional connectivity to places and markets, including international accessibility.

International connectivity via ports at Sligo and Killybegs, which are connected via the N4 to the other regions, play an important role in enablers of economic growth. Killybegs is Ireland's leading fishing port, accounting for over one-third of all fish landings in the country and services other commercial activity associated with the oil and gas industry, the tourism industry and the on-shore renewable energy industry. The significance of Sligo Port in national terms may be quite low but it remains important in the regional and local economy, supporting local industry and providing an import/export transportation facility.

International air connectivity is provided at Ireland West Airport Knock (IWAK), and Donegal Airport. Sligo Airport no longer provides passenger flights but continues to operate an important function as the Northwest base for the Irish Coast Guard Search and Rescue. Connectivity to the airports improves the attractiveness of the region and in turn enables economic growth.

The provision of new infrastructure will seek to enable the delivery of sustainable transport solutions that move more people more efficiently, improving journey time reliability and enabling better provision for alternative modes within the urban area. The project represents an integral component in supporting investment within the study area, and the northwest, by aligning the corridor with the wider policy of the TEN-T comprehensive network. The project is supported in terms of policy from international to national to local level as it is consistent with current transport policy and planning policy as set out in various policy documents over the past number of years.

3 Traffic Assessment and Intervention Required

3.1 Introduction

This chapter of the report provides an overview of the scope and methodology adopted for the transport modelling undertaken to inform option selection. In addition, a discussion on the initial selection of intervention required on the N4 over the project extents is included in Section 3.3, along with a description of the preliminary junction and access strategy considered is presented in Section 3.4.

3.2 Summary of Traffic Modelling Report

3.2.1 Introduction

An overview of the Traffic Modelling Report (TMR) and the methodology adopted in undertaking the transport modelling work on the project is presented in this Section 3.2. A copy of the full TMR is included in Appendix A.3.2.1. As outlined in PAG Unit 5.4, the TMR is used to outline the process by which the existing travel patterns are captured and thereafter to describe the transport forecasting that has been undertaken to inform the Phase 2 Option Selection. The TMR captures current traffic conditions in the study area for the 2020 base year and allows Phase 2 environmental and multi criteria assessments to take place. The report outlines the process of the development of the base year transport model and the use thereafter for the appraisal of the project.

3.2.2 Modelling Overview

The National Transport Authority's (NTA's) Western Regional Model (WRM) has been used as a starting point for the development of a single project Local Area Model (LAM) for the appraisal of alternatives and options. The WRM is a multi-modal transport model based in SATURN and CUBE Voyager with a focus on the city of Galway, but includes the counties of Galway, Mayo, Leitrim, Roscommon, Sligo and Donegal. As it encompasses the study area for this project and the likely area of influence of this project, it is deemed appropriate to use this model initially.

The highway element of the WRM provides the basic road network, zoning structure, trip matrices and traffic growth forecasts for the development of the LAM. The LAM has been developed using SATURN (strategic modelling software).

The WRM has also been used to identify the area of influence of the scheme and the associated study area for the LAM. This provides accurate representation of traffic loading in the study area and a detailed zonal structure was developed to include schools, retail centres, housing estates. The study area captures any potential competition with alternative routes or rerouting of traffic as a result of the proposed scheme. This study area has been cordoned from the WRM base models to form the initial LAM. The cordoned version of the LAM was then refined with

additional detail added where necessary to ensure the physical characteristics of the road network are reflective of the existing 2020 network.

The zoning structure of the LAM was also refined at this stage. The WRM zonal structure is based on the CSO Electoral Divisions (ED) boundaries with each zone containing one or more ED. These zones have been refined based on the CSO small area boundary system for consistency, to allow demographic data to be linked to each LAM zone.

Once the LAM road network and zone structure were appropriately refined the model was calibrated and validated against observed data in accordance with criteria set out in PAG Unit 5.1.

3.2.3 Data Collection

3.2.3.1 Traffic Surveys

A review of existing traffic survey data available for the model area was initially undertaken using any existing counts in the area and TII counter data. However, as this data was insufficient to robustly calibrate and validate the LAM, a comprehensive set of traffic count data was collected and used to calibrate and validate the N4 LAM. In accordance with PAG Unit 16.0, additional traffic surveys were undertaken to inform this transport study. Traffic surveys were carried out in December 2020 and comprised the following:

- 18 Automatic traffic counters (ATCs) along the N4 and on other key routes within the model
- 50 Junction turning counts (JTCs) at the main junctions along the route and at key points on the local road network
- ANPR (Automatic Number Plate Recognition), which is used to determine origin-destination surveys at 8 locations
- Journey time surveys between 8 locations

Full details of the traffic surveys commissioned, including survey locations, are provided in the Transport Modelling Report in Appendix A.3.2.1.

3.2.3.2 Impact of Covid-19 on Traffic Surveys

Traffic surveys were carried out in December 2020 when government restrictions arising from the Covid pandemic were removed and a certain level of travel was permitted. However, as the economy was not fully open at this time to all activities, analysis showed that whilst the 2019 and 2020 traffic flows show a similar profile, the 2020 traffic flows are approximately 11-19% lower than those in 2019 (pre – pandemic). As a result of this, the forecast AADTs output from the models (which have been calibrated to 2020 data) are likely to be approximately 11-19% lower than if the model had been developed using “typical” or pre-Covid traffic data as shown on Plate 3.2.1.

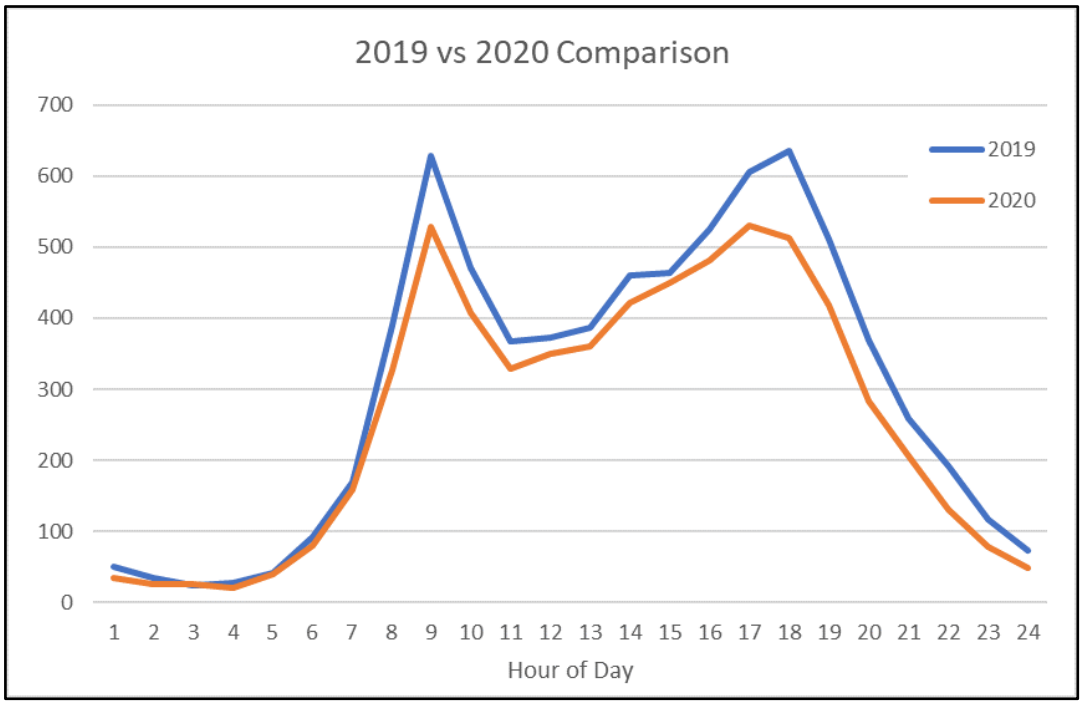

Plate 3.2.1 N4 (Between Carrick-on-Shannon and Dromod) TII Traffic Counter Data Analysis

Additionally, it follows that the calculated benefits of each option are also likely to be underestimated. The models developed will still provide a robust and consistent platform with which to assess the various options during Phase 2 of this project. However whilst stating this, it is recognised that Covid-19 changed when people travel, how they travel and whether they travel at all. The data used to develop the Phase 2 models was collected in a period when more people were working from home than usually would, causing there to be less travel to employment centres, but more travel to and within local centres and communities. Therefore, a sensitivity test will be carried out during Phase 2 on the Do Minimum and Preferred Option models with uplifted highway trip demand (+15%) to replicate a post-pandemic Base model.

As travel restrictions were lifted in 2022, employees who were able to work from home during the pandemic began to return to their place of work within an employment centre. There is potential for long-term effects on people's travel patterns that will outlast the pandemic. During Phase 3 the models will be updated using survey data collected post-pandemic (without any travel restrictions).

3.2.4 Model Development

3.2.4.1 Overview

The WRM is a strategic multi-modal transport model representing travel by all the primary surface modes – including, walking and cycling (active modes), and travel by car, bus, rail, tram, light goods and heavy goods vehicles. The WRM sits within the overall NTA Regional Modelling System which comprises of the following three main components, namely:

- The National Demand Forecasting Model (NDFM)
- 5 Regional Models (including the WRM)
- A suite of Appraisal Modules

The NDFM takes input land-use attributes such as population, no. of employees etc., and estimates the total quantity of daily travel demand produced by, and attracted to, each of the 18,488 Census Small Areas in Ireland.

The WRM is comprised of the following key elements:

- **Trip End Integration:** The Trip End Integration module converts the 24-hour trip ends output by the NDFM into the appropriate zone system and time period disaggregation for use in the Full Demand Model (FDM)
- **The Full Demand Model (FDM):** The FDM processes travel demand, carries out mode and destination choice, and outputs origin-destination travel matrices to the assignment models. The FDM and assignment models run iteratively until an equilibrium between travel demand and the cost of travel is achieved
- **Assignment Models:** The Road, Public Transport, and Active Modes assignment models receive the trip matrices produced by the FDM and assign them in their respective transport networks to determine route choice and the generalised cost for each origin and destination pair

Destination and mode choice parameters within the WRM have been calibrated using two main sources: Census 2011 Place of Work, School or College - Census of Anonymised Records (2011 POWSCAR), and the Irish National Household Travel Survey (2012 NHTS). Therefore, the WRM is the ideal tool from which to cordon the N4 LAM, and to estimate the multi-modal impact of transport schemes within the N4 study area. In addition, it provides the platform to forecast the future trip demand and distribution to/from the area.

Through a review of survey data, it was noted that the highest traffic flows entering and leaving the area were experienced from 08:00 to 09:00 in the AM, 17:00 to 18:00 in the PM and 15:00 to 16:00 for the IP period. Therefore, the LAM was developed, calibrated and validated to represent the following time periods:

- AM Morning peak period: 08:00 to 09:00
- PM Evening peak period: 17:00 to 18:00
- Inter peak period: 15:00 to 16:00

The model software used to develop the N4 LAM is the SATURN (Simulation Assignment of Traffic to Urban Road Networks) suite of transportation modelling programs.

3.2.4.2 Road Network Development

The goal in developing the N4 LAM was to create a model that accurately reflects current traffic conditions in the study area for the 2020 base year to a sufficient level of detail to allow the appraisal of each alternative and option. To achieve this goal, the model must be defined in terms of road network and trip demand

representation. The WRM developed for the NTA was utilised as a base for generating the highway network for the LAM. However, as the WRM is primarily focused on Galway, areas outside the city are represented in lesser detail within the model.

In developing the N4 LAM, additional detail was added to the cordoned WRM network to enhance the modelled road network and better represent localised access points for traffic. Best practice approach was utilised to generate the detailed traffic network for the LAM, reviewing existing link detail and adding junction detail. Digital mapping systems such as Google Earth were used to get a high-level view of the network including junction layout details, such as permitted or banned turns, junction priority etc., to ensure it represented, as accurately as possible, the existing road network.

3.2.4.3 Model Zone System

The WRM was used as a basis for development of the LAM road network. However, as the study area is located outside of the main model area, the WRM zone structure is not sufficiently localised to accurately reflect traffic loading along the N4.

To provide an accurate representation of traffic loading onto and near the existing N4 route, a detailed zonal structure was developed for the LAM to reflect key generators and attractors of trips such as:

- Shopping centres/retail car parks/supermarket car parks
- Education centres
- Key employment locations
- Townlands
- Housing Estates – areas that load onto the network in one specific place

In total, 107 zones have been created, with 91 internal zones within the study area and 16 external zones representing the roads that enter the area of interest. This level of detail ensures that traffic loads accurately onto both sides of the N4 and within Carrick-on-Shannon and the surrounding road network.

3.2.4.4 Model Calibration and Validation

Following calibration of the network, trip demand is adjusted in line with count data, so that there is an improved agreement between counts and modelled flows i.e. demand is as expected. Furthermore, controls are placed on zones to ensure that the trip demand generated is sensible and in line with census population and employment statistics. An excellent calibration has been achieved in the model for the morning, evening and inter peak periods with the resulting models falling well within required TII calibration standards.

Journey time analysis was carried out between the ANPR sites and an excellent match was achieved on cumulative route totals and all of the individual sections for all of the time periods.

3.2.4.5 Summary

The NTAs WRM was used as a basis for development of the N4 LAM with additional network and zonal detail added to more accurately represent localised traffic movements.

The N4 LAM has been calibrated and validated in-line with TII Project Appraisal Guidelines and meets all specified criteria for both the AM, PM and Inter peaks. The LAM is fit for purpose, and represents AM, PM and Inter-peak period base year traffic conditions well, as demonstrated statistically through calibration and validation. It provides a robust basis for assessing the potential alternatives and options.

3.2.5 Existing Travel Patterns

TII's Traffic Count Data website presents information on traffic volume and composition obtained via a network of traffic counters embedded in the road surface. Using this database, Annual Average Daily Traffic (AADT) volumes for the existing N4 within the study area for the year 2019 have been obtained from TII Traffic Monitoring Units (TMU) located on the route and are presented below. A review of the AADT values from 2015 - 2019 shows that, on average, traffic levels have increased by 9.2% in the last 5 years (1.8% per annum). The percentage of HGVs is also seeing an increased percentage. The TMU locations are shown in Plate 3.2.2.

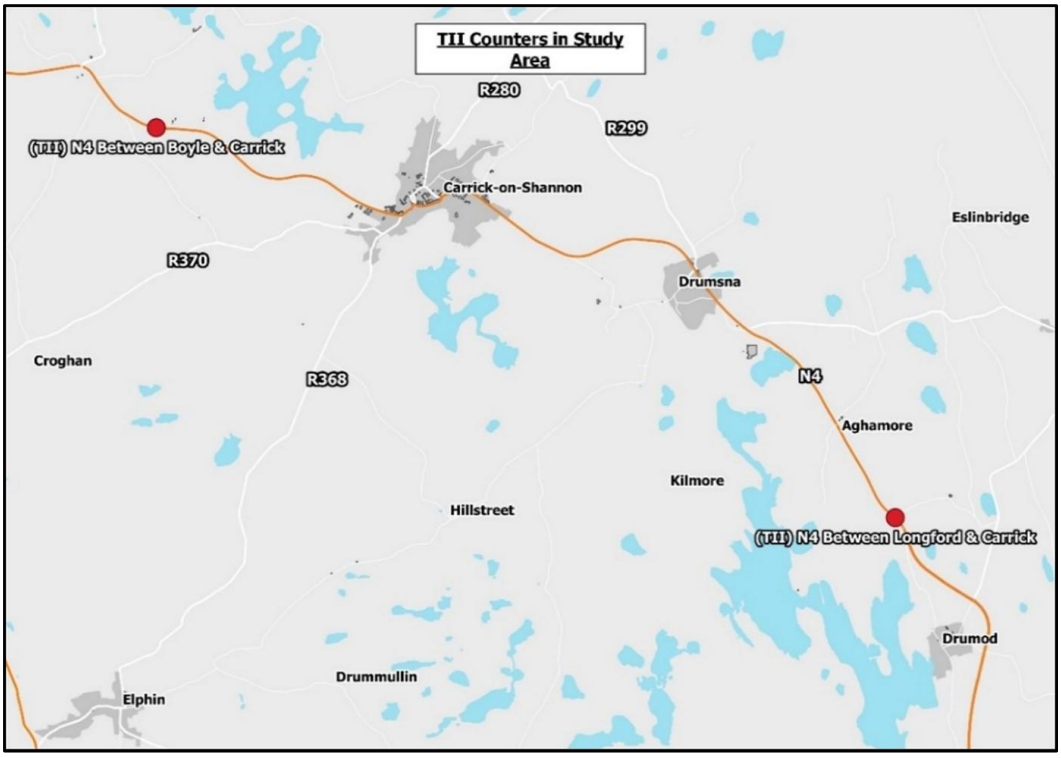

Plate 3.2.2 TII Traffic Counter Locations

Table 3.1 TII Traffic Count Data

Traffic Count Location	AADT (2019)	HGV (%)	AADT (2022)	HGV (%)
N4 Between Boyle and Carrick-on-Shannon, Usna, Co. Roscommon	8,338	5.1%	7,939	6.2%
N4 Between Longford and Carrick-on-Shannon, Dromod Bypass, Co. Leitrim	7,468	6.3%	7,352	6.9%

Average weekday traffic flow profiles extracted from the TMU's listed above shows that the AM peak occurs between 08:00 – 09:00 and the PM peak occurs between 17:00 – 18:00. Relatively high levels of traffic prevail in the interpeak period (14:00 – 16:00), indicating that this section of the N4 is well used throughout the day and that most of the demand is not solely related to commuting traffic. Significant weekend traffic flow is a regular occurrence during the tourist season, bank holidays, matchdays, special events in Carrick-on-Shannon.

An analysis of desire lines for travel around Carrick-on-Shannon has been undertaken to gain an understanding of existing travel patterns in the study area. This methodology has been developed using the extensive information on trip origins and destinations incorporated into the 2020 base year model.

The base year model is divided up into 150 zones which have been aggregated into seven sectors for the purposes of establishing the desire lines (or demand) between

each sector. Plate 3.2.3 denotes the sector boundaries, whilst noting that trips arriving at the perimeter of the outer sectors are also loaded onto that sector to ensure that the entirety of the trips within the model are captured.

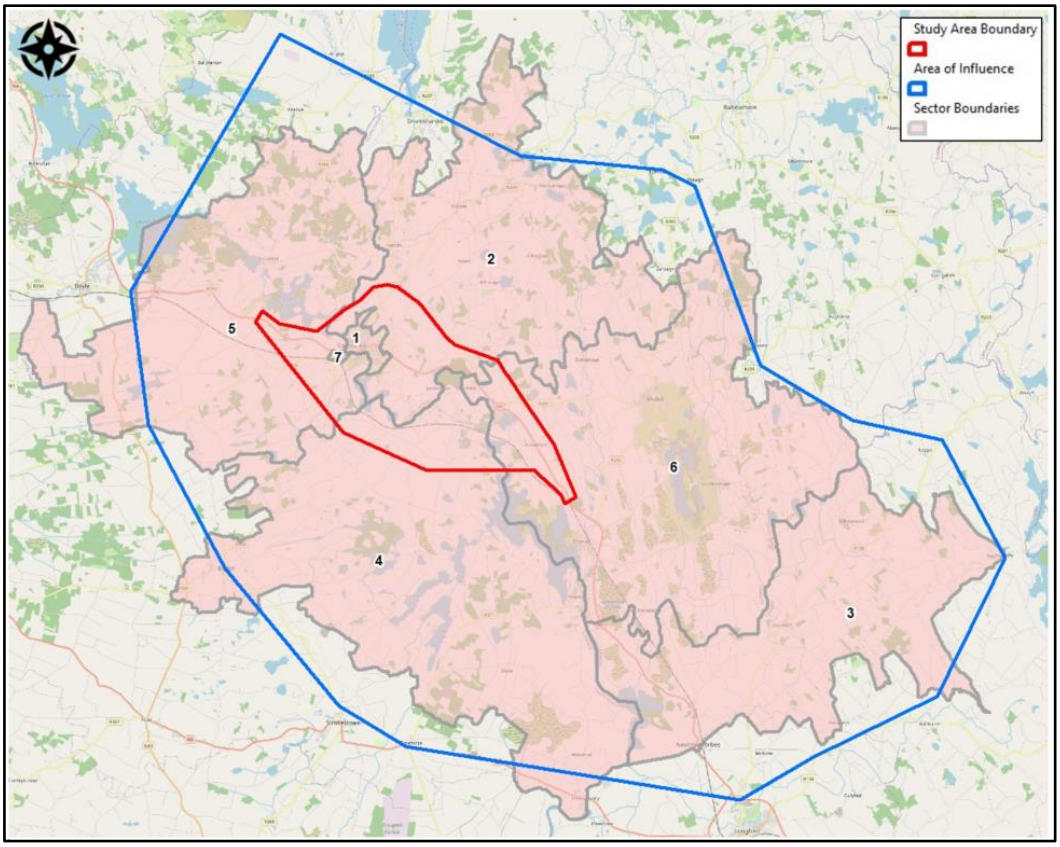

Plate 3.2.3 Sectors within Transport Model

Plate 3.2.4 below shows the desire lines between all the sectors in the vicinity of Carrick-on-Shannon using AADT values derived from the base year model. As trips arriving at the perimeter of the outer sectors are loaded onto that sector, the desire lines appear to converge outside of this graphic; however, this is necessary to ensure that all trips are captured.

The following should be noted when interpreting Plate 3.2.4:

- Sectors are delineated by solid grey lines
- Journeys from one sector to another sector are aggregated together and shown as a single red or green line, with the colour dependent on whether that traffic crosses or does not cross the bridge in Carrick-on-Shannon. The thickness of the line highlights the level of demand and includes both directions of travel combined together to give an AADT figure
- The aggregated journeys are shown from the approximate centre of one sector to the approximate centre of the destination sector
- Journeys undertaken and completed internally within sectors are not shown
- Desire lines shown are not road based, but rather are as the crow flies

- Green lines denote journeys which commence and end without crossing the bridge in Carrick-on-Shannon
- Red lines denote journeys which include crossing the bridge in Carrick-on-Shannon.

Plate 3.2.4 shows trip demand to and from Carrick-on-Shannon across the entire transport model, with particularly strong demand from the northeast and northwest, as well as strong trip demand to and from Cortober. It also shows many red desire lines which commence from sectors outside Carrick-on-Shannon and terminate in sectors outside the town, demonstrating that many trips are forced through the town and over the bridge as part of their longer journey to destinations beyond the town.

The appropriateness of a potential solution will be judged by assessment of its ability to serve these desire lines. Therefore, a bypass may be part of a potential solution if it is able to capture those sector-to-sector movements which do not need to interact with the bridge and the town.

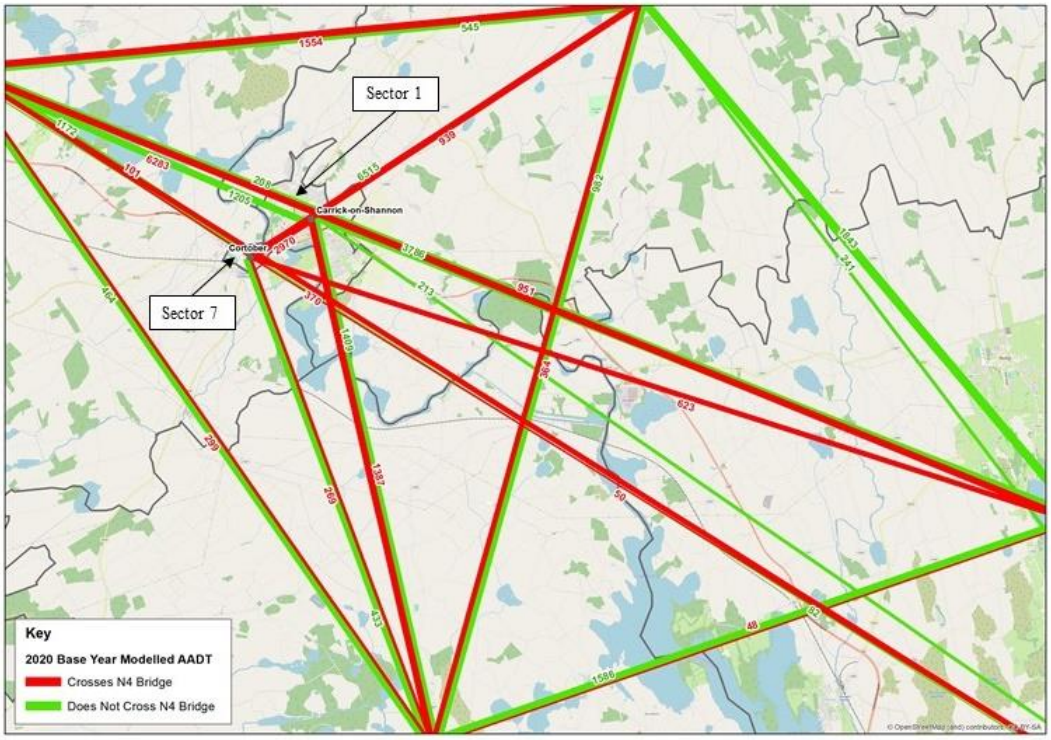

Plate 3.2.4 Desire Lines between sectors

Table 3.2 Trips between sectors over River Shannon Bridge in 2020 Base Year

	Origin – Destination crossing the N4 Bridge						
Sector To / From	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	-	-	-	694	**2,978**	-	1,601
2	-	-	-	171	644	-	428
3	-	-	-	1	212	-	32
4	694	192	1	0	159	21	184
5	**3,306**	910	158	141	66	420	42
6	-	-	-	27	530	-	400
7	1,369	511	18	85	59	223	-

Note the daily trips noted in the table are one-directional whereas the numbers shown in red on the graphic in Plate 3.2.4 are two-directional, e.g. Sector 6 to/from Sector 7 = 223+400=623 and Sector 5 to/from Sector 1 =3,306+2,978=6,284. The cumulative daily trips over the River Shannon Bridge in the base year is 16,278. This table shows that the greatest number of trips crossing the river have an origin/destination in Carrick-on-Shannon on the west of the river.

Table 3.3 Trips between sectors which do not cross River Shannon Bridge in 2020 Base Year

	Origin – Destination which do NOT cross the N4 Bridge						
Sector To / From	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	**5,749**	**3,162**	112	748	541	**2,034**	-
2	**3,353**	1,051	122	469	186	947	-
3	101	119	1,573	47	32	924	-
4	661	513	41	787	210	751	229
5	664	358	50	254	1,238	130	632
6	**1,752**	896	881	835	78	1,943	-
7	-	-	-	204	540	-	3

Again the daily trips noted in the table are one-directional whereas the numbers shown in green on the graphic in Plate 3.2.4 are two-directional, e.g. Sector 2 to/from Sector 1 = 3,162+3,353=6,515 and Sector 6 to/from Sector 1 =2,034+1,752=3,786. This table shows that there is a significant number of trips, i.e. 5,749 which start and end on the eastern side of the river within Sector 1, the urban area of Carrick-on-Shannon, without ever crossing the river. Furthermore, there are a significant number of trips originating on the east of the river in the Leitrim Village area in Sector 2 to the northeast and in the Mohill area in Sector 6 in the southeast that have an origin/destination in Carrick-on-Shannon without the need to cross the river, i.e. 6,515 and 3,786 respectively.

Plate 3.2.5 is a schematic diagram illustrating the travel patterns of vehicular trips to, from or through Carrick-on-Shannon and Cortober in the 2020 base year as extracted from the travel demand matrices and after converting the peak hour figures into AADT volumes. Red arrows show movements that cross the bridge and green arrows show movements that do not cross the bridge. The cumulative daily trips over the River Shannon Bridge in the 2020 base year is 16,278, with 5% of them consisting of HGVs, that is approximately 650 HGVs driving over this narrow bridge daily.

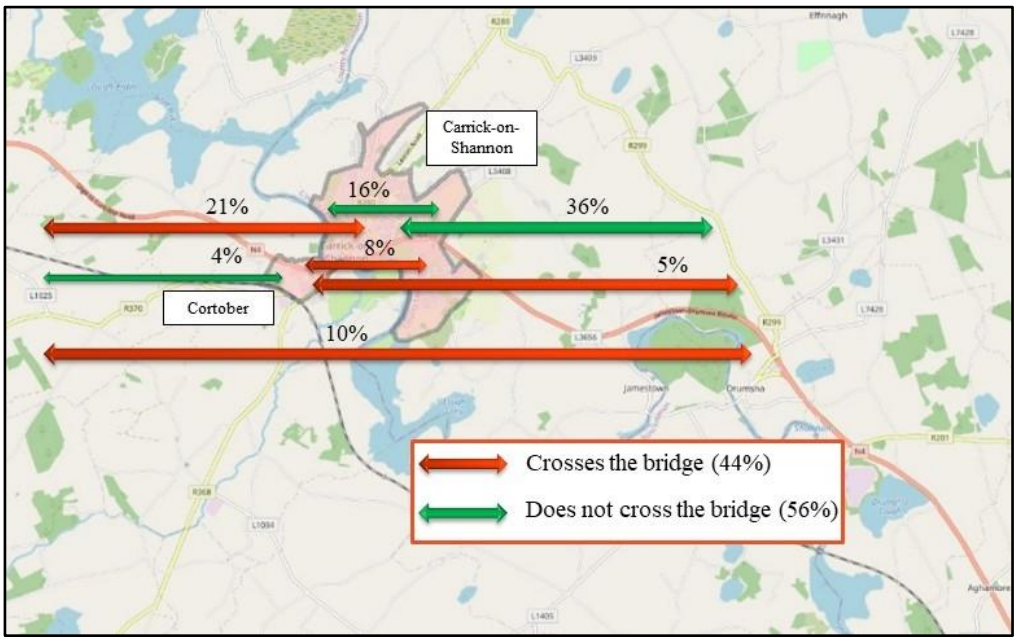

Plate 3.2.5 Existing Travel Patterns

In total 44% of trips in the transport model area cross the bridge, as represented by the red arrows. The other 56% of trips in the transport model area do not cross the bridge, as represented by the green arrows.

The strongest movement is to and from Carrick-on-Shannon with 21% of trips from the west/northwest of Cortober having a destination in Carrick-on-Shannon, and 36% of trips from the east of Carrick-on-Shannon having a destination in Carrick-on-Shannon. There also is a high percentage of trips at 16%, circulating within this urban area of Carrick-on-Shannon without crossing the bridge to Cortober. The through trips comprise 10% of all trips i.e. do not stop in either Cortober or Carrick-on-Shannon urban areas.

Plate 3.2.6 shows the travel patterns of just those 44% of total trips in the study area which cross the bridge.

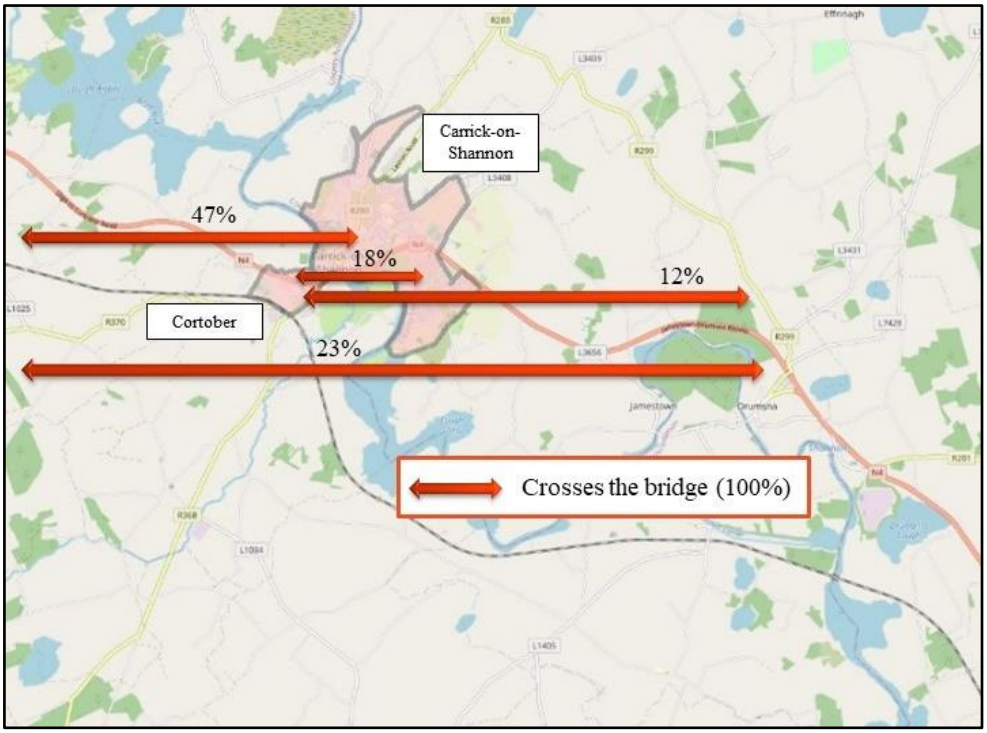

Plate 3.2.6 Existing Travel Patterns which cross the River Shannon Bridge

A review of the trips crossing the River Shannon Bridge only, shows 23% of these trips are through trips. A further 47% of these trips pass through Cortober on the west to access areas on the east of the river within Carrick-on-Shannon and in reverse, 12% pass through Carrick-on-Shannon to access Cortober on the opposite side of the river. Finally, a total of 18% of trips across the bridge originate and terminate within the urban sectors of Cortober and Carrick-on-Shannon respectively. This analysis implies that there would be use of a bypass if one were built, given that there is strong demand for travel across the existing bridge, not only on movements between the sectors comprising Carrick-on-Shannon and Cortober, but more significantly on journeys that start or end in Carrick-on-Shannon with destinations elsewhere in the study area and those journeys that pass through the town as through trips.

3.2.6 Future Year Model Development

This section sets out the development of the future year N4 LAM models for the scheme opening year (2030) and design year (2045). These forecast years will be used for assessing the performance of the project and for input into the design process.

Origin and Destination growth rates for both the internal and external zones for light and heavy vehicles were provided by TII for the years 2016 - 2030, 2030 - 2040 and 2040 - 2050. These years correspond with the NTpM forecast years. The growth rates were provided for a low, central and high growth scenario which are based on the CSO population and labour force projections. The central growth scenario, which is based on the National Planning Framework 2040 population and employment projections, was used for Phase 2 as a single growth scenario is

sufficient for this phase of the project appraisal in order to compare the different options against each other on an equal basis.

Once a preferred option is selected, low, medium and high growth scenarios will be prepared, and the preferred option will be tested in these additional scenarios as required for both the economic and environmental sensitivity tests. Additionally, the preferred option will also be assessed using an alternative demand scenario, to reflect a potential change arising from home working following the Covid-19 Pandemic.

For the NTA's Regional Models and therefore the LAM, goods vehicle growth is assumed to increase broadly in line with economic growth forecasts. CSO Gross Domestic Product (GDP) forecasts have been used to derive a growth factor for HGV traffic for each of the future years assessed.

A quantitative assessment of the impact of the traffic forecasting process was undertaken to ensure that the process of applying traffic growth factors did not unduly distort the trip matrix. This essentially comprises a comparison of trip length distribution, trip end growth and zone to zone growth in the Base Year versus the 2030 Opening Year and 2045 Design Year scenarios. Full details of this assessment are included in Appendix A.3.2.1. This shows that the profiles of these three components have a similar profile and distribution in the future years as the base year.

3.3 Initial Selection of Intervention Required

An examination of the issues contributing to existing transport deficiencies across all modes on the N4 corridor within the study area is needed in order to identify appropriate and successful interventions. Furthermore, it is imperative that the broader objectives of the project, including the promotion of active travel in particular in and around Carrick-on-Shannon, and enhancing inter-regional connectivity remain at the forefront in shaping a sustainable transport solution and achieving the project objectives.

At present, the N4 is a single corridor which is expected to cater for the following:

- Provide connectivity on the EU TEN-T comprehensive network between the N5 and N6 national primary routes
- Provide a high-quality[17] road as part of the TEN-T comprehensive network
- Strategic traffic travelling between Sligo and Dublin

[17] 2. The high-quality roads referred to in point (a) of paragraph 1 are those which play an important role in long-distance freight and passenger traffic, integrate the main urban and economic centres, interconnect with other transport modes and link mountainous, remote, landlocked and peripheral NUTS 2 regions to central regions of the Union. Those roads shall be adequately maintained to allow safe and secure traffic. (Extract from Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU)

- Local trips in Carrick-on-Shannon and Cortober
- Local access for private dwellings with frontage onto the N4 and farming operations with direct accesses onto the N4
- All modes including vehicular traffic, walking, cycling and public transport
- Non-motorised users of all ages from the very young to the very old
- All classes of vehicle from a simple scooter to the bus to emergency service vehicles to the farm vehicles to the HGV

Within the urban area, the N4 is located on the riverside of the River Shannon with significant marina facilities accessed from cars parked on the N4. There is a riverside amenity park along the extents of the N4, between the N4 and the river which contains local biodiversity gardens and children's activity zones. Furthermore, the N4 crosses the River Shannon via the only bridge crossing in Carrick-on-Shannon which is a sub-standard cross-section and dates from 1846. Therefore, the N4 is conflicted in that it is expected to provide for all trips by all modes by all people safely and efficiently, but this is physically impossible. The selection of intervention required for the N4 project is dependent on many factors, as discussed in the following sections.

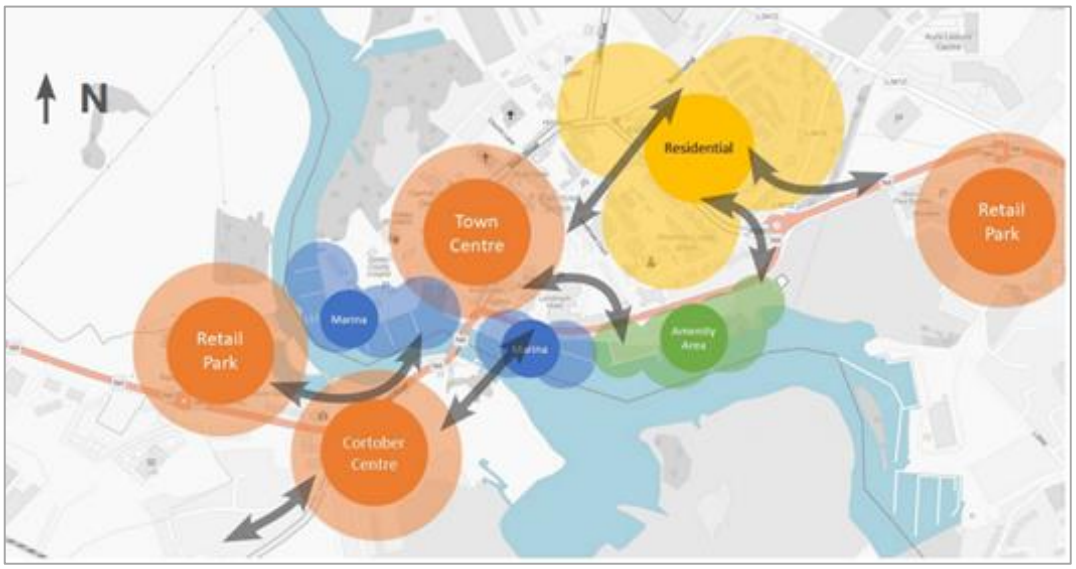

Plate 3.3.1 N4 through Carrick-on-Shannon, River Shannon Bridge and Cortober

Chapter 5 provides an overview of the methodology for the development and assessment of a range of alternatives and options that are likely to contribute to achieving the project objectives. The hierarchy of modal intervention as set out in national policy requires a primary focus on active travel measures and improved public transport systems before increased provision for the private car is contemplated. Road based options will feature among potential solutions but as set out in national policy, an incremental approach should be adopted when considering potential road based solutions commencing with an option which maximises and optimises the reuse of the existing asset before moving onto providing new road infrastructure.

The concepts of modal hierarchy and intervention hierarchy form part of the strategy when considering the initial level of intervention required. An assessment of the transport issues within the urban area identifies the need for additional space to accommodate active travel modes, the need for additional public transport provision and the need to accommodate by-passable traffic on the TEN-T network. A similar assessment in the rural area identified the need for provision for active travel modes and local traffic movements in conjunction with traffic movements on the TEN-T network.

Traditionally, selection of road type and cross-section for new or improved national road schemes has been based on projected values of Annual Average Daily Traffic (AADT) flow for a future design year. An assessment of the traffic volumes on the N4 outside of the urban area would dictate the need for a single carriageway, whereas traffic volumes in the urban area lean towards a dual carriageway.

Table 6.1 of TII Standard DN-GEO-03031 presents a range of recommended rural road layouts for various AADT capacities, and further advises that the capacity figures presented in the standard are indicative for general guidance and that the appropriate cross-section shall be selected with reference to the TII Project Appraisal Guidelines. Therefore, the appropriate road type and cross-section will be influenced by a multitude of factors, including:

- TEN-T regulations in respect of access control and junction type
- AADT
- Junction capacity and junction frequency
- Peak hour flows
- Availability of access to alternative modes of transport
- Provision for active travel
- Demand management policies and traffic control measures
- Journey time reliability

Consequently, the selection of the appropriate future road cross-section needs to consider a much broader range of criteria and influences, as opposed to adopting a traditional predict and provide or supply management approach. An incremental assessment will be undertaken on the preferred solution to establish the intervention level should a road form part of the transport solution.

Considering all of the above, various alternatives which provide for active travel and additional public transport services were developed for assessment in addition to road based solutions. As a starting point, the minimum level of intervention considered maintaining and optimising the existing N4 road, before improving certain sections of it by upgrading it to standard Type 1 single carriageway before going further to providing a wholly new Type 2 dual carriageway.

Therefore, for the purposes of option selection during Phase 2, a range of cross-section configurations and specific transport interventions have been assessed with the aim of more accurately defining the future N4 corridor needs which include:

- Future public transport provision in terms of bus
- Additional public transport improvement measures in the form of improvements to the rail service and rail station with a view to curtailing private car dependency through improved accessibility to alternative modes
- Junction improvements in certain areas together with junction closures and rationalisation elsewhere
- Capacity enhancement measures including improving the existing N4 and/or providing new off-line road infrastructure

The range of interventions are outlined in Chapter 5 of this report. Assessment of these interventions is detailed in Chapters 6, 7 and 8, with further analysis provided within the Transport Modelling Report included in Appendix A.3.2.1.

3.4 Preliminary Junction and Access Strategy

As outlined in Section 3.3 above, the N4 is a multi-modal corridor with multiple accesses and junctions as it tries to accommodate all modes, vulnerable road users and activities in a single shared place. The current junction and access provision is not entirely conducive to the safe and efficient operation of a strategic road forming part of the TEN-T comprehensive network. Few, if any, junctions along the existing N4 comply fully with current TII geometric standards. There is an absence of consistency in junction standard and design characteristics, which does not present drivers with intuitive and expected layouts. Problems also stem from the 197 direct accesses onto the N4 mainline which includes 113 farm accesses, 58 domestic accesses, 24 commercial accesses and 2 pedestrian/cycle accesses. Further details of the existing deficiencies at junctions and accesses are noted in the *Existing Road Condition Assessment Report* included as an appendix to the *Road Safety Impact Assessment (RSIA)* which is located in Appendix A.6.4.1.

The aim of a junction strategy as defined in TII Document – Rural Road Link Design (DN-GEO-03031), Section 7.10, is to ensure that the overall access arrangement and connectivity to the new road infrastructure provides drivers with layouts that have consistent standards and are not likely to confuse them whilst also providing the necessary level of connectivity and meeting the requirements of the TEN-T regulations. On lengths of rural road, sequences of junctions should not therefore involve many different layout types. TII DN-GEO-03060 "Geometric Design of Junctions" paragraph 4.1 also states *"As an overarching principle TII supports a junction strategy which seeks to prevent a proliferation of side roads junctions along national roads with speeds limits of greater than 60km/h. The application of this strategy will maintain the capacity, efficiency and safety of the national road network".*

The junction strategy objectives for the N4 project will seek to align with the following basic principles, irrespective of the option corridor:

- Compliance with the TEN-T regulations
- Restriction of number of junctions as the N4 is of strategic importance, whilst providing sufficient junctions to provide a minimum level of accessibility to the

4 Constraints Study

4.1 Introduction

4.1.1 Overview

A constraints study was undertaken to identify all the key constraints within the study area of the N4 Carrick-on-Shannon to Dromod Project to inform the development of alternatives and options which will provide a transport solution for the section of the N4 under consideration. It should be noted that some of these constraints are geographical, for example a railway line or a river and others are service constraints relating to existing public transport services.

The objective of the constraints study is to identify international, national, county, and local issues that must be considered when planning and designing the project so that the phases which follow (Option Selection Process and Evaluation of Environmental Constraints) can be properly informed.

This constraint chapter has been prepared in accordance with Transport Infrastructure Ireland's (TII) Project Management Guidelines (PMGs) PE-PMG-02041 December 2020[1] and has been compiled based on desk studies, field surveys and consultation with stakeholders. In addition, in compliance with Article 3 of the EIA Directive (Directive 2011/92/EU as amended by Directive 2014/52/EU) as transposed into Irish Legislation S.I. No. 296 of 2018[2]), environmental factors considered in the constraints study include, but are not limited to those listed in S.I. No. 296 of 2018 (i.e. Population and Human Health, Biodiversity, Land, Soil, Water, Air, Climate, Material Assets, Cultural Heritage and Landscape).
In accordance with the TII PMGs[1] the constraints are divided into three principal categories: Artificial Constraints, Natural Constraints and External Parameters. Artificial constraints are those which form part of the built environment and are detailed in Sections 4.2 to 4.10 (inclusive) of this chapter. Natural constraints are those which are naturally occurring landscapes and features and are detailed in Sections 4.11 to 4.15 (inclusive) of this chapter. External parameters include design standards, policies, procedural and legal issues and are detailed in Section 4.16 of this chapter.

4.1.2 Artificial Constraints

Artificial constraints are those which form part of the built environment. These are documented in the following sections:

- Section 4.2 Engineering

[1] Transport Infrastructure Ireland, 2020. Project Management Guidelines PE-PMG-02041. Available at: https://www.tiipublications.ie/library/PE-PMG-02041-03.pdf . These guidelines have since been updated in July 2022 and the updates do not affect the content of this report.
[2] European Union (Planning and Development) (Environmental Impact Assessment) Regulations S.I. No. 296/2018 2018, Dublin, Ireland. Available at: https://www.irishstatutebook.ie/eli/2018/si/296/made/en/print

- Section 4.3 Land Use and Planning
- Section 4.4 Population
- Section 4.5 Material Assets – Non-Agriculture
- Section 4.6 Material Assets – Agriculture
- Section 4.7 Air Quality
- Section 4.8 Climate
- Section 4.9 Noise and Vibration
- Section 4.10 Archaeological Architectural and Cultural Heritage

4.1.3 Natural Constraints

Natural constraints are those which are naturally occurring landscapes and features. These have been documented in the following sections:

- Section 4.11 Landscape and Visual
- Section 4.12 Biodiversity
- Section 4.13 Hydrology
- Section 4.14 Hydrogeology
- Section 4.15 Soils and Geology

4.1.4 External Parameters

External Parameters are those constraints which do not fall under the headings of Natural or Artificial Constraints. The external parameters which may influence the Project are detailed in the following sections:

- Section 4.16.2 Funding and Scope
- Section 4.16.3 Construction Phasing
- Section 4.16.4 Key Performance Indicators
- Section 4.16.5 Technical Standards
- Section 4.16.5.5 Access Control
- Section 4.16.6 Policy Documents
- Section 4.16.7 Procedural and Legal Requirements

4.1.5 Definition of the Study Area

4.1.5.1 Identification of the Study Area

The study area is a boundary within which key project constraints are identified and appropriate options and alternatives are examined and developed.

The definition of the study area was influenced by many factors, which include:

- topography within the area
- existing N4 corridor tie-in locations and safety considerations when determining same
- the locations of the River Shannon and Eidin Lake
- environmental criteria
- extent and catchment of public transport infrastructure
- potential zone of influence of alternatives and options

4.1.5.2 Description of the Study Area

The study area developed for the N4 Carrick-on-Shannon to Dromod Project is illustrated in Figure 4.1.1.1. The study area extends from the townland of Eidin in the northwest to the townland of Faulties in the southeast. The study area comprises an area of approximately 78.2km^2 and is 7.7km wide (at its widest point) and 18.3km long.

The study area boundary was developed with a view to ensuring a suitably sized and structured study area to allow full and extensive studies. These studies include the identification of key constraints to the project and the subsequent development of feasible alternatives and options for the creation of a transportation solution. The study area encompasses the extents of former design developments identified in previous studies, while also allowing for the development of additional options. It also fully includes the portion of the existing N4 under consideration and the extents of the towns and villages along the route.

4.1.6 Non-Statutory Public Consultation No. 1 on Constraints

Public participation is an important part of the development of a project and in particular during the early phases of a project. Public Consultation No. 1 helped identify additional key constraints and provided insight to the transport and safety issues experienced by the public using the section of the N4 within the study area.

Although an in-person consultation could not take place due to Government restrictions with respect to Covid-19, the consultation was conducted using an on-line virtual consultation space which allowed the public view the project material as if they were at an in-person event. Comment sheets were accepted by post, by email or via the public engagement feedback page on the project website.

The public consultation virtual room was live on the project website for two weeks between 5 October 2020 and 23 October 2020. A copy of the brochure and feedback form was posted to anyone who requested a hard copy.

A total of 42 submissions were received during the public consultation.

A response was provided to each submission in the same manner as received e.g. an emailed submission was provided with an email response; a letter was responded to in letter form etc.

A thematic analysis identified the following main feedback topics:

- Request to know where the planned road is going, worry that the project website isn't properly showing the location of the 'new road', and objection to the location of the new road even though there was no proposed road among the information presented
- Identification of a proposed Blueway that is currently at planning stage and objections to any interference with this
- Concerns that a road would have a negative effect on tourism, amenity and businesses in the area
- Conversely there was also much support for the project on the basis that it would be good for tourism and businesses in the area
- Criticism of the existing N4 Dromod Roosky Bypass road design for the following reasons:
    - The previous N4 improvements infringed on homeowners' properties
    - Stopping places and/or hard shoulder are required along any proposed road whilst also noting that the cross-section of the existing N4 Dromod Roosky Bypass is deficient due to the lack of same
    - Land plots/farms were severed and separated
- Noting that the 'Problem' is in Carrick-on-Shannon not in the rural areas at Dromod so any road should be near Carrick-on-Shannon, and that a single carriageway is sufficient in rural areas
- Support for the project and for the development of pedestrian and cycling infrastructure which needs to be considered as part of the project
- Concerns regarding flooding and a road interfering with the River Shannon flood plain and navigation abilities
- Concern regarding operational stage health and safety risks associated with a road being constructed near their home
- Concerns that there would be reduced response times for emergency services to individual homes with a dual carriageway design
- Concerns that the junction on the N4 beside Masonite is dangerous and requesting that this be rectified under the current project
- Offering of general support for the project, welcoming the removal of bottlenecks and positivity expressed that the project is going ahead after the previous project ceased

Other comments received to a lesser extent included:

- Highlighting the ancient Abbey of Annaduff
- Farmers requesting that their lands also be classed as 'high sensitivity'
- Objections to any proposal to quarry stone in the townland of Fearnaught

Full details of this consultation and submissions received from the public are included in Appendix A.4.1.1 Report on Public Consultation No. 1 – Constraints.

4.2 Engineering

4.2.1 Introduction

This section describes the engineering constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with Figures 4.2.1.0 to 4.2.1.5.

Section 4.2.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.2.3 describes the engineering constraints within the study area. A summary is presented in Section 4.2.4.

The objective of this engineering constraints study is to identify all the engineering constraints within the study area in order to inform the development of alternatives and options. The existing environment has been analysed under the headings of topography and landscape, rivers, existing road network, road safety characteristics of the existing road network, traffic, other transport modes, quarries and other amenities.

4.2.2 Methodology and Sources of Information

Research for this constraints study was undertaken as a desktop exercise. The following information sources were consulted to identify engineering constraints to the project:

- Bus Éireann
- Environmental Protection Agency (EPA)
- Geological Survey of Ireland (GSI)
- Iarnród Éireann
- Ordinance Survey Ireland (OSI)
- Road Safety Authority (RSA)
- Transport for Ireland (TFI)
- Westlink Coaches
- Information provided by Leitrim County Council on surveys to inform a previous road scheme through the study area in the early 2010s

4.2.3 Existing Environment

This section describes the engineering constraints within the study area. These constraints comprise the natural features (topography, landscape and rivers) and the main infrastructure (roads, railways and public transport) within the study area, and the road safety characteristics of the existing road network are addressed. Quarries are also identified as constraints in this section. Major utility constraints such as gas, water, electricity and telecommunications are detailed in Section 4.5 Material Assets Non-Agriculture and proposed developments are detailed in Section 4.3 Land Use and Planning.

4.2.3.1 Topography and Landscape

The study area incorporates the boundary of two counties namely, County Roscommon to the west and County Leitrim to the east. The River Shannon forms the boundary between the two counties.

The topography within the study area generally comprises undulating hills either side of the River Shannon. Elevations range from 40mOD along the banks of the river to peaks of over 90mOD in the townlands of Screeg to the west and Clogher to the east. Peaks of 80mOD to 90mOD are common throughout the study area[3].

There are extensive floodplains in the low-lying ground either side of the River Shannon. As a result of this, there is risk of significant seasonal flooding within the study area.

Land use within the study area is typically agricultural, aside from the urban and residential areas of Carrick-on-Shannon, Cortober, Drumsna and Jamestown and Aghamore. There are some areas of forestry within the study area; the most extensive of which are located in the townlands of Mountcampbell and Charlestown.

4.2.3.2 Rivers

The River Shannon is the most notable river within the study area. The River Shannon is Ireland's longest river, flowing from the Shannon Pot, County Cavan to the Shannon Estuary, at the border of Counties Clare and Kerry. The river meanders through the study area from north to south. The primary river crossing, on the existing N4, is by the River Shannon bridge in Carrick-on-Shannon/Cortober. In the townland of Cloonavery, on the L3656 there are also two local road crossings of the River Shannon where it forms a horseshoe bend between Jamestown and Drumsna.

The study area lies between the major lakes of Lough Allen and Lough Ree on the River Shannon. There are two smaller lakes, Lough Corry and Lough Tap, along the river within the study area. Lough Key and Lough Eidin are upstream of the study area along the Boyle River.

There are a number of other smaller watercourses within the study area including the Killukin River, Jamestown Canal and numerous tributaries and streams either side of the River Shannon.

4.2.3.3 Existing Road Network

The existing road network within the study area comprises national, regional and local roads. This network provides connectivity among nearby towns and villages, as well as a strategic corridor from Dublin to the northwest of Ireland and the border counties.

[3] Environmental Protection Agency, 2019. EPA Contours. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=088740d9f8ad466788fc25e268394656

National Road Network

The N4 is the only national road within the study area, running approximately 20km through the full length of the project, from Drumharlow to Faulties. This national primary road is a strategic corridor from Dublin to the northwest and border counties and is approximately 198km in length in total. The section of the N4 within the study area passes through both rural and urban environments, crossing the River Shannon and the Roscommon - Leitrim border at the River Shannon Bridge in Carrick-on-Shannon/Cortober. This river crossing is a narrow masonry arch bridge, dating from 1846, which is sub-standard in terms of alignment and cross-section. The need for all traffic to cross the River Shannon via a single bridge combined with a narrow carriageway, frequency of sharp bends and associated junctions continues to result in significant traffic congestion, especially during peak periods. Convergence of national, regional and local traffic in the town causes considerable congestion in the town centre and delays to through traffic.

There are 197 direct accesses onto the existing N4 throughout the study area, along with 52 junctions. The portion of the existing N4 within the study area is composed of single carriageway, apart from the southernmost 500m which is dual carriageway; forming part of the existing Dromod - Roosky bypass. Further detail of the current N4 is available from the Existing Road Condition Assessment (See Appendix A.6.4.1 – the Existing Road Condition Assessment is an Appendix to the Stage 1 Road Safety Impact Assessment (RSIA))

Regional Road Network

There are six regional roads contained within the study area which provide regional connections to the towns of Frenchpark, Elphin, Leitrim Village and Manorhamilton. These include the R280, the R370, the R368, the R903, the R299 and the R201; all of which connect directly to the N4 apart from the R370, which connects to the R368, within the study area. Each of the regional roads are composed of single carriageway.

The R280, Carrick-on-Shannon to Leitrim Village, enters the study area from the northern side of the project and runs southwest towards Carrick-on-Shannon, terminating at a roundabout junction with the N4. The entire 74km of the R280 typically runs in a north south direction between Carrick-on-Shannon and Bundoran County Donegal. The R280 also connects to the R207 to Drumshanbo.

The R370, Frenchpark to Carrick-on-Shannon, is approximately 21km long and enters the study area from the west. The R370 connects the R368 in Cortober, next to Carrick-on-Shannon Railway Station, with the R361 in Frenchpark, where traffic may join the N5. The R370 also crosses the N61, Athlone to Boyle road, at Ratallen.

The R368, Elphin to Carrick-on-Shannon, also enters the study area from the west and runs northeast towards Carrick-on-Shannon. The R368 runs under the railway line by the junction with the R370 and terminates at a roundabout junction with the N4 in Cortober. The R368 originates in Four Mile House, County Roscommon, on the N61, passes through the towns of Strokestown and Elphin en-route to Carrick-on-Shannon, and is approximately 36km long.

The R903 consists of Bridge Street and Main Street within Carrick-on-Shannon. This regional road runs from the roundabout east of River Shannon Bridge, to the R280 on the north side of the town.

The R299, Drumsna to Grange, crosses in and out of the study area along the northeast boundary. This regional road provides connection between the R280 and the N4. The R299 joins the N4 by the Drumsna grade separated junction and is approximately 7km in length.

The R201, Mohill to Annaduff, enters the study area from the east and runs for approximately 1.5km before connecting with the N4 in Annaduff. The R201 extends from Annaduff to the townland of Lisnamaine, County Cavan, where it connects with the N87 and is 50km long.

Local Road Network

There is an extensive local road network present within the study area. The rural roads are of varying quality and contain few dedicated facilities for pedestrians and other vulnerable road users apart from through villages and towns. Closer to Carrick-on-Shannon and Cortober the area becomes suburban and urban and comprises several residential, commercial and industrial estates.

The only crossings of the River Shannon by the local road network are 1.5km apart in the townland of Cloonavery on the L3656 to the west of Drumsna. These crossings traverse a horseshoe bend of the river.

4.2.3.4 Road Safety Characteristics of Existing Road Network

Current and future traffic volumes

A full transport modelling study of the study area has been carried out, refer to Chapter 3 for more details of the traffic constraints.

Collision data

Collision data for the study area was obtained from the RSA records. Table 4.2.1 presents the number of recorded fatal, serious and minor injuries resulting from collisions within the study area for the period between 1996 and 2016.

Accidents were recorded across the road network; on the national, regional and local roads. Fatalities and injuries were sustained by drivers, passengers, pedestrians and other road users.

Table 4.2.1 Collision Data within the Study Area

Year	Fatalities	Serious Injuries	Minor Injuries	Injury (Unknown Severity)
1996	0	0	3	0
1997	0	1	13	1
1998	2	0	12	0
1999	1	2	20	1
2000	0	2	11	0
2001	0	4	9	1
2002	0	2	23	0
2003	1	1	10	0
2004	0	0	8	0

Year	Fatalities	Serious Injuries	Minor Injuries	Injury (Unknown Severity)
2005	2	1	15	3
2006	0	2	0	0
2007	3	2	6	2
2008	0	1	6	0
2009	0	0	15	0
2010	0	0	9	0
2011	0	0	20	0
2012	0	1	22	0
2013	0	0	8	0
2014	0	2	11	0
2015	0	0	21	0
2016	0	0	19	0
Total	**9**	**21**	**261**	**8**

From 1996 and 2016 inclusive, nine fatalities were recorded as a result of road traffic accidents within the study area. During the same period 21 serious and 261 minor injuries were also recorded. A further eight injuries were sustained; however, the severity of these injuries is unknown.

4.2.3.5 Other Transport Modes

Rail

Carrick-on-Shannon Railway Station is located in the village of Cortober and opened on 3 December 1862[4]. The station is situated with Boyle Railway Station to the west and Dromod Railway Station to the east on the Dublin to Sligo railway line. The station serves the Dublin, Connolly to Sligo route. Iarnród Éireann provide services seven to eight times per day in both directions[5].

The railway line enters the study area from the west and runs on the south side of the River Shannon before crossing the river from the townland of Moyglass to Derrylaur, just north of Lough Tap. The railway line crosses the existing road network ten times within the study area; by way of at-grade junction, underbridges and overbridges.

[4] Ayres, B. Irish railways. Available at: https://www.railscot.co.uk/Ireland/Irish_railways.pdf.
[5] Iarnród Éireann, 2022. Dublin Sligo Timetable. Available at: https://www.irishrail.ie/Admin/IrishRail/media/Timetable-PDF-s/Connolly-DART-timetables/07_dublin_-sligo.pdf

Road based public transport

Bus Éireann[6] , TFI Local Link[7] and Westlink Coaches[8] operate several national and local bus services within the study area. These services are listed in Table 4.2.2.

Table 4.2.2 Bus Services within the Study Area

Provider	Route No.	Route
Bus Éireann	23	Dublin Airport to Sligo
Bus Éireann	468	Strokestown - Elphin - Carrick-on-Shannon
Bus Éireann	469	Drumkeeran - Drumshanbo - Carrick-on-Shannon - Longford
Local Link	564	Ballinamore - Mohill – Carrick-on-Shannon
Local Link	568	Carrick-on-Shannon to Arigna
Local Link	N/A	Carrick-on-Shannon to Manorhamilton
Westlink Coaches	N/A	Ballinamore to Athlone
Westlink Coaches	N/A	Ballinamore to Claregalway
Westlink Coaches	N/A	GMIT to Sligo
Westlink Coaches	N/A	Drumshanbo to Collooney

Many of these services do not operate multiple times per day, nor do they operate daily. For example, Bus Éireann's route 469 operates one service on a Saturday morning only. TFI Local Link's route, Carrick-on-Shannon to Manorhamilton, is limited to one service per day on Tuesdays, Thursdays and Saturdays only, while most of Westlink Coaches services operate only at weekends and on Bank Holiday Mondays. Bus Éireann's route 23 operates frequently and daily, with five services per day. This Bus Éireann route is the main link between the northwest counties and Dublin Airport.

There are three taxi companies located within the study area; all based in Carrick-on-Shannon. There are a number of other taxi companies based in nearby towns which likely travel within the study area also.

Greenways and Walking Routes

There are no dedicated greenways within the study area however, there are some recognised walking routes, namely the Anthony Trollope Trail and a signposted route through Carrick-on-Shannon town and the Riverfront Amenity Park. Although the route through the town is serviced with footpaths, such pedestrian facilities on the Anthony Trolope Trail can only be found in Drumsna Village. There is a further walking route in Derrycarne Wood known as the Lough Boderg Trail just outside the study area to the west of Faulties.

[6] Bus Éireann, 2020. View Timetables. Available at: https://www.buseireann.ie/.
[7] TFI Local Link. 2020. Sligo/Leitrim/Roscommon. Available at: https://ua.locallink.ie/en/your-local-link/sligoleitrimroscommon/.
[8] Westlink Coaches, 2020. Timetables. Available at: http://www.westlinkcoaches.ie/timetables.html.

4.2.3.6 Quarries

Although there are no active quarries within the study area[9], two quarries have been active in recent times but have not been endorsed by the local County Council. The first is Finnalaghta Quarry, a registered sandstone quarry, which the local authority has taken action against in the High Court to have it discontinued due to intensified quarrying in this location. The second, Kiltycarney Quarry, was authorised for activity during the construction of the Drumsna Bypass. It was a condition of the permission that the quarry be rehabilitated within six months of completion of the project. This did not occur and therefore this quarry is unauthorised however at present it is not active[10].

There are 38 historical pits and quarries within the study area according to GSI records[11]. See Sections 4.15.3.12 and 4.15.3.18 of the Soils and Geology section for more information on historic and active quarries respectively.

4.2.4 Summary

The purpose of this section is to provide analysis of the engineering constraints located within the study area in order to inform the development of alternatives and options for the project.

The engineering constraints within the study area include the undulating topography, the River Shannon and its associated floodplains. The primary infrastructural constraints comprise the existing road network, in particular the existing River Shannon Bridge itself, and the Dublin to Sligo railway line. The urban (commercial, industrial, retail, amenity etc.) and residential areas of Carrick-on-Shannon, Cortober, Drumsna and Jamestown and Aghamore also pose as major constraints. Other constraints in the built environment consist of disused quarries.

The River Shannon and its associated floodplains create significant risk of seasonal flooding. Careful consideration of this issue in association with any works or proposals is required, especially in the event of a new river crossing being introduced.

There is an extensive road network within the study area. The frequency of direct accesses and junctions, particularly onto the existing N4, must be observed as a constraint if any on-line upgrades are to be considered. The Dublin to Sligo railway line also provides an infrastructural constraint to the south of the study area.

There are also numerous historical pits and quarries throughout the study area, which may cause challenges for the development of alternatives and options within the project.

[9] Geological Survey Ireland, 2020. Active Quarries and Pits Ireland. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=de18ea08ecd344b88c52b65b55fd9abb
[10] Roughan & O'Donovan Consulting Engineers, 2010. N4 Carrick-on-Shannon to Dromod Road Project - Constraints Study Report. Volume: 1
[11] Geological Survey Ireland, 2019. APM Pits and Quarries. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a205a046a2474e82944f9823b6568ea0

4.3 Land Use and Planning

4.3.1 Introduction

This section describes the land use and planning constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with Figures 4.3.1.0 to 4.3.2.5.

The land use and planning constraints described in this section relate to planning designations (zonings associated with the development plans and granted planning permissions) identified within the study area. Existing land use in terms of material assets non-agriculture constraints are described in Section 4.5 and material assets agriculture constraints are described in Section 4.6.

Section 4.3.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.3.3 describes the existing environment in terms of the land use and planning constraints within the study area which will help identify any county and local planning policy issues and pending or awarded planning decisions which may influence the development of alternatives and options. A summary is presented in Section 4.3.4.

4.3.2 Methodology and Sources of Information

The methodology for identifying existing land use and planning constraints involved a desk study of the relevant County Development Plans (CDPs) maps, Local Area Plans (LAPs) maps, Google Maps and MyPlan.ie maps to ascertain the existing land uses and potential future uses within the study area.

The following sources of information were utilised in the preparation of this study:

- Regional Spatial and Economic Strategy for the Northern and Western Region, 2020[12]
- Leitrim County Council Development Plan 2015-2021[13]
- Roscommon County Council Development Plan 2014-2020[14]
- Carrick-on-Shannon Local Area Plan, 2010[15]

[12] The Northern and Western Regional Assembly, 2020. Regional Spatial and Economic Strategy 2020-2032 (RSES). Available at: https://www.nwra.ie/rses/
[13] Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan/County_Development_Plan_2015-2021/
[14] Roscommon County Council, 2014. Roscommon County Development Plan 2014-2020. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/
[15] Leitrim Council, 2018. Carrick-on-Shannon Local Area Plan 2010-2019. Available from http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Local-Area-Plan/Amendment-2-Carrick-on-Shannon-2010-2019/

- Cortober Area Plan, 2014[16]
- Draft Leitrim County Development Plan 2023-2029[17]
- Roscommon County Development Plan, 2022-2028 [18]
- Leitrim County Council Website www.leitrimcoco.ie
- Roscommon County Council Website www.roscommoncoco.ie
- Central Statistics Office Website www.cso.ie

In addition, a review of planning applications lodged within the study area was carried out. This included new planning applications, as well as those granted within the past ten years, having regard to the five-year validity of planning applications with the exception of those given permission for a longer timeframe.

4.3.3 Existing Environment

4.3.3.1 Land Use and Planning

The primary land use within the study area is agricultural, with farming and the agri-food industry important elements of the local economy. Descriptions of material assets in terms of non-agriculture and agriculture are presented in Sections 4.5 and 4.6 respectively and not repeated in this section.

The River Shannon and its associated loughs also form part of the study area and large areas adjoining these water bodies are identified as flood risk zones. This is detailed further in Section 4.13 Hydrology.

These areas also have strong amenity value to the study area and significant parts along the river are identified as being of High Visual Amenity value in the Leitrim County Development Plan 2015-2021. This is detailed further in Section 4.11 Landscape and Visual.

There are a number of settlements within the study area. These include Carrick-on-Shannon, Cortober, Aghamore, Drumsna and Jamestown. These settlements are the focus for the majority of residential populations within the study area as well as local businesses and public, community, sporting and educational facilities. All will have to be considered as well as any new facilities proposed. A detailed review of the land use zonings related with these settlements is presented below.

[16] Roscommon County Council, 2014. Cortober Area Plan 2014-2020. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/2-Cortober-Area-Plan.pdf

[17] Leitrim County Council, 2022. Draft Leitrim County Development Plan 2023-2029. Available at: https://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Leitrim-County-Development-Plan-2023-%E2%80%93-2029/Stage-3-%E2%80%93-Publication-of-Draft-Leitrim-County-Development-Plan-2023-2029.html This plan was adopted on 7 February 2023 and will become effective on 21 March 2023

[18] Roscommon County Council, 2022. Roscommon County Development Plan, 2022-2028. Available at: https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/

In addition, the study area exhibits dispersed one-off rural dwellings in the open countryside and a number of small development clusters, often in the form of ribbon development along existing public roads, including the existing N4.

There are a number of protected structures and other heritage listed buildings within the study area, mainly concentred within the urban settlements. These are further detailed in Section 4.10.

Settlement Zoning

The study area encompasses lands which fall within the administrative jurisdiction of both Leitrim County Council and Roscommon County Council. As such, the current Leitrim County Development Plan 2015-2021[13] and the Roscommon County Development Plan 2022-2028[18] in conjunction with both the Carrick-on-Shannon Local Area Plan, 2010**Error! Bookmark not defined.** and the Cortober A rea Plan 2014-2020[16] were examined to inform this study.

A review was also undertaken of the recently published Draft Leitrim County Development Plan. The provisions of this Plan will not take effect until it becomes effective.

It should be noted that the Roscommon County Development Plan does not prescribe zoning objectives for lands within the study area.

The overall strategic aim of all these plans is to promote the sustainable development of their relevant counties and the settlements within same whilst protecting natural and environmental assets through a series of broad planning policies.

The plans promote development which reinforces and promotes development within existing towns and villages within the counties of Leitrim and Roscommon.

The main towns, villages and other urban settlements zoned within the study area include Carrick-on-Shannon, Cortober, Drumsna and Jamestown.

These settlements are zoned within the relevant County Development Plan or Local Area Plan, with development boundaries established for each. Within these development boundaries a series of land use zoning objectives are set out to regulate the development of lands.

The alternatives and options developed will endeavour not to impact these development boundaries and where feasible, take cognisance of the zoning strategies contained therein.

The land use zoning objectives for each settlement are shown in Figures 4.3.1.0 to 4.3.1.5.

The detail and nature of each of these land use zoning objectives is set out in the following sections.

Leitrim County Development Plan 2015

The Leitrim County Development Plan 2015-2021 is the current Development Plan for County Leitrim. The following land use zoning objectives apply in the settlements of Jamestown and Drumsna.

General Development

This designation relates primarily to Tier 4 Centres in the county and includes residential, commercial activity and enterprise and employment uses.

In determining the suitability of alternatives and options within this zone, regard is given to the environmental impact of any alternatives and options on neighbouring uses.

The following objective applies to these zones:

- **Objective 11** To seek the development of lands zoned 'General Development' for a suitable mix and pattern of development types.

Social & Community

This zone generally caters for community buildings, schools, hospitals and health centres, football pitches and other generic or specific social and community uses.

The following objective applies to these zones:

- **Objective 10** To seek the development of lands zoned 'Social and Community' for amenity, recreational, educational and health uses.

Open Space & Amenity

This zone generally comprises open space, public walkways and public recreational areas. Table 10.1 of the Development Plan sets out the Plan's Land Use Zoning Matrix which establishes which uses are permitted within this zone.

Tourism Related Development

This zone generally provides for developments that are linked to tourism including guesthouses, hotels, hostels, holiday homes, restaurants, pubs and other tourism-related developments.

Objective 12 of the Development Plan applies.

- **Objective 12** To seek the development of lands zoned 'Tourism Related Development' for tourism-related development and activities

Draft Leitrim County Development Plan 2023-2029

The Draft Plan was adopted on 7 February 2023 and it is coming into effect on 21 March 2023.

The following land use zoning objectives are to apply in the settlements of Jamestown and Drumsna.

Town and Village Centre

The Council will encourage and facilitate the development of under-utilised land and brownfield sites creating a mix of uses to make the town and village centres attractive places to visit, shop and live in. The full use of upper floors in buildings, preferably for residential use, will be encouraged. The character of the town and village centres shall be protected and enhanced. Development proposals should

provide a use, scale, form, and design that accords with the role, function and size of the town or village centre. These areas require high levels of accessibility by all modes, including pedestrian, cyclist and public transport (where feasible).

The zoning objective is as follows:

To maintain and enhance the vitality and viability of existing town and village centres through consolidation with an appropriate mix of retailing, commercial, cultural and residential activities.

Mixed Use

A diversity of uses for both day and evening are encouraged. These areas also require high levels of accessibility for all modes, including pedestrian, cyclists, and public transport (where feasible). Compatible uses within this zone include residential, community buildings, civic buildings, entertainment, hotels, leisure and recreation, offices, professional/specialist services and restaurants.

The zoning objective is as follows:

To provide for a mixture of residential and compatible commercial uses

Existing Residential

This zoning allows for the conservation and enhancement of the quality and character of existing residential areas, to protect residential amenities and to allow for infill development which is appropriate to the character and pattern of development in the area. This zone is intended primarily to protect established housing development but may include a range of other uses particularly those that have the potential to support the residential function of residential communities such as schools, crèches, small shops, doctor's surgeries, amenities, etc.

The zoning objective is as follows:

To protect and enhance the established amenity of existing residential communities.

New Residential

High-quality residential schemes are encouraged with convenient and safe access to local services and the creation of a safe and pleasant local environment. New housing and infill developments should be of sensitive design, which are complementary to their surroundings. Adequate undeveloped lands have been zoned in the Plan for residential use to meet the requirements for both public and private house building over the Plan period. The Council will strive towards the ideal of mixed residential neighbourhoods, where people of different social and economic backgrounds, and of different ages, can live in proximity and harmony to one another.

This zone is intended primarily for housing development but may include a range of other uses particularly those that have the potential to foster the development of new residential communities The Planning Authority will therefore consider favourably other appropriate uses which support the overall residential function of the area. The range of uses identified above in 'Existing Residential' zones are also appropriate in 'New Residential' zones.

The zoning objective is as follows:

To provide primarily for new residential development and community services at appropriate densities for the positioning of the centre in the Settlement Hierarchy and with an emphasis on quality of design.

Tourism Related Development

These lands seek to provide for developments linked to tourism including all types of accommodation - guesthouses, hotels, hostels, holiday homes, etc, along with restaurants, pubs and other tourism related offerings.

The zoning objective is as follows:

To provide for and improve tourist amenities in the county.

Social and Community

In addition to identifying lands to safeguard their future provisions, these lands also contain existing community and social facilities such as community buildings, schools, hospitals and health centres, places of worship, football pitches and other generic or specific civic, social and community uses where the objective of the Planning Authority will be to protect such uses.

The zoning objective is as follows:

To protect and provide for community, social, recreational and educational services and facilities.

Utilities

This zoning primarily provides for and preserves land in the ownership of the Council or other bodies charged with the provision of services such as electricity, telecommunications, water, wastewater etc. to individual towns and villages

The zoning objective is as follows:

To provide land for public infrastructure and public utilities

Constrained Land Use

The Land Use Zoning Objectives Maps for each settlement have excluded uses vulnerable to the effects of flooding on undeveloped areas identified as being at an elevated risk of flooding. The 'Constrained Land Use' designation extends to existing developed lands in a number of settlements which could include lands in the centre of towns and villages

The zoning objective is as follows:

To ensure the appropriate management and sustainable use of flood risk areas designated as 'Constrained Land Use' on Settlement Plans.

Open Space and Amenity

The use of land shall include the provision of land for parks, public woodland, pedestrian routes and greenways, riparian zones, development incidental to the enjoyment of open space (including playgrounds, outdoor recreation centres and sports centres, civic/market square, village greens, landscaped areas, shelters, sanitary conveniences, play equipment, dressing rooms and similar facilities). It also provides for the use of such land or such facilities for games, educational and recreational purposes. High standards of accessibility are essential. The Council will not normally permit development that would result in a loss of existing open space.

The zoning objective is as follows:

To preserve, provide for and improve active and passive recreational public and private open space.

Carrick-on-Shannon Local Area Plan 2010

A range of land uses are listed in the Plan's land use matrix in Table 2.4 together with an indication of their broad acceptability in the different land use zones. The following overall policy objective applies.

- **Policy 2.2a** It is the policy of the Council to seek the development of land in accordance with the Land Use Zoning Matrix set out in Table 2.1.

The following land use zoning objectives are set out in the Local Area Plan for the settlement of Carrick-on-Shannon.

Primarily Residential

Table 2.2 of the Plan sets out the extent of lands zoned of primarily residential development, including areas for low density residential development. These are listed in Table 4.3.1.

Table 4.3.1 Capacity of Vacant Residential Lands

	Vacant Lands		**Total in Phase 1 & Phase 2**
	Phase 1	**Phase 2**	
Residential Land	21.56 ha	44.3 ha	65.86 ha
Residential Land – Low Density	2.13 ha 3	3.51 ha	5.64 ha
Total Ha	23.69 ha	47.81 ha	71.5 ha
Total Housing Capacity	453	921	1,374
Total Population Capacity	1,137	2,312	3,449

The following policy objective applies:

- **Objective 2.3c** It is an objective of the Council to seek the development of lands zoned 'Primarily Residential' for residential and associated uses. Open space and recreational facilities must be provided in association with residential development in accordance with the standards set out in Section Three of this Plan.

Social and Community

This zone includes community buildings, churches, hospitals, health centres, football pitches, municipal treatment plants etc.

The following policy objective applies:

- **Objective 2.3g** It is an objective of the Council to seek the development of lands zoned 'Social & Community Use' for educational, sport and health related uses. The redevelopment of these lands for residential or commercial use will be considered by the Council where it is satisfied that the overall provision of educational and health services to the town would be improved by such a development. Uses indicated as being 'open for consideration' in the zoning matrix below will only be so considered in that context.

General Development

It is advised that the land uses associated with this designation in the context of the Carrick-on-Shannon Local Area Plan are not the same as those applicable in the context of the County Development Plan. As the function of 'General Development' is different in both Plans, the County Development Plan takes precedence in this instance.

In determining the suitability of development within this zone, regard is given to the environmental impact of the alternatives and options on neighbouring uses. The following policy objective applies:

- **Objective 2.3d** It is an objective of the Council to seek the development of lands zoned 'General Development' for commercial, retail, light industrial, educational, health, community and related uses.

Enterprise and Employment

The plan clusters heavy traffic generating activities related to enterprise and employment uses at the edge of the town, where there is good access onto the national road network and minimal impacts on residential areas.

The following policy objective applies.

- **Objective 2.3b** It is an objective of the Council to seek the development of lands zoned 'Enterprise & Employment' for industrial and employment generating uses.

Riverside Development

This zoning relates to leisure, amenity and tourism related uses associated with the River Shannon. The following policy objective applies.

- **Objective 2.3f** It is an objective of the Council to seek the development of lands zoned 'Riverside Development' for leisure, amenity and tourism related uses associated with the River Shannon.

Mixed Use

Zones designated as 'Mixed Use' have been identified in the core of the town centre, within which a mix of residential and commercial activity takes place. The following policy objective applies.

- **Objective 2.3a** It is an objective of the Council to seek the development of lands zoned 'Mixed Use' for commercial, cultural, residential, retail and related uses.

Open Space and Amenity

This zone includes public walkways, parks and open space. The following policy objective applies.

- **Objective 2.3e** It is an objective of the Council to seek the development of lands zoned 'Open Space & Amenity' for recreational and amenity uses.

River Navigation & Amenity

This zoning seeks to protect lands and water bodies for navigation and the conservation of riverine habitats.

The following policy objective applies.

- **Objective 2.3h** It is an objective of the Council to seek the protection of lands and water bodies zoned 'River Navigation & Amenity' for navigation and the conservation of riverine habitats. Development impacting on lands and water bodies zoned 'River Navigation & Amenity' will only be acceptable if they enhance the amenity value of the river, do not unduly impact on habitats or impede river navigation.

Cortober Local Area Plan 2014-2021

The following land use zoning objectives are set out for the urban area of Cortober:

Leisure and Amenity

3.4ha of land is zoned for Leisure and Amenity uses under the Plan. The overriding objective of this zoning is to provide for new leisure and amenity facilities such as bowling, swimming pool and hotel/gym/leisure facilities as well as cinema, theatre and associated retail facilities. Rivers and lakes may be included in this use.

Leisure Tourism

0.4ha of land is zoned for Leisure Tourism uses under the Plan. The overriding objective of this zoning is to consider developments for leisure and recreational based activities including water-based activities as well as appropriately scaled coffee shops, hotel, restaurant(s) and public house(s), etc.

Greenbelt

11.9ha of land is zoned for Greenbelt under the Plan. The overriding objective of this zoning is to protect the setting, character, and environmental quality of areas of high natural beauty and safeguard their environmental, archaeological and ecological amenities.

New Residential

3.46ha of lands are zoned for new residential development under the Plan. The overriding objective of this zoning is to provide for new residential development, including a mix of residential options, as well as appropriate local services and community facilities such as recreation, education, creche/playschool, community buildings, sheltered housing, and corner shops.

Community and Educational Facilities

0.3ha of lands are zoned for Community and Educational Facilities under the Plan. The overriding objective of this zoning is to provide for health, welfare, community, education, and institutional uses including schools, childcare, community meeting areas, churches, hospitals etc. in close proximity to existing and planned residential communities as well as the other ancillary services such as public services and recycling facilities.

Neighbourhood Centre

11.7ha of lands are zoned for neighbourhood centre uses under the Plan. The overriding objective of this zoning is to provide for the development of a mix of residential, commercial/retail uses including comparison shops and community facilities around a public/focal space, where appropriate, with associated facilities, within walking distance from the existing town centre, where practicable, which will serve the needs of a new/existing residential area.

Existing Residential

27.6ha of lands are zoned for existing residential uses under the Plan. The overriding objective of this zoning is to protect and enhance the residential amenities of existing and new residential communities and provide a high level of services within walking distances of residential developments.

Industrial Uses

8.5ha of land is zoned for industrial uses under the Plan. The overriding objective of this zoning is to reserve lands for the provision of heavy industry, incinerators and thermal treatment and employment related uses.

Public Utilities, Services and Facilities

6.1ha of lands are zoned for public utilities under the Plan. The overriding objective of this zoning is to provide for and improve public utilities such as electricity, telecommunications, water, wastewater, gas etc to ensure the long-term sustainability of these services and to meet wider regional and national objectives.

Local Centre

0.1ha of lands are zoned for Local Centre uses under the Plan. The overriding objective of this zoning is to protect, provide for and/or improve local centre facilities.

4.3.3.2 Proposed and Planned Developments

All applications submitted to Leitrim and Roscommon County Councils are recorded on their online planning registers.

Information recorded includes details of the type of development proposed, the name of the applicant and the status of the application, i.e., if the permission has been refused or granted and any conditions which may be attached.

A review of planning applications lodged within the study area has been carried out. This includes new planning applications, as well as those granted within the past five years, having regard to the five-year validity of planning applications except for wind farms which often have a validity of 10 years.

All planning applications which have been granted permission are constraints and are shown on Figures 4.3.2.0 to 4.3.2.5.

4.3.3.3 Visual Amenity and Scenic Views

A large area of land adjacent the River Shannon corridor is identified as a 'High Visual Amenity Area' in the Leitrim County Development Plan, 2015-2021.

This is shown on Figures 4.3.1.0 to 4.3.1.5.

Policy objectives in relation to this are set out in Section 4.8.7 of the Plan, where it is stated:

Areas of Outstanding Natural Beauty and High Visual Amenity are identified on Map 4.12. The Council will preserve and enhance these areas, as far as is practicable, by careful management and by the operation of special controls over development in these areas.

The following policy objective applies:

- **Policy 101** It is the policy of the Council to permit development in an area of High Visual Amenity only where the applicant has demonstrated a very high standard of site selection, site layout and design and where the planning authority is satisfied that the development could not be accommodated in a less-sensitive location.

Protected Views and Prospects identified in the Leitrim County Development Plan are shown on the Landscape and Visual Constraints Figures 4.11.1.0 to 4.11.1.5 and listed as follows:

Leitrim:

- **V25:** View of River Shannon from the N4 Faulties to Aughamore
- **V27:** View of River Shannon from Local Road LS07426
- **V28:** View of River Shannon from the N4 in the townlands of Minkill and Tully

Scenic Routes and Views as identified in the Landscape Character Assessment (LCA) which accompanies the Roscommon County Development Plan, 2022-2028 are shown on the Landscape and Visual Constraints Figures 4.11.1.0 to 4.11.1.5 and listed as follows:

Roscommon (LCA):

- V8: View from Hartly Bridge to north to Slieve Anierin, Eidin Lake to the south and windfarm on Kilronan Mountain to the north west. Low undulating sparsely populated landscape in the foreground.

The following policy objectives applies:

- **NH 10.25:** Minimise visual impacts on areas categorised within the County Roscommon Landscape Character Assessment including "moderate value"," high value", "very high value" and with special emphasis on areas classified as "exceptional value" and where deemed necessary, require the use of Visual Impact Assessment where proposed development may have significant effect on such designated areas.
- **NH 10.26:** Protect important views and prospects in the rural landscape and visual linkage between established landmarks, landscape features and views in urban areas.
- **NH 10.26:** To co-ordinate with all adjoining Local Authorities in reviewing Landscape Character Assessments (LCAs) to ensure consistency in classification and policy in adjoining areas of similar character. A targeted review of the LCA shall be undertaken following the completion of the National Landscape Character Assessment, and any associated statutory Guidelines as well as the Regional Landscape Character Assessment to be completed by the Regional Assembly.

The Draft Leitrim County Development Plan sets out a series of similar policies and objectives in relation to important views and prospects in the county. The potential for impact on these views is considered during the option selection process. Large areas of land adjacent to the River Shannon corridor are identified as Areas of High Visual Amenity (AHVA) (Ref. B11 River Shannon and Lakes) in the Leitrim County Development Plan, 2023-2029.

Policy objectives in relation to this are set out in Section 11.15.2 of the Plan, where it is stated:

> *A landscape is designated as high visual amenity due to a range of factors including natural, cultural and man-made influences. Table 11.7 identifies the Areas of High Visual Amenity in Co. Leitrim.*

In section 11.15.3 it is stated:

> *The Council will seek to preserve and enhance the landscape character of Areas of and Areas of High Visual Amenity, as far as is practicable, by careful management and by the operation of special controls over development in these areas.*

The following policy objectives have relevance:

> ***LD POL 2*** *To protect Areas of Outstanding Beauty and Areas of High Visual Amenity from inappropriate development and reinforce their character, distinctiveness and sense of place.*
>
> ***LD POL 3*** *To permit development in an Area of High Visual Amenity only where the applicant has demonstrated a very high standard of site selection,*

site layout and design and where the Planning Authority is satisfied that the development could not be accommodated in a less-sensitive location.

LD POL 4 *To require that a landscape and visual impact assessment, prepared by a suitably qualified professional, be submitted with planning applications for development which may have an impact on the landscape character of the area.*

LD POL 5 *To ensure that development proposals have regard to the Landscape Character Assessment, the value of the landscape, its character, importance, sensitivity and capacity to absorb change.*

LD OBJ 4 *To protect Areas of Outstanding Natural Beauty and Areas of High Visual Amenity from inappropriate forms of development. These areas are identified in Table 11.6 and Table 11.7 of this Plan and shown graphically on Map No. 11 'Proposed Landscape Designations' in Volume III (Book of Maps).*

4.3.4 Summary

The zoning objectives and relevant specific objectives set out in the Leitrim County Development Plan 2015-2021, the Roscommon County Development Plan, 2022-2028, the Carrick-on-Shannon Local Area Plan, 2010 and the Cortober Area Plan, 2014-2020 present constraints which will be considered in the development of alternatives and options.

The project should seek to ensure that the public amenity value of the study area is not diminished. Impacts on public amenity areas adjacent to the River Shannon and its associated lakes will be considered during the option selection process.

In addition, tourist facilities and areas along the River Shannon should be considered and impacts minimised where possible.

Areas of high visual amenity along the River Shannon corridor and those views identified and protected in both the Leitrim and Roscommon County Development Plans should be taken into consideration in the option selection process.

4.4 Population and Human Health

Introduction

This section describes the population constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with Figures 4.4.1.0 to 4.4.1.5.

Population is a broad ranging topic which *"covers the existence, activities and health of people, usually considering people as groups or 'populations'"* (EPA 2015)[19].

The objective of this constraint study is to identify activities and locations of social or economic importance that could present constraints to the development of alternatives and options. These constraints are considered from the perspective of potential impacts that could arise from the proposed alternatives or options on journey patterns, journey amenity, general amenity, community severance, business, tourism and employment. Constraints which are relevant to "Population" include natural amenity, built and natural heritage, ecosystem services, material assets and nuisance and may be assessed in the first instance in in the following sections:

- Section 4.3 - Land Use and Planning
- Section 4.5 - Material Assets Non-Agriculture (which contains details of residential properties and, by association, constraints in terms of individual dwellings)
- Section 4.6 - Material Assets – Agriculture
- Section 4.7 - Air Quality
- Section 4.9 - Noise and Vibration

  Section 4.10 - Archaeological, Architectural and Cultural Heritage
- Section 4.11 - Landscape and Visual
- Section 4.12 - Biodiversity
- Section 4.13 - Hydrology
- Section 4.14 - Hydrogeology
- Section 4.15 - Soils and Geology

Human health impacts are primarily considered through an assessment of the environmental pathways by which health can be affected such as air, noise, water or soil. Therefore, the human health constraints relate to the constraints identified for Air Quality (Section 4.7); Noise and Vibration (Section 4.9); Hydrology (Section 4.13); Hydrogeology (Section 4.14); and Soils and Geology (Section 4.15).

[19] Extracted from the Advice Notes for Preparing Environmental Impact Statements (EPA draft September 2015)

Section 4.4.1 describes the methodologies and sources of information that were used to carry out the study. Section 4.4.2 describes the socio-economic constraints relating to human beings within the existing environment of the study area. A summary is presented in Section 4.4.4.

4.4.1 Methodology and Sources of Information

4.4.1.1 Legislation and Guidelines

The constraints study has been prepared in accordance with the following guidelines:

- Environmental Protection Agency (EPA): Guidelines on the Information to be contained in Environmental Impact Statements, 2002 [20], and the Revised Guidelines (Draft, August 2017)[21]
- Environmental Protection Agency (EPA): Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) 2003[22], and the revised Advice Notes for Preparing Environmental Impact Statements (Draft, September 2015)[23]
- National Roads Authority: Environmental Impact Assessment of National Road Schemes - A Practical Guide (Revision 1, November 2008)[24]

4.4.1.2 Methodology and Identification of Data Sources

An assessment of Population requires an understanding of the community. This is built up through background research, site visits, and conversations with local people and community representatives. The data to inform the constraints study was collected by means of:

- Primary data sources (e.g. demographic data from Census 2016 and Census 2011 produced by the Central Statistics Office)

[20] EPA, 2002. Environmental Protection Agency Guidelines on the Information to be contained in Environmental Impact Statements, 2002. Available at: http://www.epa.ie/pubs/advice/ea/guidelines/EPA_Guidelines_EIS_2002.pdf
[21] EPA, 2017. Environmental Protection Agency Revised Guidelines on the information to be contained in Environmental Impact Assessment Reports (Draft, August 2017). Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf
[22] EPA, 2003. Environmental Protection Agency Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) 2003. Available at: http://www.epa.ie/pubs/advice/ea/guidelines/EPA_advice_on_EIS_2003.pdf
[23] EPA, 2015. Environmental Protection Agency the Revised Advice Notes for Preparing Environmental Impact Statements (Draft, September 2015). Available at: https://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/Draft%20Advice%20Notes%20for%20preparing%20an%20EIS.pdf
[24] NRA, 2008. National Roads Authority Environmental Impact Assessment of National Roads Schemes – A Practical Guide, Revision 1, November 2008. Available at: https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf

- Maps of the study area, including Ordnance Survey Ireland (OSi) 1:50,000 maps 50 (5th Edition, 2017)[25] and 56 (4th Edition 2018)[26]
- Spatial data, including Google Maps and Google Streetview, Open Street Map, Department of Education school maps, and church and parish location maps, supplemented by site visits
- Relevant environmental data collected by other disciplines during their studies
- A review of relevant planning document including the Leitrim County Development Plan (2015-2021)[13] , Draft Leitrim County Development Plan 2023-2029[17], the Roscommon County Development Plan (2014-2020)[14], Roscommon County Development Plan 2022-2028[18], the prevailing Carrick-on-Shannon Local Area Plan (2010-2019)[15] and the Cortober Area Plan (2015)[16]
- A review of secondary sources including the National Planning Framework (GOI 2018a)[27] and the National Development Plan (GOI 2018b)[28], the Regional Spatial and Economic Strategy 2020-2032 (NWRA-RSES) (GOI 2018c)[29]
- A review of previous road EIAs, including of the Environmental Impact Assessment Report for the N4 Dromod-Roosky Bypass (2004) and Information provided by Leitrim County Council on surveys to inform a previous road scheme through the study area in the early 2010s
- Observation of local settlement and travel patterns and identification of community facilities
- Public consultations undertaken by the project team and submission received in respect of these consultations
- Websites identifying local walks and trails, angling rivers and lakes[30]

The constraints study involves the identification of settlement nodes, public transport routes and community facilities, including:

- Existing communities of more concentrated housing and development
- Pre-schools, schools and colleges
- Medical centres, nursing or residential care homes

[25] Ordnance Survey Discovery Series Map No. 50 Dublin, Kildare, Meath, Wicklow. 2017 (5th Edition) Map Scale 1:50,000
[26] Ordnance Survey Discovery Series Map No. no. 56 Wicklow, Dublin, Kildare. 2018 (4th Edition) Map Scale 1:50,000
[27] Government of Ireland, 2018a. Project Ireland 2040 Notional Planning Framework. Available From https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf
[28] Government of Ireland, 2018b. Project Ireland 2040 National Development Plan 2018-2027. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null
[29] The Northern and Western Regional Assembly, 2020. Regional Spatial and Economic Strategy 2020-2032 (RSES). Available at: https://www.nwra.ie/rses/
[30]Available at: https://leitrimtourism.com/things-to-do/walks-and-trails/, https://fishinginireland.info/coarse/shannon/carrickonshannon/, https://www.bluewaysireland.org/trails., https://www.bikemap.net/en/r/7118798/#10.84/53.9559/-8.0682.

- Churches or other places of worship and cemeteries
- Sports pitches and facilities
- Areas, foot and cycle paths used for amenity and recreation
- Rivers and lakes used for angling or other outdoor activity
- Retail outlets
- Pubs and restaurants
- Hotels and other accommodation
- Workplaces likely to include more than five employees

Constraints are listed as being of *slight* significance, *moderate* significance, *significant* or *profound*. This assessment is preliminary and relates to the community importance of the constraint, the degree to which alternatives or options could have a significant impact on public use of a community facility, or the potential for the constraint to absorb an impact or itself be moved to a new location. For businesses, the assessment is based mainly on a judgement as to the importance of the business for employment or local services.

The socio-economic constraints associated with transport projects fall into five key categories, namely:

- Journey characteristics, accessibility and connectivity, i.e. potential impacts on journey time, journey time reliability and travel patterns
- Journey amenity, i.e. factors that could affect the perceived or actual safety and the pleasantness of a journey due to proximity to traffic or exposure to e.g., noise, dirt, visual intrusion and air quality)
- Community severance with regard to the use of community facilities, particularly those used by older people, children or other vulnerable groups
- General Amenity, i.e. impacts on individual and community well-being due, for example, to people's exposure to the environmental impacts of traffic (e.g. safety, noise, dirt, visual intrusion and air quality)
- Impacts that could affect economic growth prospects and employment

Impacts can be positive or negative. Their significance depends, among other considerations, on the nature of the environment affected, the duration of an impact and the probability of its occurrence. It often follows that impacts of a socio-economic nature are a function of:

a) The scale of the impact itself

b) The numbers of people likely to be affected

c) The impact on vulnerable or sensitive groups

4.4.2 Existing Environment

The following section describes the existing environment as regards human beings, specifically the demographic character of the study area, its economy, its amenities and community facilities.

4.4.2.1 General

Carrick-on-Shannon is the county town and so contains the principal administrative offices for Leitrim County Council as well as the key community facilities to be expected of the principal population centre such as The Dock arts centre, a library, medical centre, primary and secondary schools, churches, parks, and sports facilities (including the county GAA ground) as well as a range of retail shops and restaurants, including those included in the Carrick Shopping Centre & Retail Park. Carrick-on-Shannon is the important centre for employment locally, although some businesses are located on its outskirts, for example the large Masonite Factory. Carrick-on-Shannon is also a tourist centre and popular for weekend visits, with three hotels as well as numerous guest houses. Cruising on the River Shannon is a popular activity and two cruise hire companies are located in the town along with public moorings and three marinas for private craft. There is an amenity park with seating & access to the river for small boats from near the pedestrian bridge in Cortober along with a landscaped riverside park on the Carrick-on-Shannon side.

The Roscommon/Leitrim County boundary follows the River Shannon with the community of Cortober on the west bank falling within County Roscommon. A second retail centre is located just off the N4 in the village of Cortober, including a supermarket and cinema, while a commercial business park is located a little further west along the N4 on the edge of the village. Cortober also contains a sports ground and the local railway station for the Dublin to Sligo railway line.

The study area also contains the villages of Jamestown, Drumsna, and Aghamore. The nineteenth century author Anthony Trollope once lived in the village of Drumsna and a heritage trail follows the lanes around Lough Aduff through Fargrim, Annaduff Glebe, Drumsna and Drumcleavery. Jamestown is a small historic plantation town possessing the remains of the town wall, a friary, and a scenic weir. Parts of an earlier Iron Age earthen embankment, the Doon, are visible between Jamestown and Drumsna and along the river.

Amongst the most significant constraints in the study area are the River Shannon (with an associated Blueway on parts of it), which is of considerable importance given its importance for amenity and tourism including activities such as cruising, kayaking, and angling. Carrick-on-Shannon itself, and Cortober, are located alongside the river and benefit considerably from the landscape and amenity value it provides. The river is not navigable by boats between Drumsna and Jamestown Weir (although this section is popular for kayaking). The Jamestown Canal carries boat traffic for 2km between these locations. The Albert Marina moorings are on a parallel stretch of canal.

The River Shannon winds through the study area and is the principal amenity. The river is joined by the River Boyle just to the north of the study area. Both rivers widen into small and larger loughs along their course. The River Shannon from just downstream of Drumshanbo is designated as Blueway for boating and kayaking. A navigation canal has been cut in the centre of the study area separating off the loop of the river and the weir between Jamestown and Drumsna. The parallel cut provides a private marina for boats. Another linear amenity is a lightly used spur of the Southern Loop of the Kingfisher Cycle Trail through Counties Leitrim and

Cavan which follows Castlecara Road and Elysian Meadows into Carrick-on-Shannon. This local circuit also forms a Sli-na-Slainte walking route.

The Dublin to Sligo railway line is another constraint which passes through the middle of the study area crossing the River Shannon above Lough Tap near to the large Masonite Factory.

Land use is principally given over to beef cattle with some dairy on the better land. There are areas of commercial forestry, scrub, peat bog (including some turbary - a place where turf or peat is dug or cut under the right of turbary) and riparian grazing meadow subject to regular flooding and of low agricultural productivity. There are numerous single house developments throughout the study area given the proximity to the town of Carrick-on-Shannon and the existing N4.

4.4.2.2 Population

Table 4.4.1 shows that the populations of the four counties in the region have shown small increases between 2011 and 2016 with that for County Longford having increased most, albeit by a modest 4.8%, continuing a trend of expansion for towns within a perceived commuting distance of Dublin. Table 4.4.2 shows that the populations of Carrick-on-Shannon, and of the main towns and settlements in its vicinity, have experienced a mixture of increases and decreases with the largest increases recorded for Leitrim Village and Dromod; relatively affluent communities where new housing estates have been built in recent years. However, given that there is a large amount of single house development outside of these main settlements, the data should be interpreted together with the population change experienced in the local Electoral Division (ED). A new Census was undertaken in 2022, with full analysis expected in 2023.

Table 4.4.1 Population - Counties

County	Population 2016	Population 2011	Per cent change
County Leitrim	32044	31798	0.8%
County Roscommon	64544	64065	0.7%
County Sligo	65535	65393	0.2%
County Longford	40873	39000	4.8%

Table 4.4.2 Population - Main Settlements

Settlement	Population 2016	Population 2011	Per cent change
Carrick-on-Shannon	4062	3980	2.1%
Boyle	2568	2588	-0.8%
Leitrim	594	485	22.5%
Drumshanbo	902	857	5.3%
Cootehall	184	N/A	-
Drumsna	240	247	-2.8%
Drumod (Dromod)	555	432	28.5%
Mohill	855	928	-7.9%

Settlement	Population 2016	Population 2011	Per cent change
Roosky	564	523	7.8%
Elphin	565	613	-7.8%
Longford	10008	9601	4.2%

Table 4.4.3 presents the population figures for those EDs which fall mostly within the study area along with those of the EDs just outside the study area. For the most part, the rural EDs in the study area have shown small reductions in population, but for a small increase in the ED for Carrick-on-Shannon and a larger increase of 12% for Drumod (containing the village of Dromod). A similar pattern is revealed for EDs just outside the study area, although, in line with the data for settlements, larger increases were recorded for Leitrim ED, Croghan, Killummod (from a small base) and, especially, Oakport, an ED which traverses the River Boyle in a scenic area to the north of Carrick-on-Shannon.

Table 4.4.3 Population Electoral Divisions (ED)

Electoral Division	Population 2016	Population 2011	Per cent change	Population density (km^2)
EDs mostly in the study area				
Carrick-on-Shannon	4080	3986	2.4%	168.2
Killukin (Co Roscommon)	274	286	-4.2%	21.9
Danesfort (Co Roscommon)	827	865	-4.4%	62.3
Aughrim East (Co Roscommon)	222	227	-2.2%	10.8
Cloonteen (Co Roscommon)	274	291	-5.8%	15.1
Drumsna (Co Leitrim)	685	701	-2.3%	31.5
Annaduff (Co Leitrim)	225	221	1.8%	18.8
Drumod (Co Leitrim)	869	776	12.0%	39.2
EDs outside or partly in study area				
Gowel (Co Leitrim)	325	333	-2.4%	24.1
Leitrim	1224	1123	9.0%	53.4
Tumna North (Co Roscommon)	166	178	-6.7%	11.9
Tumna South (Co Roscommon)	191	204	-6.4%	11.4
Oakport (Co Roscommon)	413	319	29.5%	26.9
Rockingham (Co Roscommon)	337	345	-2.3%	10.9
Croghan (Co Roscommon)	379	359	5.6%	15.8
Killummod (Co Roscommon)	120	107	12.1%	9.9
Aughrim West (Co Roscommon)	172	188	-8.5%	9.3
Kilmore (Co Roscommon)	178	184	-3.3%	9.3
Drumdoo (Co Leitrim)	303	299	1.3%	19.5
Bunnybeg (Co Leitrim)	153	169	-9.5%	11.7

Table 4.4.4 lists levels of absolute and relative social and economic disadvantage by ED as identified by the Pobal HP Deprivation Index (Haase & Pratschke, 2017)[31]. The absolute deprivation index is based on criteria of age dependency, population change, education, household occupancy, employment and social class, and has a mean of zero which is influenced by economic conditions for the country as a whole at that time. Relative disadvantage in an index relative to average levels across the country for the census period. This data is relevant to Accessibility and Social Inclusion assessment given that improved transport links can potentially reduce isolation and improve access to employment. The data for 2016 shows an improvement on the situation during the depth of the last recession in 2011, although only slightly for many EDs, including Carrick-on-Shannon. In terms of the relative level of affluence or deprivation nationally, Oakport performs best followed by Aughrim East within the study area (highlighted pink), while the highest level of social deprivation (highlighted brown) is recorded for the most rural EDs to the south and southwest of the study area in both counties Leitrim and Roscommon. Within Carrick-on-Shannon, estates with higher levels of social disadvantage are found in the north central and southeast.

Table 4.4.4 Population – Pobal HP Deprivation Index (by ED)

Electoral Division	2016 Absolute	2011 Absolute	2016 Relative
EDs mostly in the study area			
Carrick-on-Shannon	-6.6	-6.0	-2.2
Killukin (Co Roscommon)	-0.4	-1.1	3.2
Danesfort (Co Roscommon)	-1.1	-4.5	2.8
Aughrim East (Co Roscommon)	1.6	-4.7	4.9
Cloonteen (Co Roscommon)	-3.5	-4.6	.2
Drumsna (Co Leitrim)	-6.1	-7.9	-2.4
Annaduff (Co Leitrim)	-2.8	-3.4	1.1
Drumod (Co Leitrim)	-1.9	-5.3	2.1
EDs outside or partly in study area			
Gowel (Co Leitrim)	-3.1	-8.8	.7
Leitrim	0.7	-3.7	4.5
Tumna North (Co Roscommon)	-7.3	-12.2	-3.3
Tumna South (Co Roscommon)	-5.5	-9.3	-2.1
Oakport (Co Roscommon)	3.4	-1.5	8.3
Rockingham (Co Roscommon)	-0.9	-1.6	2.8
Croghan (Co Roscommon)	-2.7	-2.3	.9
Killummod (Co Roscommon)	-1.6	-2.2	2.1
Aughrim West (Co Roscommon)	-3.9	-5.9	-.5
Kilmore (Co Roscommon)	-3.9	-9.8	-.8

[31] Haase & Pratschke, 2017. Pobal HP Deprivation Index. Available at: https://data.gov.ie/dataset/pobal-hp-deprivation-index

Electoral Division	2016 Absolute	2011 Absolute	2016 Relative
Drumdoo (Co Leitrim)	-8.9	-12.5	-5.6
Bunnybeg (Co Leitrim)	-10.2	-10.4	-6.8

4.4.2.3 Economy

Carrick-on-Shannon is the county town and, as such contains Leitrim County Council offices and the Leitrim County Enterprise Board as well as public facilities such as The Dock arts centre, Courthouse, Carrick-on-Shannon Garda Station, facilities for employment training and professional development, a fire station, library, primary and secondary schools. The town is a centre of employment with a range of businesses and services. Tourism is an important local industry supporting hotels, guest houses, restaurants, bars and specialist shops. The main street contains a range of shops in addition to four main retail centres in Carrick-on-Shannon and Cortober. Business and industrial estates are located off Castlecara Road, the N4 in Carrick-on-Shannon and the N4 in Cortober.

4.4.2.4 Community facilities

Carrick-on-Shannon has primary schools on Dublin Road (Scoil Mhuire) and on Castlecara Road (Gaelscoil Liatroma) on the edge of the town, as well as a Carrick-on-Shannon Community School on Glen Carrick in Summerhill and St Mary's Boy's School in Townparks. Medical facilities include St. Patrick's Community Hospital, a medical centre and retirement homes. Pairc Sean MacDiarmada is the county GAA stadium and there are other sports facilities for Gaelic and soccer in both Carrick-on-Shannon and Cortober. Churches are located on the Main Street in Carrick-on-Shannon and in Cortober. The town has a cineplex in Cortober beside the N4, a swimming pool and indoor sports centre. There are two riverside parks, a small one in Cortober south of the River Shannon Bridge and a second larger landscaped park along the River Shannon on the Carrick-on-Shannon side of the river which includes a walkway that is popular with both locals and visitors. There is a connecting park on the opposite side of the Dublin Road.

4.4.2.5 Transport

The N4 passes through Carrick-on-Shannon and Cortober connected by a single bridge which is accompanied by a joined pedestrian bridge. The R280 to Leitrim Village and Drumshambro commences at Main Street in Carrick-on-Shannon. The R368 to Elphin leaves from a roundabout with the N4 in Cortober and connects with the R370 to Croghan and Frenchpark. The Sligo to Dublin railway line is important for regional connectivity and development, with the station being located on the western edge of Cortober.

4.4.3 Residential development

There is much linear residential development on the edge of Carrick-on-Shannon, particularly to the northeast, representing the community of Hartley, and along the R280 Leitrim Road and Castlecara Road on the edge of the town. In Cortober, linear

development extends 500m from the railway station along the R368 and there are residential estates 500m from the station along the R370.

4.4.4 Summary

The principal community facilities, public facilities, businesses and employers, along with the greatest concentration of these facilities, are to be found in Carrick-on-Shannon and Cortober. Various of these facilities are, though, to be found on the outskirts of these communities, including sports facilities, retail estates and the gaelscoil in Carrick-on-Shannon and business estates, sports fields and the station in Cortober. Residential development extends outwards as ribbon development along secondary roads in both communities. The River Shannon threads through the study area and is the focus of much amenity and tourist activity as well as providing for the community's essential sense of place. There are guest houses and B&Bs close to the river and the N4. There are also moorings and marinas along the river, for example at Jamestown.

Several community facilities are located in the wider study area, including churches at Annaduff, Dangan and Kilmore, GAA sports facilities at Annaduff and a school at Annaduff. There is also a mixture of large and small businesses throughout the study area, of which the former includes the Masonite Factory at Annaduff and Rosderra Meats in Jamestown.

A summary of the social and economic constraints is included in Table 4.4.5 below and are shown on Figures 4.4.1.0 to 4.4.1.5.

Table 4.4.5 Social and Economic Constraints in the Study Area

Constraint	Significance
Jamestown	
Historic town walls, friary ruins, Mulvey's Arch Bar / shop, Cottage Restaurant, River Edge B&B, scenic weir, public moorings.	
Drumsna	
Church, Taylor's Bar, McLoughlins Bar, Thomas Duignan Bar, two grocery shops, garden centre, small museum, community resource centre, public moorings, riverside walk, Trollope heritage trail.	
Aghamore (Annaduff)	
St. Mary's Church, Annaduff National School, Leitrim GAA Centre of Excellence, Annaduff GAA, Lakelands B&B	
Carrick-on-Shannon, Cortober and Peripheral Area	
Tourism and amenity	
River Shannon & Blueway	Significant (Profound in places)
Kingfisher Cycle Trail spur	Significant
Trollope Heritage Trail	Significant
Springfield Lodge B&B	Slight
Angler's Rest Guest House	Slight
Ballinaboy Lodge B&B	Slight

Constraint	Significance
Clenahoo Guest House	Slight
Hartley House B&B	Slight
Hartley Lodge B&B	Slight
Carrick Camping	Slight
River Edge B&B	Slight
Public moorings Jamestown	Slight
Public moorings Albert Canal	Moderate
Albert Canal, Lock & Marina	Profound
Amenity (sports / other)	
Bullfield pitch, Cortober	Significant
Pairc Seán Mac Diarmuida	Significant
Carrick RFC	Significant
Cartown night club	Moderate
Albert Canal moorings	Significant
Moorings Jamestown	Moderate
Moorings Drumsna	Significant
Gortconnellan Lough	Moderate
Lowfield Lough	Slight
Religious	
St. Ann's Church of Ireland	Profound
St Mary's Cemetery	Profound
Kilmore Church (within 500m)	Profound
St. Bridgid's Church, Dangan	Profound
Educational	
Dangan NS	Significant
Businesses / employment	
King & Moffatt	Significant
Knight Logistics / Wes-Chem	Closed
Wholesale Furniture	Moderate
CD Carrick Commercials	Significant
McLoughlin Transport	Significant
Westgate Business Park	Significant
Gannon & Sons Chickens	Moderate
Cartown night club	Moderate

Constraint	Significance
Drino Drinks Limited	Moderate
Commercial estate (Noone Carpets, Luxury Permanent Makeup, Gannon Poultry)	Significant
Connaught Gold	Significant
Durkin Concrete	Moderate
AC Direct (used cars)	Slight
Archway Products (road construction)	Slight
Rosderra Irish Meats	Significant
Masonite Doors & Windows	Profound
McDonaghs Feeds	Moderate
Tony Gill Agri. / Hanly's Garage	Moderate

4.5 Material Assets Non-Agriculture

4.5.1 Introduction

This section describes the non-agricultural material asset constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with Figures 4.5.1.0 to 4.5.3.5.

Material assets – non-agriculture includes amenities, residential properties, commercial properties, industrial properties, utilities and services and waste facilities.

Section 4.5.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.5.3 describes the material assets non-agricultural constraints within the study area. A summary is presented in Section 4.5.4.

4.5.2 Methodology and Sources of Information

The aim of this assessment is to first identify the non-agricultural material assets within the study area and to then assess these assets to distinguish if they are constraints.

The assessment methodology comprises a desktop study, site visits and information gathered through consultation with statutory organisations and service providers. The desktop study consists of an analysis of information contained within land registry records, statutory records, orthophotography and both Leitrim County and Roscommon County planning records. Table 4.5.1 contains a list of the information gathered and their sources.

Table 4.5.1 Material Assets Non-Agriculture Sources of Information

Information Type	Data Sources
Land ownership and land use details	• Property Registration Authority (Land Registry)[32] • Orthophotography[33]
Locations of properties	• Orthophotography[33] • Site visits along the existing N4 to identify non-agricultural properties
Planning Applications	• Leitrim County Council Planning database[34] • Roscommon County Council Planning database[35]

[32] Property Registration Authority, 2020. Land Registry: Available at: https://www.landdirect.ie/
[33] Google Maps. Available at: https://www.google.ie/maps
[34] Leitrim County Council, 2020. Map Based Planning Enquiry: Available at: https://leitrimcoco.maps.arcgis.com/apps/webappviewer/index.html?id=8645fc340c8d457b99ce71ce20bd79f1
[35] Roscommon County Council, 2020. Map Based Planning Enquiry. Available at: https://roscoco.maps.arcgis.com/apps/webappviewer/index.html?id=84b0356c3b45483c9da36ecccbd3aa93

Information Type	Data Sources
ESB/ESBI	• Consultation between the Design Team and ESB/ESBI representatives
Gas Networks Ireland (Bord Gáis)	• Consultation between the Design Team and Gas Networks Ireland (Bord Gáis) representatives
Water, Wastewater, Stormwater (Irish Water and local authorities)	• Consultation between the Design Team and Irish Water representatives • Consultation between the Design Team and the Local Authorities
Virgin Media	• Consultation between the Design Team and Virgin Media representatives
BT Ireland	• Consultation between the Design Team and BT Ireland representatives
Eircom/Eir	• Consultation between the Design Team and Eircom/Eir representatives
Vodafone	• Consultation between the Design Team and Vodafone representatives
Three	• Response not received
ComReg	• Consultation between the Design Team and ComReg representatives
E-net	• Consultation between the Design Team and E-net representatives

The data sources listed in Table 4.5.2 were consulted to identify the location of waste based constraints.

Table 4.5.2 Sources of Waste Facility Information

Information Type	Data Sources
Waste Facility Permits and Certificates of Registration issued by local authorities	• Local Authority Waste Facility Register[36]
Civic Amenity Sites	• Repack Website[37]
Existing waste applications, licences or environmental information	• EPA Waste Licence Applications[38]
Records of closed landfills	• EPA Report- Focus on Landfilling in Ireland[39]
Active and other landfills in the region	• Connacht Ulster Waste Management Plan 2015-2021[40]

[36] National Waste Collection Permit Office, 2020. Local Authority Waste Facility Register. Available at: http://facilityregister.nwcpo.ie/
[37] Repak, 2020. Recycling Register. Available at: https://repak.ie/
[38] Environmental Protection Agency, 2020. Licensing and Permitting, Waste Licence Search. Available at: https://www.epa.ie/our-services/licensing/waste/
[39] Environmental Protection Agency, 2010. EPA Report – Focus on Landfilling in Ireland. Available at: http://www.epa.ie/pubs/reports/waste/stats/EPA_Focus_on_Landfilling_Ireland.pdf
[40] Mayo County Council, 2015. Connacht - Ulster Region Waste Management Plan 2015 – 2021. Available at: http://www.curwmo.ie/

4.5.3 Existing Environment

4.5.3.1 Amenities (Open Spaces, Recreation and Tourism and Leisure Related)

There are many amenities and recreation spaces within the study area. Although most are located in or near to Carrick-on-Shannon, there are amenity areas located throughout the study area.

The River Shannon, which is central to the study area, is also the primary provider of tourism attractions, offering opportunities for angling, boating and other water related sporting activities. There is a rowing club, a boat club and two marinas either side of the river north of the River Shannon Bridge.

The Riverfront Amenity Park is an amenity space along the east bank of the River Shannon, to the south of the N4 inner relief road in Carrick-on-Shannon. The development was completed in 2007. The park includes pathways, seating and public lighting in an area of native tree planting along with selected decorative shrubbery. In addition, the 174m boardwalk extends onto the River Shannon and includes two viewing platforms.

Carrick-on-Shannon is an established tourism area and is a main centre for river cruising traffic and anglers. Accordingly, the areas within the study area zoned "Open Space and Amenity", "Recreation and Amenity", "Tourism Related Development" and "Leisure and Amenity" are all located in proximity to the River Shannon.

The "Leisure and Amenity" zoned area in Cortober is located along the banks of the Shannon and is bisected by the N4 bridge crossing. Not all the lands zoned are currently developed, as noted by the Cortober LAP, see Land Use and Planning Figures 4.3.1.0 and 4.3.1.5.

There are a number of hotels within Carrick-on-Shannon and various guest houses located throughout the study area. There is also an existing camping ground located on the bank of the River Shannon at Cordrehid.

There are three existing marinas located within the study area. The Marina St George's Terrace is between Cortober and Carrick-on-Shannon on the northern bank of the River Shannon, adjacent to the Shannon Bridge. Further southeast along the Shannon, the second marina, Butlers' Marina, is located in Attirory on the western bank of the River Shannon. The third marina, Albert Lock and Marina, is located on Jamestown Canal near Jamestown and Drumsna (see Population Figures 4.4.1.0 to 4.4.1.5). There are also various mooring locations along the route of the River Shannon within the study area at Carrick-on-Shannon Floating Moorings, Ardanaffrin, Drumsna Old Harbour and Albert Lock (see Population Figures 4.4.1.0 to 4.4.1.5).

The "Recreation and Amenity" zoned lands in Cortober comprise The Bull Field which is a GAA, Soccer and 'other' field sports ground located south of the existing N4. Further to this, Leitrim GAA Centre of Excellence and Annaduff GAA field are located southeast of Annaduff (see Population Figures 4.4.1.0 to 4.4.1.5).

The Leitrim County Development Plan 2015-2021[13] have zoned the banks of the River Shannon adjacent to Jamestown and Drumsna "Open Space and Amenity" while the lands approaching the Shannon banks in Drumsna are zoned for "Tourism Related Development". These areas are located just south of the existing N4. See Land Use and Planning Figures 4.3.1.0 to 4.3.1.5.

There are a number of pitches within the study area which are used for a variety of sports. Carrick Town FC and Carrick-on-Shannon RFC have pitches in Drishoge and Keenaghan respectively. Five GAA facilities are located within the study area; Bull Field in Cortober, Páirc Seán Mac Diarmada and St. Mary's GAA in Attifinlay and the Leitrim GAA - Centre of Excellence and Annaduff GAA in Moher. Carrick-on-Shannon Golf Club is located just outside the study area to the northwest in the townland of Usna.

Further amenities within Carrick-on-Shannon Town include Carrick Cineplex, The Dock Gallery and Theatre, Carrick Indoor Karting, Aura Leitrim Leisure Centre and tennis courts.

There are multiple churches and cemeteries located within the study area.

4.5.3.2 Residential Properties

With the exception of dense residential development in Carrick-on-Shannon, with a population of 3,250 and other notable settlements in the study area such as Cortober (~700 people), Dromod (673 people) and Drumsna (223 people); due to the rural nature of most of the N4 study area, much of the residential development consists of dispersed, rural style, one-off housing. The type of residential property varies from residential estates and apartment complexes within Cortober and Carrick-on Shannon to one-off, linear development and residential clusters in the remainder of the study area.

It should be noted that Leitrim County Development Plan 2015-2021 Housing Strategy[41] has acknowledged that the issue of housing vacancy is comparatively high in Leitrim but that the issue is masked as, due to Leitrim's environmental assets and low-price housing, many homes in the county are used as secondary holiday homes.

4.5.3.3 Industrial and Commercial Properties

Several areas within the study area are zoned "Industrial" or "Business Enterprise Park/Light Industry and Warehousing". The main business parks and industrial estates located in the study area include:

- Westgate Business Park located on the N4 Boyle Road in Cortober
- Carrick Retail and Business Park located on the N4 Boyle Road in Cortober

[41] Leitrim County Council, 2014. Leitrim County Development Plan 2015-2021 Housing Strategy. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan-2015-2021/

- Carrick Shopping Centre and Retail Park located on the N4 in Attifinlay, Carrick-on-Shannon
- Carrick-on-Shannon Business & Technology Park located on Castlecara Road, Carrick-on-Shannon
- Carrick Business Campus located in Attifinlay, Carrick-on-Shannon

The majority of the commercial properties within the study area are located within the environs of Carrick-on-Shannon. Two of the largest employers in the area are VistaMed located in the IDA Ireland Business & Technology Park and Avantcard in Carrick Business Campus.

Masonite Ireland Limited is one of the largest employers in the county. They occupy a large industrial building with associated settlement ponds, storage tanks and carparks located in Annaduff, east of Carrick-on-Shannon on the N4. There are various other industrial and commercial properties located outside of Carrick-on-Shannon and Cortober, the larger of which include Rosderra Irish Meats and Archway Products Limited located just outside Jamestown and Durkin Concrete in Drumkeeran (See Population Figures 4.4.1.0 to 4.4.1.5).

4.5.3.4 Proposed Developments (Non-Agricultural)

Proposed developments are detailed in Section 4.3 Land Use and Planning.

4.5.3.5 Utilities and Services

Irish Water (Water Supply and Foul Sewer Infrastructure)

Irish Water were consulted and provided the locations of known existing water supply and foul sewer infrastructure within the study area as shown on Material Assets Non-Agriculture Figures 4.5.1.0 to 4.5.1.5.

Public watermains are located in much of the existing N4 road; from Cloonman to Cortober, Carrick-on-Shannon to Tully and Mountcampbell to Fearnaght. Group Water Scheme (GWS) pipelines also tee off the public watermains within the study area. Aside from the existing N4, public watermains are present in the regional roads R299, R280, R368 and R370, and on many other local roads. The remainder of the properties in the study area are serviced by private wells (ref Section 4.1.4 for further details).

The public water abstraction point is located on the Shannon, upstream of the town of Carrick-on-Shannon. This is a large regional drinking water abstraction.

The public foul water network is primarily located in the town of Carrick-on-Shannon, which indicates that a large proportion of the study area is serviced by private septic tanks or other private systems. The public sewer network is located in the existing N4 from the R368 junction to the bridge, along the N4 inner relief road to the south of the town and crosses the existing N4 east of the Castlecara Road (L3408) Junction. There is also a Wastewater Treatment Plant (WWTP) located on the L3655 between Priors Point housing estate and Burke's Funeral Directors in the townland of Attirory.

ESB/ESBI electricity supply

Figures 4.5.2.0 to 4.5.2.5 show the high voltage 38kV, 110kV and 220kV ESB lines around Carrick-on-Shannon. Many of these lines converge at the 110kV sub-station adjacent to Carrick-on-Shannon railway station.

In total within the study area, there are:

- Three 38kV lines coming from Claremorris, Gorteen and Mohill which converge at the Carrick-on-Shannon 110kV substation
- Six 110kV lines, four of which converge at the Carrick-on-Shannon 110kV substation. Of these four, one connects to Corderry and another to Arva and the final two originate from the large Flagford 220kV station on the L1034 approximately 3km southwest of Carrick-on-Shannon. Two other 110kV lines pass through the study area, both originating from the large Flagford 220kV station, they connect to Sligo and the Masonite site south of Drumsna
- One 220kV line which passes through the southern portion of the study area travelling from Arva to the Flagford 220kV station

All lines are overhead except for a 1.5km section of the 38kV line connecting Carrick-on-Shannon and Mohill which goes underground through the Cnoc Na Sí housing estate before emerging on the other side of the existing N4.

The ESB high voltage network does not follow the path of the existing N4 but crosses the national road in five locations. Two overhead (OH) lines cross the N4 west of Cortober, in Cloonman and Cloonskeevan, one crosses just east of Carrick-on-Shannon in Lisseeghan and one crosses overhead in Moher. One high voltage underground (UG) power line crosses the existing N4 at the Cnoc na Sí housing estate, also in Lisseeghan. Further to the power lines crossing, there is a short 125mm diameter ESB duct that crosses the existing N4 just west of the River Shannon Bridge.

Eirgrid

Eirgrid are responsible for the development, management and operation of the electricity transmission grid in Ireland. Eirgrid were contacted in relation to the location of works on existing or proposed infrastructure which may form a constraint on the project. The locations of high voltage transmission lines within the study area boundary are shown on Figure 4.5.2.0.

It is noted that two of the existing high voltage transmission circuits that pass through the area, Flagford to Sligo and Arva to Carrick-on-Shannon 110 kV circuits, need a capacity increase. However, this is expected to be completed by re-using existing structures where possible and following the existing route of the circuits. The Flagford to Louth 220 kV circuit also passes through the study area and it is planned that this will also be refurbished. Again, the existing route and structures will be retained, with some hardware changes provided where needed.

Eirgrid confirmed that, at the time of writing this Constraints Study, there are no planned network developments that will add transmission infrastructure in the study area.

EIR

Eir were contacted and the locations of Eir infrastructure are shown in Figure 4.5.3.0 to 4.5.3.5. The Eir telecoms network follows the route of the existing N4 for most of the road within the study area. The Eir broadband network also follows the route of the existing N4 from Cloonman, through Carrick-on-Shannon, past the L3408 junction and again from the L7426 junction through to Faulties.

BT

BT were contacted in relation to the location of BT services within the study area. They confirmed that it is their policy to not provide electronic data for large swathes of areas however, they did confirm that there are BT fibre optic cables within the N4 study area. BT services are present within the N4 study area at the following locations:

- Leitrim Leisure Centre
- Rosebank Retail Park
- Along the railway line
- At the train station

Gas Networks Ireland (Bord Gáis) Gas Supply

Gas Networks Ireland (Bord Gáis) were contacted and have confirmed that there is no existing gas infrastructure within the study area boundary.

Vodafone

The locations of Vodafone' mobile phone antennas within the study area are shown on Figures 4.5.3.0 to 4.5.3.5.

Three

Three were contacted but did not respond. Three antennas within the study area were identified through use of the ComReg database (see proceeding section).

ComReg

The Commission for Communications Regulation (ComReg) is the statutory body responsible for the regulation of the electronic communications sector (telecommunications, radio-communications and broadcasting transmission) and the postal sector. They are the national regulatory authority for these sectors in accordance with EU law which is subsequently transposed into Irish legislation.

ComReg were contacted in relation to identifying the location of telecoms antennas within the study area who identified Eircom, Enet, Imagine, Meteor, Three and Vodafone.

They also provided information on the location of antennas which is included in Figures 4.5.3.0 to 4.5.3.5.

Virgin Media

Virgin Media was contacted by the project team and has confirmed that there is no record of underground services within the study area boundary.

Aurora (Telecom)

The Aurora Telecom Network Maps[42] were consulted and there is no network located within the study area boundary.

ENet

ENet were contacted and confirmed that there is ENet infrastructure located in the road carriageway in both Carrick-on-Shannon and Cortober. The location of ENet infrastructure is shown on Figures 4.5.3.0 to 4.5.3.5.

COLT (Telecom)

The Colt online Fibre Availability Checker[43] was consulted and there is no network located within the study area boundary.

SIRO (Telecom)

The SIRO Roll-Out Map[44] was consulted and SIRO do not have any existing infrastructure within the study area.

4.5.3.6 Waste Facilities

Licenced Facilities

The Environmental Protection Agency (EPA) provide licensing for certain activities in the waste sector. These include landfills, transfer stations, hazardous waste disposal and other significant waste disposal and recovery activities. A waste licence is a single integrated licence dealing with emissions to all environmental media and the environmental management of the facility.

There are two licenced facilities within the study area, and these are listed in Table 4.5.3. Carrick-on-Shannon landfill is a municipal waste landfill located approximately 3km north-east of Carrick-on-Shannon on the R280 and holds a Waste Licence W0064-01. Masonite Ireland Limited located in Derryoughter in Drumsna hold an Integrated Pollution Prevention and Control (IPPC) Licence P0021-02.

Table 4.5.3 EPA Waste Licenced Facilities

Licence No	Company	Address	IPC / IEL / Waste
P0021-02	Masonite Ireland	Derryoughter, Drumsna, Carrick-on-Shannon, Leitrim	IPC
W0064-01	Carrick-on-Shannon Landfill	Ballynamoney, Carrick-on-Shannon, Leitrim	Waste

[42] Aurora, 2022. Network Maps. Available at: https://www.auroratelecom.ie/network-maps/
[43] Colt, 2022. Fibre Availability Checker. Available at: https://www.colt.net/colt-network-map/
[44] SIRO, 2022. SIRO Roll-Out Map. Available at: https://siro.ie/roll-out/#Leitrim

Closed/Historic Landfills

The EPA is obliged to process applications from local authorities in relation to "closed landfills" in accordance with the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations, 2008.

"Closed landfills" are also commonly referred to as historic landfills.

A search of the list of Historic Landfill-Certificates of Authorisation[45] available on the EPA website showed no Historic Landfills located within the study area boundary.

Waste Facility Permits/Certificate of Registration

The Waste Facility Permit and the Certificate of Registration Database is a register for waste facility permits and certificates of registration issued by local authorities under the Waste Management (Facility Permit and Registration) Regulations, S.I. No. 821 of 2007, as amended.

A search of the Local Authority Waste Facility Register[36] returned four Permits and Certificates of Registration for County Leitrim and 17 for County Roscommon. None of the Permits or Certificates of Registration identified are located within the study area boundary.

Civic Amenity Sites

The Leitrim County Council website[46] was consulted and there are no civic amenity sites located within the study area boundary.

The Roscommon County Council website[47] was consulted and there are no civic amenity sites located within the study area boundary.

Recycling

The Repak Recycling Register[37] was examined and although there are a number of Bring Banks located at various stores and carparks within the study area, there are no recycling facilities present which would act as a constraint to the Project.

4.5.3.7 Pits, Quarries and Mines

The presence of historic and active pits, quarries and mines are discussed in Section 4.15 – Soils and Geology.

[45] Environmental Protection Agency, 2020. Historic Landfill-Certificate of Authorisation. Available at: https://epawebapp.epa.ie/terminalfour/HLF/index.jsp
[46] Leitrim County Council, 2022. Civic Amenity Sites (Recycling Centres)- Information. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Environment/Recycling_Waste_and_Litter_/Recycling-Centres/Leitrim-Recycling-Centres-Civic-Amenity-Sites.html
[47] Roscommon County Council, 2022. Civic Amenity Sites. Available at: https://www.roscommoncoco.ie//en/Services/Environment/Waste_Management,_Disposal_and_Recycling/Civic-Amenity-Sites/

4.5.4 Summary

In summary, there are many constraints relating to non-agricultural material assets present within the study area. The most significant of these include:

- Residential, Industrial, Business and Commercial Properties (see Land Use and Planning Figures 4.3.1.0 and 4.3.1.1)
- Amenities associated with the River Shannon (see Population Figures 4.4.1.0 to 4.4.1.5)
- Tourism and recreational attractions (see Population Figures 4.4.1.0 to 4.4.1.5)
- Major high voltage ESB transmission lines, related infrastructure and substation

4.6 Material Assets — Agriculture

4.6.1 Introduction

This section describes the material assets - agriculture constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the material assets – agriculture constraints shown on Figures 4.6.1.0 to 4.6.3.5.

Section 4.6.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.6.3 describes the material assets - agricultural constraints within the study area. A summary is presented in Section 4.6.4.

4.6.2 Methodology and Sources of Information

4.6.2.1 Methodology

This constraints study is comprised of a desktop collation and interpretation of published data and a site survey of the study area that was undertaken on 25 August and 26 August 2020. The purpose of this constraints study is to identify features which reflect the agricultural potential and agricultural sensitivity of the study area. The identification of agricultural constraints and classification of agricultural land is completed by:

- Identification of generalised land use categories within the study area
- Measuring the area of agricultural land within the footprint of the study area
- Measuring the area of good agricultural land within study area. Poor land is where there is scrub, very heavy rush growth and boggy wet land. Good agricultural land is grass land without scrub and heavy rush infestations. For the purposes of this assessment land quality is identified using aerial photography and visual assessment from site surveys
- Numerating the quantity of farm yards and agricultural structures within the study area and identifying the number of high sensitivity farm yards (e.g. equine farms). For the purpose of this assessment these were identified using aerial photography and visual assessment from a site survey

4.6.2.2 Guideline and Legislation

The following guidelines and legislation were referenced to inform this constraints study:

- European Union (2018) (Planning and Development) (Environmental Impact Assessment) Regulations. (SI 296 of 2018)[48]

[48] European Union, 2018. (Planning and Development) (Environmental Impact Assessment) Regulations. (SI 296 of 2018) Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print

- Environmental Protection Agency (EPA) (August 2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports[21]
- Transport Infrastructure Ireland (TII) (2019) Project Management Guidelines PE-PMG-02041[1]. In line with the TII and EPA guidelines, the constraints study seeks to identify the issues that are likely to be important at this stage of the environmental assessment process and to inform the design team so that preventative action can be pursued

4.6.2.3 Sources of Information

The following sources of information informed the constraints study:

- Data from the Central Statistics Office:
- The Census of Agriculture[49]. At the date of publication of this document the 2010 Agricultural Census publication is the only complete and finalised source of data which gives the number of farms for each farm enterprise at a county level. Only preliminary results are available for the most recent agricultural census in 2020. The 2010 county data is used as an indicator of the size of farms within the study area. It is possible to use the PxStat (CSO Main Data Dissemination Service) [50] to access this data at an Electoral Division (ED) level. This data is listed in Table 4.6.4 and Table 4.6.5
    - The average farm size has changed very little from 2010 to 2020. Although a complete set of data for all enterprise types has not been published by the CSO from the 2020 census, the available data indicates that while the number of specialist sheep farmers has increased since 2010, the number of dairy farms has not changed significantly and hence the overall number of high sensitivity and medium sensitivity farms will not have changed significantly since 2010.
    - The 2020 CSO June Crops and Livestock Survey[51]. This is the most up to date data source for the total number of dairy cows in Counties Leitrim and Roscommon (but does not provide the number of dairy farmers)
- Soil mapping data from the Teagasc Irish Soil Information System[52] was used to identify the soil types within the study area. For example, rock, peat and low-lying alluvial soils are generaly poor quality. The soil quality and type varies within a small area and the mapping data used is consistent over large areas, thus the information is indicative only

[49] Central Statistics Office, December 2012. Census of Agriculture 2010 – Final Results. Available at: https://www.cso.ie/en/media/csoie/releasespublications/documents/agriculture/2010/full2010.pdf.
[50] Central Statistics Office, 2020. Databases, PxStat (CSO Main Data Dissemination Service), Business Sector, Census of Agriculture. Available at: https://data.cso.ie/#
[51] Central Statistics Office, 2020. Statistics, Agriculture, Crops and Livestock June Final Results, Table 4. Available at: https://www.cso.ie/en/releasesandpublications/er/clsjf/cropsandlivestocksurveyjunefinal2018/
[52] Teagasc, 2019. Irish Soil Information System. Available from http://gis.teagasc.ie/soils/

- Corine data[53] on land use was examined for the study area
- Irish Forestry Geo-portal[54] was examined to identify forestry plots
- Bing[55] and Google[33] aerial maps were used to identify yards, farm facilities, forestry, scrub and rough boggy land
- The Property Registration Authority of Ireland (PRAI)[32] open database was used to identify folio land parcels where grazing dairy cows and horses were noted during the site survey

The following features were identified from desktop information sources:

- Yards and farm facilities - farm yards and other yards and facilities such as sand arenas used by horses and farm paddocks and roadways typical of dairy farms were identified from aerial photography
- Dairy farms are generally of high sensitivity and equine enterprises are within the high to very high range of enterprise sensitivity. The PRAI open database was used to identify folio land parcels
- Areas with good quality soils generally have a higher agricultural potential than poor quality land. Good quality land was initially identified by using the Teagasc Irish Soils Information System and aerial photography and later verified with site surveying. Ordnance Survey Discovery mapping was used to identify upland areas

A site survey was conducted in August 2020. The survey involved driving through the study area and recording farm enterprises, land use and land quality. The purpose of the survey was to verify where possible the desktop data and identify the following:

- Farm yards and other yards - farm yards and facilities such as stables, sand arenas and lounging areas were identified
- Fields with dairy cows
- Fields with horses
- Land quality - desktop information was verified and areas with forestry, scrub and marshes were noted

Table 4.6.1 lists a range of common Irish enterprise categories alongside their respective sensitivity dependent on their intensity/scale. Where farm enterprises were identified during the survey, the rating system set out in Table 4.6.1 was used to categorise the sensitivity. It should be noted that the information from the survey has been interpreted based on the professional judgement of the author.

[53] EPA, 2020. Corine Landcover 2018. Available from http://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/e09739bf-abd1-4408-9fa5-510a156673ba
[54] Irish Forestry Geo-portal, Available at https://www.agriculture.gov.ie/forestservice/forestservicegeneralinformation/foreststatisticsandmapping/forestmapviewer/geoportal/
[55] Bing Aerial Mapping. Available at: https://www.bing.com/maps

Table 4.6.1 Farm Sensitivity

Farm enterprise type	Intensity / Scale	Sensitivity
Stud farms, farm shops / open farms / agri tourism farms are generally high or very high sensitivity. Intensive horticulture (mushroom farms) is generally high or very high sensitivity. Intensive agriculture (pigs and poultry) is high sensitivity	High	Very High
	Medium	High
	Low	Medium
Dairy farms and equine enterprises	High	High
	Medium	High
	Low	Medium
Non dairy grazing livestock enterprises (including beef, sheep and small non intensive equine) and grass cropping enterprise	High	Medium
	Medium	Low
	Low	Very Low
Tillage	High	Medium
	Medium	Low
	Low	Very Low
Rough Grazing, Bog, Forestry, Woodland	Low	Low or Very Low

4.6.3 Existing Environment

4.6.3.1 Land use (2018 Corine Data)

The study area, as illustrated in Figure 4.1.1.1, is approximately 7.7km at the widest point and extends approximately 18.3km from Drumharlow townland north of Carrick-on-Shannon to Faulties townland south of Aghamore and encompasses approximately 7,820 hectares (ha) of land within its boundary.

Table 4.6.2 Land Use within the Study Area [53]

Land Use Category	% of Study Area
Total Area (ha)	7,820
Discontinuous Urban Fabric	4%
Mineral Extraction Sites	0.3%
Pasture	59.2%
Land Principally used for Agriculture, with Significant Areas of Natural Vegetation	20%
Forestry (conifers and deciduous)	6%
Inland marshes	4.5%
Waterbodies	6%
Total	100%

Agricultural pasture land is the main land use within the study area; which combined with significant areas of natural vegetation account for 79% of the study

area. Some of the inland marshes (4.5%) are also used for agriculture. Forestry and waterbodies both account for 6% each of the total land cover. The Corine land cover data is presented in Figure 4.6.1.0 to 4.6.1.3.

4.6.3.2 Soil type (Teagasc Soils Data and survey data)

A review of the Irish Soils Information System Map Viewer[52] was carried out to identify the soil types occurring within the study area.

The principal soils of the study area are surface water gleys mainly comprised of the Ballinamor (0760BN) and Kilrush (0700KR) series which account for approximately 44% of the study area. These are heavy, often poorly drained, clay loam gley type soils with intermediate agricultural potential and suited mainly for extensive pasture use. Luvisols are loam soils over a clay enriched subsoil and within this study area are often poorly drained. However, when adequately drained these are productive soils. These soils (Elton (1000ET) and Rathowen (1030RA) series) are located at the south side of the River Shannon and account for approximately 22% of the study area. Luvisols vary from intermediate to high agricultural potential depending on site specific factors such as drainage and management. Poor quality peat soils (1xx) are located throughout the study area and account for 15% of the study area. These are generally low agricultural potential soils. Alluvial soils occur along river channels and lakes and in marshes (05RIV). Making up for 10% of the study area, these are generally poorly drained, may be subject to flooding and have low to intermediate agricultural potential. Brown earths (Baggotstown (1150BG) series) are productive soils suitable for ploughing and are generally free draining. These are generally high agricultural potential soils and account for 1% of the study area. The Teagasc soil types are presented in Figures 4.6.2.0 to 4.6.2.5.

Table 4.6.3 Soils of the Study Area [52]

Principle Soil type	% of Study Area
Total area (ha)	7,820
Surface Gley Soils [(Kilrush (0700KR), Ballinamore 0760BN)]	44%
Luvisols (loam top soil / clay subsoil) [Elton (1000 ET), Rathowen (1030RA)]	22%
Peat (1xx)	15%
Alluvial soils (05RIV) including marshes	10%
Brown earths [Baggotstown (1150BG), Mullabane (1100MB)]	1%
Water / manmade	8%
Total	100%

4.6.3.3 Enterprise types (CSO Data)

The primary source of data available on existing farm types in Ireland is the 2010 census data. However, although the 2010 census can be a useful indicator of agricultural data in the study area it should be interpreted with caution as National and European policy has changed in the interim. For example, milk quotas have

been abolished since 2015 and this abolition has resulted in an increase in the size of the national dairy herd. In County Roscommon dairy cow numbers have almost doubled from 4,891 in 2010 (2010 Census data) to 8,800 in 2020 (2020 CSO livestock survey June 2020)[56] while numbers of dairy cows in Leitrim have stayed relatively stable at approximately 1,900 dairy cows.

Table 4.6.4 Enterprise Types within the Study Area

Farm enterprise type (Table 2, 2010 Ag Census, CSO)	**% of farms within each category**		
	Leitrim	**Roscommon**	**Nationally**
Mainly dairy	1.2 (0.9)	1.5 (1.5)	11 (11.3)
Non-dairy grazing livestock (beef cattle) and mixed field crops	84.1	90.1	72.5
Specialist sheep	14.1 (19)	7.4 (9.7)	10 (12.9)
Mainly tillage	0.0	0.2	3.5
Mixed crops & livestock	0.1	0.4	2
Other	0.5	0.4	1
Total	100	100	100
Average size (ha)	25.1 (25.5)	27.1 (27.7)	32.7 (33.4)
(Figures in brackets are from the available 2020 Census of Agriculture preliminary results)			

[56] Central Statistics Office, 2020. Livestock Survey Final (Table 4). Available at: https://www.cso.ie/en/releasesandpublications/er/clsjf/cropsandlivestocksurveyjunefinal2020/

Table 4.6.5 Agricultural Statistical Data for Local Electoral Divisions [57]

Electoral Division	No of Farms	Size of farms (ha)	Grassland (ha)	Grassland Rough grazing(%)	Tillage (ha)	No. Beef cattle	No. Dairy cows	No. Sheep	No. Horses
County Leitrim EDs									
Carrick-on-Shannon	63	23.5	1355	9%	7	1153	0	438	26
Drumsna	78	19.6	1425	7%	0	1330	0	212	17
AnnaDuff	33	21.8	716	1%	0	816	0	435	1
Average		21.6		6%					
County Roscommon EDs									
Killukin	31	28.1	842	4%	0	876	69	0	6
Danesfort	36	29.4	1032	3%	0	997	72	232	6
Aughrim East	50	29	1413	3%	0	1641	0	193	6
Clonteen	53	29.6	1474	6%	0	1873	57	246	55
Average		29		4%					

[57] Central Statistics Office, 2020. General Statistics Office-Census of Agriculture Mapviewer. Available from: http://census.cso.ie/agrimap/

Size of farms

Table 2 of the 2010 Agricultural Census shows the average size of farms in Counties Leitrim and Roscommon to be approximately 25ha and 27.1ha respectively. These areas correspond closely to the EDs as described in Table 4.6.4. The 2020 Agricultural Census preliminary results show that neither the national or the County Leitrim and County Roscommon average farm size have varied significantly since 2010. The 25ha average size (i.e. as per Table 4.6.4 (21.6 + 29) ÷ 2) is significantly lower than the national average of 32.7ha.

Type of Enterprise

According to the 2010 Agricultural Census the principal enterprise type is beef cattle and land used for forage (hay/silage). As shown in Table 4.6.4 above there is a very low percentage of dairy farms in Counties Leitrim and Roscommon and this is reflected in the EDs statistics (i.e. no dairy cows in the three County Leitrim EDs and 4% of cattle in the Roscommon EDs are dairy cows). Table 8D of the 2010 Agricultural Census statistics shows that approximately 10% and 12% of farms in County Leitrim and County Roscommon have horses and ponies ad these farms have an average of 5.3 horses per farm. The local ED statistics show a relatively high number of horses in Carrick-on-Shannon, Drumsna and Clonteen see Table 4.6.5.

4.6.3.4 Key Constraints

The key material assets - agricultural constraints identified within the study area during a site survey carried out in August 2020. From the aerial mapping surveys, they are identified as “agricultural land”, “farm yards” and “highly sensitive folios”, this is documented in Table 4.6.4. These are also shown on Figures 4.6.3.0 to 4.6.3.5 and described in detail in the proceeding sections.

Table 4.6.6 Farm Yard Types Identified in the Site Survey (Based on Professional Judgement)

Enterprise	Low – Medium sensitivity	High – Very High sensitivity
Equine	1	1
Dairy	-	2
Horticulture (mushroom)	1	1
Beef cattle / sheep / silage / hay	236	-
Poultry	-	2
Other	-	2
Total	238	8

Agricultural Land

Agricultural land is the dominant land use within the study area. Overall, the agricultural potential of the land in the study area is intermediate and its suitability is restricted to medium intensity pasture-based enterprises and is not suitable for tillage. There are some local exceptions, particularly in the south of the study area,

where there are high agricultural potential Luvisols and Brown Earth soils. Forestry and low agricultural potential soils such as peats, alluvial soils and river marshes have lower sensitivity than productive pastureland.

When urban land cover, waterbodies, quarries, forestry, inland marshes, alluvial soils and peat soils are deducted from the study area what remains is land with an intermediate agricultural potential and this is presented as a constraint in Figures 4.6.3.0 to 4.6.3.5. From an agricultural perspective, where possible, poorer quality land should be considered in preference to this land when identifying alternatives and options for the project transport solution.

Farm yards

All farm yards and associated facilities identified in the site survey and from aerial photography are identified as agricultural constraints and are presented on Figures 4.6.3.0 to 4.6.3.5 and should be avoided where possible. 246 agricultural yards/buildings were identified in the study area. Of these eight were identified as having high sensitivity and the remaining 238 were low – medium sensitivity. The high sensitivity enterprises are:

- One equine in Tonnagh, Co Leitrim – northwest of Carrick-on-Shannon
- Two dairy farms. One in Tullyleague, Co Roscommon – west of Carrick-on-Shannon and one in Liscolvan, Co Roscommon – southeast of Carrick-on-Shannon
- One farm shop in Tullyleague, Co Roscommon – west of Carrick-on-Shannon
- Two poultry houses. One in Tullyleague, Co Roscommon – west of Carrick-on-Shannon and one in Knockadalteen, Co Roscommon – west of Carrick-on-Shannon
- One mushroom farm in Cuiltyconeen, Co Roscommon – west of Carrick-on-Shannon
- One agri-tourism farm (quad-biking) in Cuiltyconeen, Co Roscommon – west of Carrick-on-Shannon

High sensitivity Areas

Four folios were mapped as high sensitivity areas (two dairy farms, one equine farm and one agri-tourism farm) and are illustrated as high sensitivity agricultural constraints in Figures 4.6.3.0 to 4.6.3.5.

4.6.4 Summary

The constraints study involved a site survey assessment and desktop information assessment. The study area encompasses approximately 7,820ha of land within its boundary of which approximately 79% is agricultural land (as determined from Corine 2018 data[53] ,the examination of aerial photography and DAFM Irish Forestry Geo-portal). The statistics for Counties Leitrim and Roscommon and seven local EDs were examined to determine the typical farm types, farm size and cropping for the study area. The farm type was also identified from the site survey. Forestry, waterbodies, mineral extraction land-cover, urban land-cover and inland marshes was identified from Corine 2018[53], aerial photography and DAFM Irish Forestry Geo-portal data[58]. The Irish Soils Information system was examined to identify soil types. The site survey assessed that the majority of the agricultural land is of intermediate agricultural potential and is not a high sensitivity constraint. However, Figures 4.6.3.0 to 4.6.3.5 differentiates this intermediate agricultural potential land from poorer quality peats and alluvial soils and other low sensitivity areas such as land devoted to urban use, forestry, mineral extraction sites, inland marshes and waterbodies. The site survey identified 246 farm yards as constraints. Eight of these are high sensitivity enterprise farm yards (two dairy, one equine, one mushroom, one agri-tourism, one farm shop, two poultry). Four folios were digitised as high sensitivity areas (two dairy farms, one equine farm and one agri-tourism farm).

[58] Department of Agriculture, Food and the Marine, 2022. Irish Forestry Geo-Portal. Available at: https://data.gov.ie/dataset/suggest/e08f7fc5-6fcb-4301-b996-49bacd0c4409

4.7 Air Quality

4.7.1 Introduction

This Section describes the air quality constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the Population Constraints Figures 4.4.1.0 to 4.4.1.5, Biodiversity Constraints Figures 4.12.1.0 to 4.12.2.5 and Soils and Geology Constraints Figures 4.15.1.0 to 4.15.4.5.

Section 0 describes the methodologies and sources of information that were used to carry out the study. Section 4.7.3 describes the air quality constraints and the ambient air quality within the study area. A summary is presented in Section 4.7.4.

The main constraints associated with air quality are the numbers of sensitive locations in the study area and the assimilative capacity of the baseline air quality relative to limit values. The study area consists of high density urban residential to the north (Carrick-on-Shannon) and low density residential rural to the south.

4.7.2 Methodology and Sources of Information

4.7.2.1 Methodology

The air quality constraints study has been prepared in accordance with the Transport Infrastructure Ireland (TII) guidance document[59].

Section 2.3, *Route Selection Process Stage 1 Preliminary Options Assessment* of the above document[59] includes the initial steps to be taken to identify air quality constraints within a study area as follows:

"The initial step (Stage 1, i.e., Preliminary Options Assessment) in the Route Selection Process is to identify the nature and extent of significant constraints within a defined Study Area. These constraints should be documented and mapped so that feasible route options can be designed to avoid such constraints, where possible.

The first part of this data collection should be based on deskbound research studies. All known physical constraints from an air quality perspective should be identified and recorded on suitably scaled maps.

The specific objectives of the air quality input to the Stage 1 Preliminary Options Assessment of the Route Selection Process are to characterise the existing ambient air quality in the study area and to initially identify all sensitive receptor locations within the study area likely to be impacted by a proposed scheme before feasible route options are identified…"

[59] TII, 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

The above approach has been followed for this constraints study and the study area is as described in Section 4.1 and shown on Figure 4.1.1.1.

In addition, Section 2.3 of the TII guidance document[59] also describes the air quality input required for the Stage 1 Preliminary Options Assessment as follows:

1. *"Describe existing local air quality conditions within the study corridor in relation to nitrogen dioxide (NO_2) and PM_{10}.This should take full account of any existing monitoring data from networks established by the Environmental Protection Agency (EPA) and local authorities and monitoring carried out by other organisations, as relevant. It should also identify any areas where the standards are exceeded;*
2. *Describe any non-road sources that may significantly affect air quality within the study corridor, for example, industry, ports, areas of domestic solid fuel combustion, or powerstations;*
3. *Identify and record all sensitive receptor locations within the study area and all sensitive receptors within 50m of the carriageway of each feasible route option that are, or have the potential to be, significantly affected by a proposed scheme;*
4. *Take full account of all previous studies, local air quality assessments or reports, and any other air quality work undertaken by the TII (NRA), EPA or local authorities, and*
5. *Include a review of planning permissions granted within the Study Area of relevance from an air quality perspective (e.g. significant sensitive receptors and developments likely to have a significant impact on air quality)".*

The requirements of the TII guidance document[59] have been considered in this assessment with the exception of Item 3 in relation to feasible options, as alternatives and options are developed after the Constraints Study.

Sensitive receptor locations are defined in the guidelines[59] as residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. These are shown on the Population Constraints Figures 4.4.1.0 to 4.4.1.5.

Designated habitats are also potentially sensitive receptors. Such sites include, Natural Heritage Areas (NHA), Special Areas of Conservation (SAC), Special Protection Areas (SPA), National Parks, Nature Reserves, Refuges for Fauna, Refuges for Flora, Wildfowl Sanctuaries, Ramsar Sites, Biogenetic Reserves and UNESCO Biosphere Reserves. The biodiversity receptors present within the study area are detailed in Section 4.12. and on the Biodiversity Constraints Figures 4.12.1.0 to 4.12.2.5. All ecologically sensitive sites identified will be considered in terms of nitrogen oxide concentrations.

4.7.2.2 Air Quality Standards and Limit Values

In order to reduce the risk of poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values are set for the protection of human health and ecosystems.

On 12 April 2011 the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)[60] came into force and transposed Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe into Irish law.

The purpose of the Air Quality Standards Regulations 2011 is:

- to establish limit values and alert thresholds for concentrations of certain pollutants
- to provide for the assessment of certain pollutants using methods and criteria common to member states
- to ensure that adequate information on certain pollutant concentrations is obtained and made publicly available
- to provide for the maintenance and improvement of ambient air quality where necessary

The limit values established in these regulations are included in Table 4.7.1. Table 4.7.2 presents the United Nations Economic Commission for Europe (UNECE) Critical Loads for Nitrogen as presented in the TII guidance[59].

Table 4.7.1 Air Quality Standards (AQS) from Regulations 2011 (S.I No. 180 of 2011)

Pollutant	Limit value for the protection of:	Averaging period	Limit value ($\mu g/m^3$)	Basis of application of limit value
Nitrogen Dioxide (NO_2)	Human Health	1-hour	200	≤18 exceedances p.a. (99.79 %-ile)
		Calendar year	40	Annual mean
Nitrogen Oxides (NO_x)	Vegetation	Calendar year	30	Annual mean
Particulate Matter (PM_{10})	Human Health	24-hours	50	≤35 exceedances p.a. (98.1%ile)
		Calendar year	40	Annual mean
Particulate Matter ($PM_{2.5}$)	Human Health	Calendar year	25	Annual mean
		Calendar year	20	Annual mean
Carbon Monoxide (CO)	Human Health	8-hour Annual Average	10,000	8-hour Average

[60] Department of the Environment, Heritage and Local Government, 2011. Air Quality Standards Regulations 2011. Available at: https://www.irishstatutebook.ie/eli/2011/si/180/made/en/print

Pollutant	Limit value for the protection of:	Averaging period	Limit value ($\mu g/m^3$)	Basis of application of limit value
Benzene	Human Health	Calendar year	5	Annual mean

Table 4.7.2 UNECE Critical Loads for Nitrogen

Ecosystem type	Kg(N)/ha/yr	Reliability and indication of exceedance effects (see reliability key at end of table)
Forest habitats		
Temperate and boreal	10-20	# Changes in soil processes, ground vegetation, mycorrhiza, increased risk of nutrient imbalances and susceptibility to parasites
Heathland, scrub and tundra habitats		
Tundra	5-10[a]	# Changes in biomass, physiological effects, changes in species composition in moss layer, decrease in lichens
Arctic, alpine and subalpine scrub habitats	5-15[a]	(#) Decline in lichens, mosses and evergreen shrubs
Northern wet heath • 'U' Calluna dominated wet heath (upland moorland) • 'L' Erica tetralix dominated wet heath	10-20 10-25[a,b]	(#) Decreased heather dominance, decline in lichens and mosses (#) Transition heather to grass
Dry heaths	10-20[a,b]	## Transition heather to grass, decline in lichens
Grassland and tall forb habitats		
Sub-Atlantic semi-dry calcareous grassland	15-25	## Increase tall grasses, decline in diversity, increased mineralization, N leaching
Non-Mediterranean dry acid and neutral closed grassland	10-20	# Increase in graminoids, decline typical species
Inland dune pioneer grasslands	10-20	(#) Decrease in lichens, increase biomass
Inland dune siliceous grasslands	20-30	(#) Increase in tall grasses, decrease in diversity
Mountain hay meadows	10-20	(#) Increase in nitrophilous graminoids, changes in diversity
Moist and wet oligotrophic grasslands • *Molinia caerulea* meadows • Heath (*Juncus*) meadows and humic (*Nardus stricta*) swards	 15-25 10-20	 (#) Increase in tall graminoids, decreased diversity, decrease of bryophyte # Increase in tall graminoids, decreased diversity, decrease of bryophytes

Ecosystem type	Kg(N)/ha/yr	Reliability and indication of exceedance effects (see reliability key at end of table)
Alpine and subalpine grasslands	10-15	(#) Increase in nitrophilous graminoids, biodiversity change
Moss and lichen dominated mountain summits	5-10	# Effects upon bryophytes or lichens
Mire, bog and fen habitats		
Raised and blanket bogs	5-10[a,c]	## Change in species composition, N saturation of Sphagnum
Poor fens	10-20	# Increase sedges and vascular plants, negative effects on peat mosses
Rich fens	15-35	(#) Increase tall graminoids, decrease diversity, decrease of characteristic mosses
Mountain rich fens	15-25	(#) Increase vascular plants, decrease bryophytes
Inland and surface water habitats		
Permanent oligotrophic waters • Softwater lakes • Dune slack pools	 5-10 10-20	 ## Isoetid species negatively affected (#) Increased biomass and rate of succession
Coastal habitat		
Shifting coastal dunes	10-20	(#) Biomass increase, increase N leaching
Coastal stable dune grassland	10-20	# Increase tall grasses, decrease prostrate plants, increased N leaching
Coastal dune heaths	10-20	(#) Increased plant production, increase N leaching,accelerated succession
Moist to wet dune slacks	10-25	(#) Increased biomass, tall graminoids
Marine habitats		
Pioneer and low-mid salt marshes	30-40	(#) Increased late-successional species, increase productivity

Reliability key: ## reliable, # quite reliable, (#) expert judgement
[a] Use towards high end of range at phosphorus limitation, and towards lower end if phosphorus is not limiting
[b] Use towards high end of range when sod cutting has been practiced, use towards lower end of range with low intensity management
[c] Use towards high end of range with high precipitation and towards low end of range with low precipitation

4.7.2.3 Sources of Information

The existing constraints have been determined through the review of published data from the EPA[61,62]. The EPA collates all air quality monitoring data carried out by the EPA and local authorities.

4.7.3 Existing Environment

This section describes the existing local air quality conditions within the study area. Any non-road sources that may significantly affect air quality within the study area are also described. Finally, sensitive receptor locations within the study area are described.

4.7.3.1 Existing Local Air Quality Conditions within the Study Area

The existing air quality is determined from air quality data recorded by the EPA. The EPA divides Ireland into four zones, with air quality data recorded for each zone.

- Zone A includes Dublin City and its environs
- Zone B includes Cork City and its environs
- Zone C is defined by the EPA as 21 large towns in Ireland with a population greater than 15,000
- Zone D includes Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C

Pollutants that are of concern in relation to transport projects are identified in Section 4.7.2.2. They are NO_2, NO_x, CO, PM and benzene. Table 4.7.3 presents baseline data for the most recent available years, 2021, 2020, and 2019 for each of these pollutants.

As the study area for the project is contained within Zone D, background data for this zone has been presented. Baseline values are compared to the limit values from the Air Quality Standards.

Table 4.7.3 Baseline Concentrations of Pollutants – Zone D

Year	Pollutant	Time Period	Concentration µg/m^3	Air Quality Standard µg/m^3	% of Air Quality Standard Limit
2021	NO_2	Annual Average	7.5	40	18.75
	NO_x	Annual Average	14.2	30	47.3

[61] EPA, Air Quality Reports. Available at, http://www.epa.ie/pubs/reports/air/quality/
[62] EPA, EPA Maps. Available at, https://gis.epa.ie/EPAMaps/

Year	Pollutant	Time Period	Concentration µg/m^3	Air Quality Standard µg/m^3	% of Air Quality Standard Limit
	CO	8-hour Annual Average	300	10,000	0.003
	$PM_{2.5}$	Annual Average	8.7	25	34.8
	PM_{10}	Annual Average	11.8	40	29.5
2020	NO_2	Annual Average	7.6	40	19
	NO_x	Annual Average	15.8	30	52.6
	CO	8-hour Annual Average	400	10,000	0.004
	$PM_{2.5}$	Annual Average	7.8	25	31.2
	PM_{10}	Annual Average	11.2	40	28
2019	NO_2	Annual Average	5.7	40	14.3
	NO_x	Annual Average	7.8	30	26.0
	CO	8-hour Annual Average	-	10,000	-
	$PM_{2.5}$	Annual Average	10.3	25	41.2
	PM_{10}	Annual Average	12.8	40	32.0

4.7.3.2 Ecologically Sensitive Areas

Nitrogen emissions are of importance in instances where any alternative or option crosses, or comes into close proximity to an ecologically sensitive area due to their harmful effect on vegetation. The study area includes the following ecologically sensitive areas; Lough Boderg and Lough Bofin pNHA and Lough Eidin pNHA.

Both sites are located within Zone D which has a background NO_2 concentration level of 13% of the limit value and a background NO_x concentration level of 25% of the limit value, refer to Table 4.7.3**Error! Reference source not found.**. In general, the air quality concentrations recorded in Zone D by the EPA are shown to

be well within Air Quality Standards and the assimilative capacity of the air in Zone D is considered good.

4.7.3.3 Existing Sources of Air Pollution in the Study Area

Table 4.7.4 presents the major road networks and volumes located in the study area. Annual average daily traffic (AADT) volumes are obtained from the TII`s 'Traffic Counter Data Website'[63].

Table 4.7.4 AADT for Major Roads within Study Area

Roads	Year	Location	AADT
N4	2019	N4 Between Longford and Carrick-on-Shannon, Dromod Bypass, Co. Leitrim	7,528

The data presented in Table 4.7.4 show the 2019 (pre-Covid) volumes of traffic within the study area. The emissions to air from these vehicles are assumed to form part of the baseline concentration levels as presented in Table 4.7.3.

4.7.3.4 Non-Road Emission Sources in the Study Area

Table 4.7.5 presents a list of industrial facilities licenced by the EPA[64] within the study area, with Industrial Emissions Directive (IED), Integrated Pollution Control (IPC) or Waste Licences in place.

Table 4.7.5 EPA IED/IPC/Waste Licence Holders within the Study Area

Licence No	Company	Address	IPC/IEL/ Waste
P0021-02	Masonite Ireland	Derryoughter, Drumsna, Carrick-on-Shannon, Leitrim	IPC
W0064-01	Carrick-on-Shannon Landfill	Ballynamoney, Carrick-on-Shannon, Leitrim	Waste

The effect of the emission sources presented in Table 4.7.5 are likely to be reflected in the baseline air monitoring data presented in Table 4.7.3. No significant additional new sources have been determined through a review of planning permissions and draft EPA licences in the study area.

Sensitive receptor locations within the study area are defined in the guidelines[59], Refer to Population Constraints Figures 4.4.1.0 to 4.4.1.5 and Biodiversity Constraints Figures 4.12.1.0 to 4.12.2.5 for sensitive receptor locations. Designated habitats are also included in the Biodiversity Constraints, refer to Section 4.12 for further detail.

[63] Transport infrastructure Ireland (TII), Traffic Counter Data Website. Available at https://www.nratrafficdata.ie/c2/gmapbasic.asp?sgid=ZvyVmXU8jBt9PJE$c7UXt6
[64] Environmental Protection Agency, IED and IPC Licence Search. Available at https://gis.epa.ie/EPAMaps/

4.7.4 Summary

The existing air quality concentrations recorded by the EPA are shown to be within the air quality standards. The assimilative capacity of the air within the study area, Zone D, is considered high.

Two industrial facilities are located in the study area, however, any emissions from these sources are represented in the baseline environment.

The main constraint associated with air quality is the statutory requirement to continue to comply with Air Quality Standards for the protection of human health and vegetation.

4.8 Climate

4.8.1 Introduction

This section describes the climate constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project.

Section 4.8.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.8.3 describes the climate constraints and the climate in Ireland. A summary is presented in Section 4.8.4.

4.8.2 Methodology and Sources of Information

4.8.2.1 Methodology

The Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[21] outlines the topics to consider in assessing the impact of projects on climate. The topics include greenhouse gas emissions, acid rain, thermal pollution and climate change trends (macro and micro).

Furthermore, Document LA114 - Climate in the Design Manual for Roads and Bridges (DMRB)[65] Sustainability and Environment Appraisal section states that *"Environmental assessments must, as required by the EIA Directive, describe the likely significant effects of proposed projects on the environment resulting from the impact of the project on climate (greenhouse gas (GHG) emissions) and vulnerability of the project to climate change (adaptation)".*

Consequently, this constraints study presents baseline climate information in terms of GHG emissions, the microclimate of the Midlands and the macroclimate of Ireland.

No significant variation in climatic constraints is expected which would influence the choice of alternatives and options as climate is a regional issue. However, climate is considered in the context of national emissions and Ireland's EU and national climatic obligations, at the time of writing this assessment. In terms of climate change adaptation, flood risk is assessed separately in Hydrology in Section 4.13 of the Constraints Study.

[65] Highways England, 2021. LA114 Climate, Design Manual for Roads and Bridges. Available at: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0

4.8.2.2 Climate Commitments

National Climate Policy

Ireland's Climatic Obligations

The European Green Deal[66], published by the European Commission in 2019, provides an action plan which aims for the EU to be climate neutral by 2050. The European Green Deal will increase the GHG emissions reduction 2030 target to at least 55% in comparison to 1990 levels. The Commission's proposal for the first European Climate Law aims to write into law the goal set out in the European Green Deal – for Europe's economy and society to become climate-neutral by 2050.

In May 2019, the Government of Ireland declared a climate and biodiversity emergency. Following on from this, the Government of Ireland's first national Climate Action Plan[67] was published in 2019. It commits to achieving a net zero carbon energy systems objective for Ireland. The most recent Climate Action Plan (2023) was published in December 2022.

In October 2019, the Transport Climate Change Sectoral Adaption Plan[68] was published under the NCCAF. The Plan identifies the key vulnerabilities in the transport network and looks to promote greater resilience to safeguard its continued operation. There is a constraint in relation to ensuring the development of the project allows for the climate targets and commitments to be met.

The new Programme for Government: Our Shared Future[69], agreed in June 2020, accelerated the decarbonisation agenda, committing to a 7% average yearly reduction in overall greenhouse gases over the next decade, and to achieving net zero emissions by 2050.

The Government of Ireland's updated Climate Action Plan[70] (2023) sets out a detailed sectoral roadmap to deliver a cumulative reduction in emissions, building on the commitments of the first Climate Action Plan (2019). The policies to reduce transport emissions are through improving our town, cities and rural planning, and by adopting the Avoid-Shift-Improve approach: reducing or avoiding the need for travel, shifting to public transport, walking and cycling and improving the energy efficiency of vehicles.

The Climate Action and Low Carbon Development (Amendment) Act[71] was enacted into national law in July 2021. The Act commits Ireland, in law, to move

[66] European Commission, 2019. European Green Deal. Available at: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[67] Department of the Environment, Climate and Communications, 2019. Climate Action Plan. Available at: https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/
[68] Department of Transport, 2019. Sectoral Adaptation Plan for Transport Infrastructure. Available at: https://www.gov.ie/en/publication/a2444e-sectoral-adaptation-plan-for-transport-infrastructure/
[69] Department of the Taoiseach, 2020. Programme for Government: Our Share Future. Available at: https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/
[70] Department of the Environment, Climate and Communications, 2023. Climate Action Plan. Available at: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/
[71] Climate Action and Low Carbon Development (Amendment) Act, 2021. Available at: https://www.irishstatutebook.ie/eli/2021/act/32/section/15/enacted/en/html

to a climate resilient and climate neutral economy by 2050 in alignment with the European Green Deal, and includes the following elements:

- Establishes a 2050 emissions target;
- Introduces a system of successive 5-year, economy-wide carbon budgets. The first two carbon budgets covering the periods 2021-2025 and 2026-2030 were announced by the Climate Change Advisory Council in 2021 (with a provisional budget from 2031). Once adopted by the Oireachtas, the carbon budgets will be used to prepare sectoral emissions ceilings for relevant sectors of the economy - this will include emission ceilings for the transport sector;
- Strengthens the role of the Climate Change Advisory Council in proposing carbon budgets;
- Introduces a requirement to annually revise the Climate Action Plan and prepare a National Long Term Climate Action Strategy at least every decade;
- Introduces a requirement for all Local Authorities to prepare individual Climate Action Plans which will include both mitigation and adaptation measures.

On 14 July 2021, the European Commission adopted a series of legislative proposals setting out how the EU intends to achieve climate neutrality by 2050 including the intermediate target of at least a 55% net reduction in greenhouse gas emissions by 2030. The package of proposals[72] (known as the 'Fit for 55 Package') includes revisions to the legislation put forward as part of the Climate and Energy Framework 2021-2030, including the EU Emissions Trading System (ETS), Effort Sharing Regulation, transport and land use legislation. The package sets out in real terms the ways in which the Commission intends to reach EU climate targets under the European Green Deal. There is a new Emission Trading System proposed for the transport sector from 2026 as part of the package. The new ETS for road transport will be upstream focused, regulating fuel suppliers. The new ETS is proposed as emissions from road transport have risen in recent years.

There is a constraint in relation to meeting Ireland's Climatic Obligations whereby the project must ensure alignment with the national and European targets and commitments for a low carbon future.

The first carbon budget programme proposed by the Climate Change Advisory Council was approved by Government and adopted by both Houses of the Oireachtas in April 2022.

The carbon budgets comprise of three successive 5-year budgets. The total emissions allowed under each budget is set out below in Table 4.8. as well as the average annual reduction for each 5-year period.

[72] European Commission, 2021. Fit for 55 Package. Available at: https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/

Table 4.8.1 Carbon Budgets Comprise of Three Successive 5-year Budgets

Period	Mt CO_2eq	Emission Reduction Target
2021-2025	295 Mt CO_2eq	Reduction in emissions of 4.8% per annum for the first budget period.
2026-2030	200 Mt CO_2eq	Reduction in emissions of 8.3% per annum for the second budget period.
2031-2035	151 Mt CO_2eq	Reduction in emissions of 3.5% per annum for the third provisional budget.

The CAP 2023 provides that the economy-wide carbon budgets will be supplemented by sectoral emissions ceilings, setting the maximum amount of GHG emissions that are permitted in a given sector of the economy during each five-year carbon budget. The Sectoral Emission Ceilings for each Sector, published in July 2022, is shown in Table 4.8.2. It should be noted that 5.25 $MtCO_{2eq}$ of annual emissions reductions are currently unallocated on an economy-wide basis for the second carbon budget period (2026-2030). These will be allocated following a mid-term review and identification of additional abatement measures. The transport sector emitted approximately 12 $MtCO_{2eq}$ in 2018 and has a ceiling of 6 $MtCO_{2eq}$ in 2030 which is a 50% reduction over this period.

Table 4.8.2 Sectoral Emission Ceilings for each Sector

Sector	Reduction Required	2018 Emissions ($MtCO_{2eq}$)	2030 Emission Ceiling ($MtCO_{2eq}$)
Electricity	75%	10.5	3
Transport	50%	12	6
Buildings (Commercial and Public)	45%	2	1
Buildings (Residential)	40%	7	4
Industry	35%	7	4
Agriculture	25%	23	17.25
Other*	50%	2	1

* = F-gases, Petroleum Refining and Waste

Local Climate Policy

Leitrim County Council has prepared a Climate Change Adaptation Strategy for period 2019-2024[73]. The Climate Change Adaptation Strategy takes on the role as the primary instrument at local level to:

- Ensure a proper comprehension of the key risks and vulnerabilities of climate change
- Bring forward the implementation of climate resilient actions in a planned and proactive manner
- Ensure that climate adaptation considerations are mainstreamed into all plans and policies and integrated into all operations and functions of Leitrim County Council

Roscommon County Council has prepared a Climate Change Adaptation Strategy for period 2019-2024[74]. The Climate Change Adaptation Strategy takes on the role as the primary instrument at local level to

- Ensure a proper comprehension of the key risks and vulnerabilities of climate change
- Bring forward the implementation of climate resilient actions in a planned and proactive manner
- Ensure that climate adaptation considerations are mainstreamed into all plans and policies and integrated into all operations and functions of Leitrim County Council

The strategies provide for many actions that will be developed and implemented over a five-year period.

There is a constraint in relation to ensuring the development of the project allows for the local climate targets and commitments to be met.

4.8.2.3 Sources of Information

The existing constraints have been determined through the review of published data from the EPA and Met Eireann on existing and projected greenhouse gas emissions.

4.8.3 Existing Environment

This section describes the existing climate conditions in Ireland and the Midlands, and as such, within the study area.

[73] Leitrim County Council, 2019. Leitrim County Council Climate Change Adaptation Strategy 2019 - 2024. Available at: https://leitrimcoco.ie/eng/Services_A-Z/Environment/Climate-Change-Adaptation-Strategy/Leitrim-CCAS-2019-2024-.pdf

[74] Roscommon County Council, 2019. Roscommon County Council Climate Change Adaptation Strategy 2019 - 2024. Available at: https://www.roscommoncoco.ie/en/About_Us/Business-Units/Assets-Energy-Management/Climate-Change-Adaptation-Strategy-2019-%E2%80%93-2024/Final-Climate-Change-Adaptation-Strategy-2019-%E2%80%93-2024.pdf

4.8.3.1 Climate

The existing climate within the study area corresponds with the general climatic conditions for Ireland which is dominated by the Atlantic Ocean and its air and oceanic currents.

The World Meteorological Organization (WMO) recommends that climate averages are computed over a 30-year period of consecutive records. The period of 30 years is considered long enough to smooth out year to year variations. Met Eireann holds 30-year data[75] for the Mullingar Meteorological station, the closest station to the study area that holds such data. The average annual temperature is 9.3°C. Mean annual wind speed is 4 m/sec. Average rainfall in the Midlands region is approximately 950mm with, on average, 3.6 hours of sunshine per day.

According to the United Nations Integrated Panel on Climate Change, Ireland's average temperature has increased by 0.7°C over the last 100 years. Temperatures in Ireland are predicted to increase by 1.25 – 1.5°C by 2040 compared to 1961 to 2000. This rise has the potential to affect the intensity and frequency of storms in the North Atlantic. Rainfall is expected to increase in Ireland in winter by about 15% and summer projections range from no change to a 20% decrease.

4.8.3.2 Greenhouse Gas Emissions

In June 2022, the EPA released the report Ireland's Greenhouse Gas Emissions Projections 2021-2041[76], which includes total projected emissions and a breakdown of projected emissions per sector under the "With Existing Measures" and "With Additional Measures" scenarios.

Implementation of "Additional Measures" (including those in the 2021 Climate Action Plan), transport emissions are projected to decrease by 28% over the period 2020 to 2030 from 10.3 to 7.4 Mt $CO_{2\ eq}$.

Table 4.8.3 outlines the projected emissions in 2030 for the 'With Existing Measures' and 'With Additional Measures' scenarios for the transport sector.

Table 4.8.3 Projected Emissions for the Transport Sector (EPA, 2022)[76]

Scenarios	Projected Emissions for transport sector in 2030 (Mt CO_2 eq.)
Projections (with existing measures)	10.3
Projections (with additional measures)	7.4

[75] Met Eireann, 2021. 30-year Climate Averages. Available at: https://www.met.ie/climate/30-year-averages
[76] EPA, 2022. Ireland's Greenhouse Gas Emissions Projections. Available at: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-Ireland's-GHG-Projections-Report-2021-2040v4.pdf

There is a constraint in relation to ensuring the development of the project allows for the emissions reduction targets and carbon budgets to be met.

4.8.4 Summary

The main climate constraints relate to developing a transport solution in accordance with the requirements of Ireland's national carbon budgets and EU climate change commitments. This will be the main constraint for the N4 Carrick-on-Shannon to Dromod Project, as potential projected increases in carbon emissions due to the project will need to align with carbon budgets.

An objective of the project, as outlined in Section 1.5. of this report is as follows – *to ensure the improvement of the N4 with consideration of sustainable development principles and measures to minimise the effects on the environment in support the government's Climate Action Plan.*

It is essential that the N4 Carrick-on-Shannon to Dromod Project harnesses low carbon construction materials, material reuse, enables modal shift and lowered operational carbon to ensure the project aligns with climate targets and requirements.

4.9 Noise and Vibration

4.9.1 Introduction

This section describes the noise and vibration constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the noise and vibration constraints shown in Figures 4.9.1.0 to 4.9.2.5.

The specific objective of the noise and vibration constraints study is to identify any receptors that may be deemed to be particularly sensitive to noise and/or vibration. Examples of receptors include schools, hospitals, places of worship, heritage buildings, special habitats, amenity areas in common use and designated quiet areas. Residential buildings including houses, hotels, hostels etc. are also noise sensitive (Source: TII Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes[77] and Guidelines for the Treatment of Noise and Vibration in National Road Schemes[78]. Some commercial or industrial uses can also be noise sensitive, for example noise recording studios and manufacturing facilities using noise or vibration-sensitive equipment.

Whilst is it preferable to locate new road developments away from noise sensitive areas where feasible, it is not always possible, particularly for roads located close to and through urban and sub-urban settings. For the proposed N4 Carrick-on-Shannon to Dromod Project, there is a high density of noise sensitive buildings and noise sensitive areas centred around Carrick-on-Shannon and its environs, and to a lesser extent around the towns of Drumsna and Jamestown.

From a constraints point of view for noise, the objective is largely to avoid, where necessary and where possible. The location of alternatives and options through built up areas with a large density of noise sensitive buildings, particularly those not already exposed to high volumes of traffic and associated road traffic noise should be avoided where possible.

Section 4.9.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.9.3 describes the noise and vibration constraints within the study area. A summary is presented in Section 4.9.4.

4.9.2 Methodology and Sources of Information

The noise and vibration constraints study has been prepared in accordance with the following guidelines:

[77] National Roads Authority (NRA), 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Good_Practice_Guidance_for_the_Treatment_of_Noise_during_the_Planning_of_National_Road_Schemes.pdf

[78] National Roads Authority (NRA), 2004. Guidelines for the Treatment of Noise and Vibration in National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Treatment_of_Noise_and_Vibration_in_National_Road_Schemes.pdf

- National Roads Authority (NRA) (2014) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes[77] (hereafter referred to as NRA 2014)
- NRA (2004) Guidelines for the Treatment of Noise and Vibration in National Road Schemes[78]

The study consisted of a desk-based study and a preliminary site inspection of the project study area.

The following information was reviewed as part of this study:

- OS Mapping (2016/2017)
- Open Streetmap [79]
- Satellite Mapping (Google Earth Imagery Year – 2020))
- EPA Road Traffic Noise Maps Round 3 (2016)[80]
- Leitrim County Council Noise Action Plan 2013 to 2018[81]
- Roscommon County Council Noise Action Plan 2018 to 2023[82]
- Submissions received in relation to Public Consultation No. 1 - Constraints

4.9.3 Existing Environment

This section is set out as follows:

- Description of existing noise environment
- Identification of any receptors that may be deemed to be particularly sensitive to noise and/or vibration

4.9.3.1 Review of Published Noise Data

The study area comprises a mixture of rural, suburban and urban areas. Road traffic is likely the dominant source of noise across the study area to varying extents depending on the proximity of sensitive receptors to national roads (N4), regional roads (R370, R368, R280, R299 and R201) and the extensive network of local roads. Within the town of Carrick-on-Shannon and to lesser extent the smaller built up areas of Drumsna, Jamestown and Aghamore additional sources typically relate to commercial and business facilities etc. Outside these areas, background noise from agricultural sources and general environmental sources (e.g. foliage, bird

[79] OSM, 2021. Open Streetmap. Available at: https://www.openstreetmap.org/
[80] Environmental Protection Agency (EPA), 2020. EPA Webmapping Service. Available at: https://gis.epa.ie/EPAMaps/
[81] Leitrim County Council, 2018. Noise Action Plan 2018 to 2023. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Environment/Noise-Control/Noise-Action-Plan-2018-2023.pdf
[82] Roscommon County Council, 2018. Noise Action Plan 2018 – 2023. Available at: http://www.roscommoncoco.ie/en/Services/Environment/Air-and-Noise-Regulation/Noise/Noise-Action-Plan-2018-2023.pdf

song, amenity activities etc.) are additional contributing sources over and above road traffic.

The road traffic noise mapping in the Round 3 Noise Mapping published by the EPA as part of the Environmental Noise Regulations[83] has been reviewed to determine the range of modelled traffic noise in the vicinity of the study area. As part of the noise mapping requirements, all roads with traffic flows greater than 3 million vehicle trips per annum, which is approximately 8,000 Annual Average Daily Traffic (AADT), were required to be mapped. Within the Leitrim County Council section of the study area, a small section of the N4 road met this criterion and was therefore included in the EPA noise modelling and mapping process. The extent of the mapped road is noted as follows:

- Carrick-on-Shannon: N4 Dublin Road from Attifinlay Roundabout to Carrick-on-Shannon Bypass Road/River Shannon Bridge (at the Roscommon/Leirtrim county border)

Within the Roscommon County Council portion of the study area, a small section of the N4 road met this criterion and hence was included within the EPA noise modelling and mapping process. The extent of the mapped road is noted as follows:

- Carrick-on-Shannon: N4 River Shannon Bridge to Cortober

Noise levels due to road traffic sources from these sections of road have been modelled and the relevant noise maps prepared. The maps are presented in noise contour bands in increments of 5 decibels starting at 55dB L_{den} and 50dB $L_{night.}$ Figure 4.9.1.0 to Figure 4.9.1.5 display the noise maps for the L_{den} period (Annual 24-hour average) which is the noise parameter used to assess road traffic noise in Ireland[77,78].

The results of the mapping indicate that along the mapped section of the N4 Road, noise sensitive buildings (residences and hotels) lie within the 60 dB to 64 dB L_{den} noise contours typically within 30 – 35m from the road edge, reducing to within the 55 dB to 59 dB L_{den} noise contour beyond approximately 35m from the road edge.

The Riverfront Amenity Park to the south of the N4 Carrick-on-Shannon bypass is mapped within the 65 dB to 69 dB L_{den} noise contour at distances of up to 15m from the road edge. At distances between 15m and 50m from the road edge, the park area is mapped within the 60 dB to 64 dB L_{den} noise contour. At distances beyond 50m from the road edge, the park area is mapped within the 55 dB to 59 dB L_{den} noise contour.

It should be noted that the noise contour maps extend only for the sections of the N4 which were included in the mapping. Traffic noise levels along the remainder of the N4 are likely to result in similar noise levels at the same distances from the road as those discussed above. Noise from road traffic along the regional and local roads within the study area will also contribute to the ambient noise levels in the vicinity of these roads.

[83] Government of Ireland, 2018. S.I. No. 549/2018 – European Communities (Environmental Noise) Regulations. Available at: http://www.irishstatutebook.ie/eli/2018/si/549/made/en/print

4.9.3.2 Identification of Noise and/or Vibration Sensitive Receptors

The study area was examined to identify the distribution of noise and/or vibration sensitive receptors and to determine the presence, if any, of significant constraints relating to noise and/or vibration.

Noise and/or vibration sensitive areas were grouped into the following categories:

- Education establishments (primary schools, secondary schools, college and university buildings)
- Hospitals/Medical facilities
- Amenity areas with noise sensitivity (camping areas, golf clubs, parks, fishing areas etc)
- Religious buildings
- Residential areas

The OS mapping and satellite imagery mapping were reviewed in order to identify the presence of these locations. These are discussed in the following sections.

Education Establishments

The location of schools within the study area have been identified and annotated as part of the constraint mapping process for the study. A total of four schools are identified within Carrick-on-Shannon. These school buildings are located off local roads to the west of Carrick-on-Shannon town. One school is located at Dangan and one at Annaduff. The presence of a school building does not preclude the development of alternatives or options in its vicinity; however, their presence should be included for consideration to avoid encroaching in proximity, which could cause high noise levels and potential impacts, particularly for those set back within quieter locations.

Hospitals/Nursing Homes

There are no hospital buildings within the study area. There are two nursing homes identified; Castlecara to the west of Carrick-on-Shannon, located off the Castlecara Road and St. Patricks Community Hospital nursing home at Summerhill.

Amenity Areas

The location of amenity areas which are considered sensitive to noise within the study area have been identified and annotated as part of the constraint mapping process for the study. The locations include the River Front Amenity Park within Carrick-on-Shannon, Carrick Camping site, Kingfisher Cycle Trail spur, Albert Canal Lock and Marina, Public Moorings at Jamestown, and Carrick-on-Shannon Marina. The length of the River Shannon has also been identified as a high amenity area given its use for boating, fishing, water sports, riverside walks etc. Where the prevailing noise environment in these areas is considered an important part of the area's character, consideration should be taken to preserve the noise environment within defined noise thresholds.

Leitrim and Roscommon County Council's Noise Action Plans (NAP) include an onset noise assessment level for measures to preserve the existing noise situation as the following in these identified amenity areas:

- 55dB L_{den}
- 45dB L_{night}

During the development of options in the study area, the prevailing noise environment within amenity areas will be considered to ensure those areas with noise levels below the onset noise assessment level for the preservation of the existing noise situation are protected, as far as practicable.

Religious Buildings

There are seven churches and five graveyards distributed within the study area. Three active churches and a graveyard are identified within Carrick-on-Shannon, one church within Dangan, and two active churches within Annaduff. Whilst these buildings and/or areas are noise sensitive when in use by the public, they are commonly located within urban and suburban settings in proximity to existing roads. The presence of a church or other religious building does not preclude the development of alternatives or options in its vicinity. The presence of these buildings and/or areas should, however, be considered when developing alternatives and options for the project, particularly for those set back within quieter locations.

Residential Areas and Accommodation Buildings

The overall study area is relatively low in housing density. The most densely populated residential areas are located at Carrick-on-Shannon and to lesser extents smaller built-up areas of Drumsna, Jamestown and Cortober. There are a number of guest houses, B&B's and hotels used for short term accommodation within Carrick-on-Shannon.

Within the remainder of the study area, residential dwellings are typically in ribbon style development along the local and regional roads and clustered at crossroads. Given the distribution of towns and villages, housing clusters and individual residential buildings along the extensive regional and local road network within the study area, it will not be possible for any off-line options to avoid passing in proximity to them. Consideration will however be given to development of options which minimise the number of residential buildings exposed to road traffic, as far as practicable. This will form part of the Option Selection process.

For the purpose of this assessment, individual residential buildings or short-term accommodation buildings have not been highlighted in the constraint mapping due to their number and distribution, however, the areas of Carrick-on-Shannon, Drumsna, Jamestown and Cortober are annotated. Whilst individual residential buildings and residential clusters are not specifically marked on mapping, the development of any off-line options will need to consider avoiding areas with a high density of noise sensitive locations which will include those passing through villages and urban areas.

It is important to note that the presence of the noise sensitive receptors listed above is not necessarily considered to be a strict constraint which would prevent the

development of alternatives or options in proximity to them. The purpose of this initial exercise is to highlight those areas which should be considered, where possible, when developing alternatives and options in conjunction with the other identified constraints. In this instance, where it is not possible to develop alternatives or options away from identified noise sensitive locations, consideration can be given to the vertical alignment, the use of natural screening or false cuttings to act as noise buffers and mitigation measures as part of the design of a road based option.

Residential dwellings make up most of the noise sensitive receptors within the study area extending out to all areas of the constraint boundaries. Other noise sensitive receptors include hotels, educational or religious buildings, and amenity areas. These tend to be located primarily in existing built-up areas and are generally less distributed across the study area compared to housing, so are easier to avoid.

In terms of the constraint study, the development of alternatives and options needs to consider the following for residential areas:

- Areas of housing clusters within areas set back from existing road traffic noise
- Areas of high-density housing in proximity to existing road traffic noise (e.g. those along the existing N4)
- Residential clusters at crossroads, townlands, village centres, etc.
- Ribbon style residential housing along local roads

In this instance, consideration will be given to a balance among protecting residential properties currently not exposed to high levels of road traffic noise and not increasing or generating significant negative impacts to residential properties already exposed to high levels of road traffic and other environmental sources. Where possible, alternatives and options passing through or in proximity to clusters of residential estates with large populations should be avoided.

For other noise sensitive areas, consideration will be given to the sensitivity of specific receptors depending on their use in addition to the existing noise environment in which they are located.

For all receptors, the availability for noise mitigation in the form of the horizontal and vertical alignments, natural screening and road surfaces will all be considered during the Phase 3 Design and Environmental Evaluation stage of the project.

4.9.4 Summary

The constraint study area for the N4 Carrick-on-Shannon to Dromod Project is made up of a mixture of urban, suburban and rural areas. The study area within and surrounding Carrick-on-Shannon contains the highest density of residential areas, schools and religious buildings. The River Shannon and adjacent amenity areas along its corridor extends from northwest of Carrick-on-Shannon to Lough Boderg southeast of the study area and therefore covers an extensive section of the study area. Outside of Carrick-on-Shannon, the study area consists of lower density villages and for much of the remaining study area is categorised as rural to semi-rural with low density residential and amenity areas with lower noise environments.

Whilst there is a mix of noise sensitive areas distributed across the study area, a large proportion of these are already exposed to road traffic noise to varying degrees depending on traffic volumes, distance from the road edge and screening.

During the development of alternatives and options, consideration will be given to protecting existing noise sensitive areas and incorporating noise mitigation into the base design including the use of natural topographical features and false cuttings, where feasible.

4.10 Archaeological, Architectural and Cultural Heritage

4.10.1 Introduction

This section describes the archaeological, architectural, and cultural heritage constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the archaeological, architectural, and cultural heritage constraints shown on Figure 4.10.1.0 to 4.10.1.5.

Section 4.10.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.10.3 describes the archaeological, architectural, and cultural heritage constraints within the study area. A summary is presented in Section 4.10.4.

4.10.2 Methodology and Sources of Information

The study has been carried out in accordance with the TII Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes (2005a) and the TII Guidelines for the Assessment of Architectural Heritage Impacts of National Road Scheme (2005b)[84]. The assessment comprises a study of the archaeological, architectural, historical, and cultural background of the study area. This includes information from the Record of Monuments and Places (RMP) and the Sites and Monuments Records (SMR) of Counties Leitrim and Roscommon as well as a review of all relevant county development plans and the National Inventory of Architectural Heritage (NIAH).

This Constraints Study is a desktop survey, and the following sources were reviewed to identify archaeological, architectural, and cultural heritage constraints:

- Record of Monuments and Places (RMP) for County Leitrim and County Roscommon[85]
- Sites and Monuments Record (SMR) for County Leitrim and County Roscommon [85]
- Monuments in State Care Database[86]
- Preservation Orders[87]
- Register of Historic Monuments[85]
- Leitrim County Development Plan, 2015-2021[13]

[84] TII, 2005. Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes. Available at: https://www.tiipublications.ie/downloads/SRM/12-Archaeology-Planning-Guidelines-2005.pdf
[85] Available at: http://webgis.archaeology.ie/historicenvironment/
[86] Available at: https://www.archaeology.ie/national-monuments/search-by-county
[87] National Monuments Service (June 2019) Preservation Orders, Available from https://www.archaeology.ie/sites/default/files/media/publications/po19v1-all-counties.pdf

- Roscommon County Development Plan, 2014-2020[14]
- Historic Ordnance Survey mapping (1835-6, 1838, 1882-7, 1889-95, 1907-13)[85] [88]
- National Inventory of Architectural Heritage (NIAH): Architectural and Garden Survey, County Leitrim and County Roscommon[89]
- Excavations Bulletin (1970-2019)[90]

Once all Archaeological Heritage (RMP/SMR) and Built Heritage (protected structures and NIAH structures) sites were identified during the initial research, the information was plotted onto a map of the study area. In addition, Designed Landscapes (also known as demesnes), which may not be subject to statutory protection, but which should nonetheless be considered as cultural heritage constraints, were also added, and mapped. These often include the site or ruins of former country houses.

The Draft Leitrim County Development Plan 2023-2029 was adopted on 7 February 2023, and it is coming into effect on 21 March 2023. There will be additions and deletions to the protected structures listed in the new Plan when it becomes effective. Of the 11 number additions, only one is relevant to the study area, and that is the addition of a façade to a shop in the town of Carrick-on-Shannon. There are nine structures to be removed, but only one of these is relevant to the study area, and it is not omitted fully, rather it is amalgamated with another existing entry on the list. Therefore, the new Plan will not affect this constraints study, and all figures are cross-referenced against the current Plan.

4.10.3 Existing Environment

The study area is characterised by a rural environment across the majority of the landscape, with suburban settlements such as Carrick-on-Shannon, Cortober, Jamestown, Drumsna, Dromod, and Aghamore. The rural landscape is mostly utilised for pastoral farming with some forestry also present. The cultural heritage resource is characterised by numerous recorded monuments from various periods, mainly the early medieval, protected structures, and a small number of designed landscapes dating to the 19th century.

4.10.3.1 Archaeological Heritage

RMP/SMR Sites within the Study Area

A total of 364 individual RMP/SMR sites have been identified within the study area, which covers an area measuring approximately 7,820 hectares (ha). The sites have been grouped in 307 sites, which allows for the identification of groups of monuments that may occur in association with one another. These sites are labelled as Archaeological Heritage (AH) sites in Figures 4.10.1.0 to 4.10.1.5 and listed in

[88] Available at: http://www.askaboutireland.ie/griffith-valuation/index.xml?action=placeSearch
[89] Available at: http://www.buildingsofireland.ie/
[90] Available at: https://excavations.ie/

Table 4.10.1. Where sites have been identified through archaeological excavation, the relevant excavation (EX) number is provided in Table 4.10.1.

Table 4.10.1 Archaeological Heritage Sites within the Study Area

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 1	RO007-107	Barrow - ring-barrow	Woodbrook	Proposed RMP
AH 2	RO007-096	Burnt mound (EX 2)	Woodbrook	None
AH 3	RO007-097	Burnt mound (EX 2)	Woodbrook	None
AH 4	RO007-098	Excavation - miscellaneous (EX 2)	Cloongownagh	Proposed RMP
AH 5	RO007-099001	Excavation - miscellaneous (EX 2)	Cloongownagh	None
	RO007-099002	Excavation - miscellaneous (EX 2)	Cloongownagh	Proposed RMP
AH 6	RO011-008	Ringfort - rath	Cloongownagh	RMP
AH 7	RO007-100	Excavation - miscellaneous (EX 2)	Cloongownagh	None
AH 8	RO011-164001	Burnt mound (EX 1)	Cloongownagh	None
	RO011-164002	Excavation - miscellaneous (EX 1/2)	Cloongownagh	None
AH 9	RO007-095	Redundant record	Cloongownagh	None
AH 10	RO011-160001	Ringfort - rath (EX 1)	Cloongownagh	Proposed RMP
	RO011-160002	Enclosure (EX 1)	Cloongownagh	Proposed RMP
	RO011-160003	Hut site (EX 1)	Cloongownagh	None
	RO011-160004	Fulacht fia (EX 1)	Cloongownagh	None
	RO011-160005	Burnt mound (EX 1/10)	Cloongownagh	None
	RO011-160006	Burnt mound (EX 1)	Cloongownagh	Proposed RMP
	RO011-160007	Burnt mound (EX 1)	Cloongownagh	Proposed RMP
	RO011-160008	House - prehistoric (EX 1)	Cloongownagh	None
AH 11	RO011-005	Ringfort - rath	Dorrary	RMP
AH 12	RO011-009	Redundant record	Cuiltyconeen	None
AH 13	RO011-010	Ringfort - rath	Cuiltyconeen	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 14	RO011-016	Ringfort - rath	Cuiltyconeen	RMP
AH 15	RO011-165001	Burnt mound (EX 2)	Cuiltyconeen	Proposed RMP
	RO011-165002	Burnt mound (EX 1)	Cuiltyconeen	Proposed RMP
AH 16	RO011-011	Redundant record	Meera	None
AH 17	RO011-017	Redundant record	Meera	None
AH 18	RO011-175	Ringfort - rath	Meera	Proposed RMP
AH 19	RO011-018	Ringfort - rath	Meera	RMP
AH 20	RO011-174	Ringfort - rath	Meera	Proposed RMP
AH 21	RO007-089	Ringfort - rath	Tumna	RMP
AH 22	RO007-090	Ringfort - rath	Tumna	RMP
	RO011-019	Ringfort - rath (EX 7)	Cloonmaan	RMP
AH 23	RO011-020001	Ringfort - rath	Cloonmaan	Proposed RMP
	RO011-020002	Hut site	Cloonmaan	Proposed RMP
AH 24	RO011-023	Ringfort - rath	Cloonskeeveen	RMP
AH 25	RO011-024001	Ringfort - rath	Cloonskeeveen	Proposed RMP
	RO011-024002	House - indeterminate date	Cloonskeeveen	Proposed RMP
AH 26	RO011-025	Ringfort - rath	Cloonskeeveen	RMP
AH 27	RO011-026	Ringfort - rath	Cloonskeeveen	RMP
AH 28	RO011-027	Ringfort - rath	Cloonskeeveen	RMP
AH 29	RO011-012	Ringfort - rath (EX 3)	Tawlaght (Boyle By., Killukin Ed)	RMP
AH 30	RO011-013	Ringfort - rath (EX 3)	Sroankeeragh	RMP
AH 31	RO011-014001	Ringfort - rath	Tawlaght (Boyle By., Killukin Ed)	Proposed RMP
	RO011-014002	Ringfort - rath	Tawlaght (Boyle By., Killukin Ed)	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 32	RO011-015	Ringfort - cashel	Tawlaght (Boyle By., Killukin Ed)	RMP
AH 33	RO011-156	Ringfort - rath	Knockadalteen	RMP
AH 34	RO011-155	Ringfort - rath	Tawlaght (Boyle By., Killukin Ed)	RMP
AH 35	RO011-021	Ringfort - rath	Mullaghmore	RMP
AH 36	RO011-022	Ringfort - rath	Drishoge	RMP
AH 37	RO011-035	Ringfort - cashel	Scregg (Boyle By.)	RMP
AH 38	RO011-167	Mass-rock	Knockananima	Proposed RMP
AH 39	RO011-169	Ringfort - rath	Scregg (Boyle By.)	Proposed RMP
AH 40	RO011-177	Ringfort - rath	Knockadalteen	Proposed RMP
AH 41	RO011-178	Enclosure	Mullaghmore	Proposed RMP
AH 42	RO011-179	Ringfort - rath	Mullaghmore	Proposed RMP
	RO011-179001	Hut site	Mullaghmore	Proposed RMP
AH 43	RO011-189	Ringfort - rath	Mullaghmore	Proposed RMP
AH 44	RO018-005	Barrow - unclassified	Skeagh	RMP
AH 45	LE035-017	Standing stone	Fearnaght	RMP
AH 46	LE035-018	Bullaun stone	Fearnaght	RMP
	LE035-018001	Ritual site - holy well	Fearnaght	Proposed RMP
AH 47	RO011-157	Ringfort - rath	Killukin (Boyle By.)	RMP
AH 48	RO011-044001	Ringfort - cashel	Killukin (Boyle By.)	Proposed RMP
	RO011-044002	Redundant record	Killukin (Boyle By.)	None
AH 49	RO011-047001	Church	Killukin (Boyle By.)	RMP
	RO011-047002	Graveyard	Killukin (Boyle By.)	RMP
	RO011-047003	Ecclesiastical enclosure	Killukin (Boyle By.)	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 50	RO011-166	Inscribed stone	Danesfort	Proposed RMP
AH 51	RO011-041	Ringfort - rath	Lodge	RMP
AH 52	RO011-042	Ringfort - rath	Deerpark (Boyle By., Danesfort Ed), Lodge	RMP
AH 53	RO011-043	Ringfort - rath	Deerpark (Boyle By., Danesfort Ed)	RMP
AH 54	RO011-045	Ritual site - holy well	Glebe (Boyle By., Danesfort Ed)	Proposed RMP
AH 55	RO011-046	Ringfort - rath	Danesfort	Proposed RMP
AH 56	RO011-048	Ringfort - rath	Danesfort	RMP
AH 57	RO011-049	Ringfort - rath	Danesfort	RMP
AH 58	RO011-162001	Mill - unclassified	Deerpark (Boyle By., Danesfort Ed)	Proposed RMP
AH 59	RO011-163	Enclosure - large enclosure	Deerpark (Boyle By., Danesfort Ed)	Proposed RMP
AH 60	RO011-073	Ringfort - rath	Cartron (Boyle By., Danesfort Ed)	RMP
AH 61	RO011-074	Ringfort - rath	Danesfort	RMP
AH 62	RO011-183	Ringfort - rath	Danesfort	Proposed RMP
AH 63	RO011-150001	House - 17th century	Cortober	Proposed RMP
	RO011-150002	Bridge (EX 8)	Cortober	Proposed RMP
AH 64	LE031-005	Historic town (EX 21-26/29/32-38/40-46)	Townparks	RMP
	LE031-005001	Fortification (EX 8) (also BH 4)	Townparks	Proposed RMP, RPS
	LE031-005002	Church (Also BH 4)	Townparks	Proposed RMP, RPS
	LE031-005003	Mausoleum	Townparks	RPS
	LE031-005004	Bridge (also BH 4)	Townparks	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 65	RO011-028	Ringfort - rath	Cordrehid	RMP
AH 66	RO011-180	Ringfort - rath	Cortober	Proposed RMP
AH 67	RO011-181	Ringfort - rath	Cortober	Proposed RMP
AH 68	RO011-182	Ringfort - rath	Cortober	Proposed RMP
AH 69	RO011-050	Enclosure	Danesfort	RMP
AH 70	RO011-051	Ringfort - rath	Danesfort	RMP
AH 71	LE031-099	Ringfort - rath	Townparks	RMP
AH 72	LE031-006	Ringfort - unclassified	Townparks	RMP
AH 73	LE031-001	Ringfort - rath	Lisnagat	RMP
AH 74	LE031-002	Ringfort - rath (EX 18)	Lisnagat	RMP
	LE031-002001	Hut site (EX 19)	Lisnagat	None
AH 75	LE027-099	Ringfort - rath	Hartley	RMP
AH 76	LE027-101	Ringfort - rath (EX 20)	Cartown	RMP
AH 77	LE027-143	Ringfort - rath	Cartown	Proposed RMP
AH 78	LE027-104	Ringfort - rath	Grange	RMP
AH 79	LE027-105001	Church	Drumheckil	Proposed RMP
AH 80	LE027-102	Ringfort - rath	Cloonsheebane	RMP
AH 81	LE027-103	Ringfort - rath	Ballynamony (Leitrim By.)	RMP
AH 82	LE031-003	Ringfort - rath (EX 39)	Ballynamony (Leitrim By.)	RMP
AH 83	LE031-004	Megalithic structure	Ballynamony (Leitrim By.)	RMP
AH 84	LE031-105	Ringfort - rath	Ballynamony (Leitrim By.)	Proposed RMP
AH 85	LE031-113	Ringfort - rath	Cloonsheebane	Proposed RMP
AH 86	LE027-106	Ringfort - rath	Drumlumman	RMP
AH 87	LE027-107	Ringfort - rath	Drumlumman	RMP
AH 88	LE027-108	Ringfort - rath	Grange	RMP
AH 89	LE027-109	Ringfort - rath	Grange	RMP
AH 90	LE027-110	Ringfort - rath	Drumlumman	RMP
AH 91	LE027-111	Ringfort - rath	Lismakeegan	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 92	LE027-112	Ringfort - rath	Lismakeegan	RMP
AH 93	LE027-113	Enclosure	Lismakeegan	RMP
AH 94	LE027-114	Enclosure	Tonnagh	Proposed RMP
AH 95	LE027-115	Ringfort - rath	Tonnagh	RMP
AH 96	LE031-007	Ringfort - rath	Cloonmulligan	RMP
	LE031-007001	Enclosure	Cloonmulligan	Proposed RMP
AH 97	LE031-008	Ringfort - rath	Aghameeny	RMP
AH 98	LE031-009	Castle - unclassified	Aghancarra	None
AH 99	LE031-126	Ringfort - rath	Dromore (Leitrim By.)	Proposed RMP
AH 100	LE031-022	Ringfort - rath	Clogher (Leitrim By.)	RMP
AH 101	LE031-114	Ringfort - rath	Dromore (Leitrim By.)	Proposed RMP
AH 102	LE031-115	Enclosure	Clogher (Leitrim By.) Dromore (Leitrim By.)	Proposed RMP
AH 103	LE031-116	Redundant record	Clogher (Leitrim By.)	None
AH 104	LE031-117	Enclosure	Clogher (Leitrim By.)	Proposed RMP
AH 105	LE031-010	Ringfort - rath	Keenaghan	RMP
AH 106	LE031-011	Ringfort - rath	Keenaghan	RMP
AH 107	LE031-012	Ringfort - rath	Keenaghan	RMP
AH 108	LE031-013	Ringfort - rath	Correen	RMP
AH 109	LE031-014	Ringfort - rath	Correen	RMP
AH 110	LE031-015	Ringfort - rath (EX 58)	Dromore (Leitrim By.)	RMP
AH 111	LE031-016	Ringfort - rath (EX 58)	Cornaslieve	RMP
AH 112	LE031-017	Ringfort - rath	Cornaslieve	RMP
AH 113	LE031-018	Ringfort - rath	Correen	RMP
AH 114	LE031-019	Ringfort - rath	Lisduff (Leitrim By., Carrick-On-Shannon Ed)	RMP
AH 115	LE031-020001	Ringfort - rath	Lisduff (Leitrim By., Carrick-On-Shannon Ed)	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
	LE031-020002	Church	Lisduff (Leitrim By., Carrick-On-Shannon Ed)	Proposed RMP
AH 116	LE031-021	Ringfort - rath	Garvlough	RMP
AH 117	LE031-023	Ringfort - rath	Aughriman South	RMP
AH 118	LE031-024	Ringfort - rath	Aughriman South	RMP
AH 119	LE031-106	Enclosure	Garvlough	Proposed RMP
AH 120	LE031-043	Ringfort - rath	Kiltycarney	RMP
AH 121	LE031-044	Ringfort - rath	Kiltycarney	RMP
AH 122	LE031-045	Ringfort - rath	Kiltycarney	RMP
AH 123	LE031-046	Ringfort - rath	Kiltycarney	RMP
AH 124	LE031-047	Ringfort - rath	Kiltycarney	RMP
AH 125	LE031-048	Ringfort - rath	Greagh (Leitrim By., Carrick-On-Shannon Ed)	RMP
AH 126	LE031-049	Ringfort - rath	Aughriman South	RMP
AH 127	LE031-050	Ringfort - rath	Aughriman South	RMP
AH 128	LE031-051	Ringfort - rath	Kiltycarney	RMP
AH 129	LE031-052	Ringfort - rath	Kiltycarney	RMP
AH 130	LE031-053	Ringfort - rath	Kiltycarney	RMP
AH 131	LE031-054	Ringfort - rath	Tully (Leitrim By., Carrick-On-Shannon Ed)	RMP
AH 132	LE031-055	Enclosure	Tully (Leitrim By., Carrick-On-Shannon Ed)	RMP
AH 133	LE031-056	Crannog	River Shannon	RMP
AH 134	LE031-057	Ringfort - rath	Minkill	RMP
AH 135	LE031-058	Ringfort - rath	Minkill	RMP
AH 136	LE031-059	Ringfort - rath	Minkill	RMP
AH 137	LE031-060	Ringfort - rath	Kildorragh (Leitrim By.)	RMP
AH 138	LE031-110	Ringfort - rath	Tully (Leitrim By., Carrick-On-Shannon Ed)	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 139	LE031-111	Redundant record	Tully (Leitrim By., Carrick-On-Shannon Ed)	None
AH 140	LE031-118	Ringfort - rath	Kiltycarney	Proposed RMP
AH 141	LE031-119	Ringfort - rath	Kiltycarney	Proposed RMP
AH 142	LE031-039	Burial ground	Attirory	RMP
	LE031-039001	Church	Attirory	Proposed RMP
	LE031-039002	Bullaun stone	Attirory	None
	LE031-039003	Ecclesiastical enclosure (EX 48-49)	Attirory	Proposed RMP
AH 143	LE031-040	Ringfort - rath (EX 16)	Lisseeghan	RMP
AH 144	LE031-041	Ringfort - rath	Drumkeeran (Leitrim By., Carrick-On-Shannon Ed)	RMP
AH 145	LE031-042	Ringfort - rath	Ballynacleigh	RMP
AH 146	LE031-072	Ringfort - rath	Rinnacurreen	RMP
AH 147	LE031-073	Ringfort - rath	Rinnacurreen	RMP
AH 148	LE031-096	Enclosure	Rinnacurreen	RMP
AH 149	LE031-120	Field system	Inishmucker Island	Proposed RMP
AH 150	LE031-098	Fulacht fia (EX 16)	Tully (Leitrim By., Carrick-On-Shannon Ed)	None
AH 151	LE031-101	Fulacht fia (EX 16)	Kiltycarney	None
AH 152	LE031-102	Mound	Tully (Leitrim By., Carrick-On-Shannon Ed)	Proposed RMP
AH 153	LE031-103	Burnt mound (EX 16)	Minkill	None
AH 154	LE031-104001	Fulacht fia (EX 16)	Kildorragh (Leitrim By.)	None
	LE031-104002	Hut site (EX 16)	Kildorragh (Leitrim By.)	None
AH 155	RO011-052	Redundant record	River Shannon	RMP
AH 156	RO011-053	Ringfort - rath	Charlestown	RMP
AH 157	LE031-074	Ringfort - rath	Drummaunroe	RMP
AH 158	LE031-075	Ringfort - rath	Lisgarney	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 159	LE031-076	Ringfort - rath (EX 55)	Jamestown	RMP
AH 160	LE031-077	Ringfort - rath	Drummaunroe	RMP
AH 161	LE031-078	Ringfort - rath	Drummaunroe	RMP
AH 162	LE031-079	Ringfort - rath	Drummaunroe	RMP
AH 163	LE031-080	Ringfort - rath	Drummaunroe	RMP
AH 164	LE031-081	Ringfort - rath	Rue	RMP
AH 165	LE031-083	Redundant record	River Shannon	None
AH 166	LE031-089	Ringfort - rath	Cornacorroo	RMP
AH 167	LE031-090	Ringfort - rath	Adereen	RMP
AH 168	LE031-091	Ringfort - rath	Gort	RMP
AH 169	LE031-092	Enclosure - large enclosure	Gort	RMP
AH 170	LE031-093	Designed landscape - tree-ring	Jamestown, Rue	None
AH 171	LE031-094	Ringfort - rath	Jamestown	RMP
AH 172	LE031-097	Ringfort - rath (EX 55)	Tully (Leitrim By., Carrick-On-Shannon Ed)	RMP
AH 173	LE031-108	Ringfort - rath	Coraughrim	Proposed RMP
AH 174	LE031-109	Enclosure	Jamestown	Proposed RMP
AH 175	LE031-112	Ringfort - rath	Coraughrim	Proposed RMP
AH 176	LE031-121	Ringfort - rath	Jamestown	Proposed RMP
AH 177	LE031-082	Historic town (EX 28/30/50-54/56)	Jamestown	RMP
	LE031-082001	Gateway (also BH 6)	Jamestown	Proposed RMP, RPS
	LE031-082002	Town defences (Also BH 6)	Jamestown	Proposed RMP, RPS
	LE031-082003	Redundant record	Jamestown	None
	LE031-082004	Church	Jamestown	Proposed RMP
	LE031-082005	Bastioned fort	Jamestown	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
	LE031-082006	Religious house - Franciscan friars	Jamestown	Proposed RMP
	LE031-082007	Bridge (EX 15)	Jamestown	Proposed RMP
	LE031-082008	Bridge	Jamestown	None
	LE031-082009	Graveyard (alos BH 6)	Jamestown	Proposed RMP
AH 178	RO011-151001	Bridge (EX 15)	Cloonavery	RMP
	RO011-151002	Bridge (EX 15) (Also BH 6)	Cloonavery	RMP
AH 179	RO011-075	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 180	RO011-076	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 181	RO011-077	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 182	RO011-078	Crannog	Lough Corry	RMP
AH 183	RO011-079	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 184	RO011-080	Linear earthwork	Corry (Roscommon By.)	RMP
AH 185	RO011-081	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 186	RO011-082	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 187	RO011-083	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 188	RO011-084	Ringfort - rath	Cloonfad Beg	RMP
AH 189	RO011-116----	Ringfort - rath	Corry (Roscommon By.)	RMP
AH 190	RO011-118	Ringfort - rath	Cloonfad Beg	RMP
	RO011-118001	Ringfort - rath	Cloonfad Beg	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 191	RO011-185	Ringfort - rath	Corry (Roscommon By.)	Proposed RMP
AH 192	RO011-086	Ringfort - rath	Cuiltyconway	RMP
AH 193	RO011-087	Ringfort - rath	Cuiltyconway	RMP
AH 194	RO011-172	Ringfort - rath	Cuiltyconway	Proposed RMP
AH 195	RO011-188	Linear earthwork (EX 9)	Cuiltyconway	Proposed RMP
AH 196	RO011-085	Ringfort - rath	Corgullion	RMP
AH 197	RO011-121	Ringfort - rath	Moneyduff	RMP
AH 198	RO011-122	Ringfort - rath	Tawnagh More	RMP
AH 199	RO011-123	Ringfort - rath	Tawnagh More	RMP
AH 200	RO011-126	Ringfort - rath	Liscolvan	RMP
AH 201	RO011-127	Ringfort - rath	Tawnagh More	RMP
AH 202	RO011-128001	Church	Kilbride	RMP
	RO011-128002	Graveyard	Kilbride	RMP
	RO011-128003	Redundant record	Kilbride	None
	RO011-128004	Ecclesiastical enclosure	Kilbride	Proposed RMP
AH 203	RO011-129001	Ringfort - rath	Kilbride	RMP
	RO011-129002	Souterrain	Kilbride	Proposed RMP
AH 204	RO011-130	Ringfort - rath	Liscolvan	RMP
AH 205	RO011-135	Ringfort - rath	Cornasleehan	RMP
AH 206	RO011-159	Ringfort - rath	Liscolvan	RMP
AH 207	RO011-186	Redundant record	Corgullion	None
AH 208	RO011-088	Ringfort - rath	Dangan (Nugent)	RMP
AH 209	RO011-090001	Ringfort - rath	Corralara	Proposed RMP
	RO011-090002	Ringfort - rath	Corralara	Proposed RMP
AH 210	RO011-131	Ringfort - rath	Carrowmore (Ballintober North By.)	RMP
AH 211	RO011-132	Ringfort - rath	Carrowmore (Ballintober North By.)	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 212	RO011-133	Ringfort - rath	Carrowmore (Ballintober North By.)	RMP
AH 213	RO011-134	Ringfort - rath	Cornasleehan	RMP
AH 214	RO011-136	Ringfort - rath	Ardmacroan	RMP
AH 215	RO011-137	Enclosure	Ardmacroan	RMP
AH 216	RO011-138	Ringfort - rath	Dangan (King)	RMP
AH 217	RO011-139	Castle - unclassified	Dangan (King)	RMP
AH 218	RO011-140	Ringfort - rath	Dangan (King), Dangan (Nugent)	RMP
AH 219	RO011-141001	Ringfort - rath	Dangan (King)	Proposed RMP
	RO011-141002	Ringfort - rath	Dangan (King)	Proposed RMP
AH 220	RO011-142	Ringfort - rath	Dangan (King)	RMP
AH 221	RO011-143	Enclosure	Dangan (King)	RMP
AH 222	RO011-152	Redundant record	Cartron (King)	RMP
AH 223	RO012-008	Ringfort - rath	Moyglass (Ballintober North By., Cloonteem Ed)	RMP
AH 224	RO012-009	Ringfort - rath	Dangan (Nugent)	RMP
AH 225	RO012-010	Ringfort - rath	Dangan (Nugent)	RMP
AH 226	RO012-011	Crannog	Lowfield	RMP
AH 227	RO012-012	Ringfort - rath	Moyglass (Ballintober North By., Cloonteem Ed)	RMP
AH 228	RO012-013	Redundant record	Moyglass (Ballintober North By., Cloonteem Ed)	None
AH 229	RO012-014	Ringfort - rath	Tooloscan	RMP
AH 230	RO012-015	Ringfort - rath	Tooloscan	RMP
AH 231	RO012-016	House - 18th/19th century	Lowfield	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 232	RO012-017	Standing stone	Tooloscan	RMP
AH 233	RO012-018	Ringfort - rath	Clogher (Ballintober North By.)	RMP
AH 234	RO012-019	Ringfort - rath	Clogher (Ballintober North By.), Kilmore (Ballintober North By.)	RMP
AH 235	RO012-021	Ringfort - rath	Clogher (Ballintober North By.)	RMP
AH 236	RO012-022	Burial	Cartron (King),Corry (Ballintober North By.)	Proposed RMP
AH 237	RO012-023	Ringfort - rath	Tooloscan	Proposed RMP
AH 238	RO012-025	Redundant record	Cartron (King)	None
AH 239	RO012-030	Ringfort - rath	Moyglass (Ballintober North By., Cloonteem Ed)	Proposed RMP
AH 240	RO017-069	Earthwork	Carrowcuil	RMP
AH 241	RO011-054	Ringfort - rath	Cloonavery	RMP
AH 242	RO011-056	Ringfort - rath (EX 10)	Cloonavery	RMP
AH 243	RO011-057	Enclosure	Drumcleavry	RMP
	RO011-057001	Ring-ditch (EX 11)	Drumcleavry	Proposed RMP
AH 244	RO011-058	Linear earthwork (EX 12/14/17)	Cloonavery, Drumcleavry, Lackagh, Ardanaffrin	RMP
AH 245	RO011-059	Ringfort - rath	Ardanaffrin	RMP
AH 246	RO011-060	Ringfort - rath	Ardanaffrin	RMP
AH 247	RO011-089	Ringfort - rath	Corry (Ballintober North By.)	RMP
AH 248	RO011-153	Redundant record (EX 13)	Cloonavery	RMP
	RO011-153001	Enclosure (EX 13)	Cloonavery	Proposed RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 249	RO011-187	Ringfort - rath	Drumcleavry	Proposed RMP
AH 250	RO012-001	Ringfort - rath	Charlestown	RMP
	RO012-001001	Redundant record	Charlestown	None
AH 251	RO012-002	Ringfort - rath	Drumcleavry	None
AH 252	RO012-004	Ringfort - rath	Lackagh	RMP
AH 253	RO012-005	Ringfort - rath	Corry (Ballintober North By.)	RMP
AH 254	RO012-006001	Ringfort - rath	Cloonteem	Proposed RMP
	RO012-006002	Enclosure	Cloonteem	Proposed RMP
AH 255	RO012-007	Redundant record	Cloonteem	None
AH 256	RO012-024	Ringfort - rath	Charlestown	Proposed RMP
AH 257	RO012-026	Ringfort - rath	Corry (Ballintober North By.)	Proposed RMP
AH 258	RO012-027	Ringfort - rath	Cloonteem	Proposed RMP
AH 259	RO012-028	Ringfort - rath	Cloonteem	Proposed RMP
AH 260	RO012-029	Ringfort - rath	Cloonteem	Proposed RMP
AH 261	LE031-061	Ringfort - rath	Drishoge	RMP
AH 262	LE031-062	Ringfort - rath	Mullaun (Leitrim By.)	RMP
AH 263	LE031-063	Ringfort - rath	Mullaun (Leitrim By.)	RMP
AH 264	LE031-066	Ringfort - rath	Foxborough	RMP
AH 265	LE031-067	Ringfort - rath	Lavagh (Leitrim By.)	RMP
AH 266	LE031-122	Ringfort - rath	Mountcampbell	Proposed RMP
AH 267	LE031-123	Ringfort - rath	Crickeen	Proposed RMP
AH 268	LE032-021	Ringfort - rath	Lavagh (Leitrim By.)	RMP
AH 269	LE031-068	Ringfort - rath	Drumsna	RMP
AH 270	LE031-069	Ringfort - rath (EX 16)	Drumsna	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 271	LE031-070	Ringfort - rath	Gortconnellan	RMP
AH 272	LE031-071	Ringfort - rath	Gortconnellan	RMP
AH 273	LE031-084	Redundant record	Drumsna	None
AH 274	LE031-085	Ringfort - rath (EX 59)	Drumsna	RMP
	LE031-085002	Burial ground (EX 59) (also BH 7)	Drumsna	Proposed RMP
AH 275	LE031-086	Ringfort - rath	Drumsna	RMP
	LE031-086001	Ringfort - rath	Drumsna	Proposed RMP
AH 276	LE031-087	Ringfort - rath (EX 62)	Drumsna	RMP
AH 277	LE031-088	Ringfort - rath	Drumsna	RMP
AH 278	LE031-100	Enclosure	Drumsna	Proposed RMP
AH 279	LE031-107	Ringfort - rath	Drumsna	Proposed RMP
AH 280	LE031-124	Enclosure	Drumsna	Proposed RMP
AH 281	LE031-125	Ringfort - rath	Drumsna	Proposed RMP
AH 282	LE032-022	Ringfort - rath	Fargrim	RMP
AH 283	LE032-023	Ringfort - rath	Fargrim	RMP
AH 284	LE032-024	Ringfort - rath	Fargrim	RMP
AH 285	LE032-051	Crannog	Gortconnellan	RMP
AH 286	LE032-052-	Enclosure	Annaduff	Proposed RMP
AH 287	LE032-053	Barrow - mound barrow	Annaduff Glebe	RMP
AH 288	LE032-054001	Church (EX 16)	Annaduff	Proposed RMP
	LE032-054002	Graveyard (EX 16)	Annaduff	Proposed RMP, RPS
	LE032-054003	Architectural fragment (EX 16)	Annaduff	Proposed RMP
	LE032-054005	Ecclesiastical enclosure (EX 16)	Annaduff	Proposed RMP
AH 289	LE032-097	Mound	Annaduff	RMP
AH 290	LE032-101	Fulacht fia	Drumsna	Proposed RMP
AH 291	LE032-071	Crannog	Derryoughter	RMP

AH No.	SMR Number	Name	Townland	Statutory Protection
AH 292	LE032-072	Crannog	Derryoughter	RMP
AH 293	LE032-073	Redundant record	Gortinty	None
AH 294	LE032-074	Crannog	Gortinty	RMP
AH 295	LE032-075	Redundant record	Carrick (Leitrim By., Annaduff Ed)	None
AH 296	LE032-076	Redundant record	Carrick (Leitrim By., Annaduff Ed)	None
AH 297	LE032-077	Ringfort - rath	Drumgilra (Leitrim By.)	RMP
AH 298	LE032-078	Ringfort - rath	Drumgilra (Leitrim By.)	RMP
AH 299	LE032-080	Ringfort - rath	Drumcoora (Mohill By.)	RMP
AH 300	LE032-105	Ringfort - rath	Carrick (Leitrim By., Annaduff Ed)	Proposed RMP
AH 301	LE032-106	Ringfort - rath	Carrick (Leitrim By., Annaduff Ed)	Proposed RMP
AH 302	LE035-001	Ringfort - rath	Derrybrack	RMP
AH 303	LE035-002	Ringfort - rath	Aghamore (Mohill By., Drumod Ed)	RMP
AH 304	LE035-003	Ringfort - rath	Aghamore (Mohill By., Drumod Ed)	RMP
AH 305	LE035-005	Enclosure	Aghintass, Antfield	RMP
AH 306	LE035-042	Ringfort - rath	Aghamore (Mohill By., Drumod Ed)	Proposed RMP
AH 307	RO018-004	Ringfort - rath	Skeagh	RMP

Of the 364 individual RMP/SMR sites, none are listed as National Monuments in state ownership or guardianship, and none are listed as being subject to a Preservation Order.

Of the 364 individual archaeological sites recorded within the study area, 211 are listed on the RMP and are subject to statutory protection, 112 are proposed for inclusion in the RMP at its next revision and are therefore not currently subject to statutory protection and 41 are included in the SMR and are not subject to statutory protection. There is a total of 22 sites classed as ‘redundant records’; however, they have been included within the assessment as in the past, sites that have been made

redundant have occasionally been found to be archaeological in nature during road-scheme related archaeological testing or other archaeological investigations.

A total of five of the sites are listed as 'Excavation – miscellaneous', representing archaeological sites that have been subject to preservation by record. These are not subject to statutory protection, as they are either proposed for inclusion on the RMP or are listed on the SMR for information by the Archaeological Survey of Ireland. The SMR records sites of various date and form, which are not intended to be added to the RMP at the next revision.

The recorded monuments within the study area can be roughly divided into seven categories: prehistoric sites, early medieval sites, medieval sites, post-medieval sites, sites of indeterminate date, excavations and redundant records. The majority of the sites can be allotted a time period; however, some have the potential to belong to any period and as such have been added to the sites of indeterminate date. Where no firm date can be established for individual sites, on typological, morphological, written-historical or cartographic grounds, these have been assigned to a period on the basis of professional judgement. Plate 4.10.1 shows the overall percentage of sites in each category.

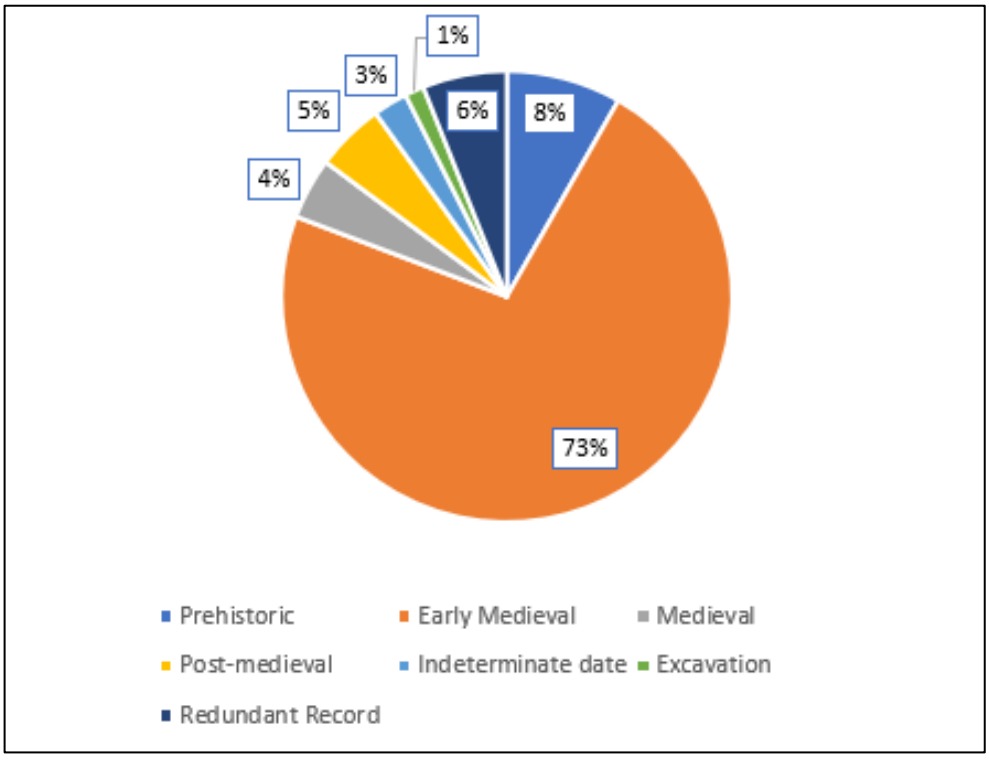

Plate 4.10.1 Percentages of Recorded Archaeological Sites within the Study Area

Prehistoric Period (c. 7000 BC-AD 500)

A total of 11 site classifications are included within the prehistoric category, see Plate 4.10.2. The most numerous are burnt mounds, which account for nine out of 30 sites in total. This site type presents as a mound of burnt stone, ash, charcoal and other combustible material, often with one or more (sometimes lined) troughs and can date from the Bronze Age to the early medieval period; however, a prehistoric date has been assumed for the purposes of this Constraints Study. No specific

concentrations of prehistoric sites within the Study Area have been identified during the course of this study.

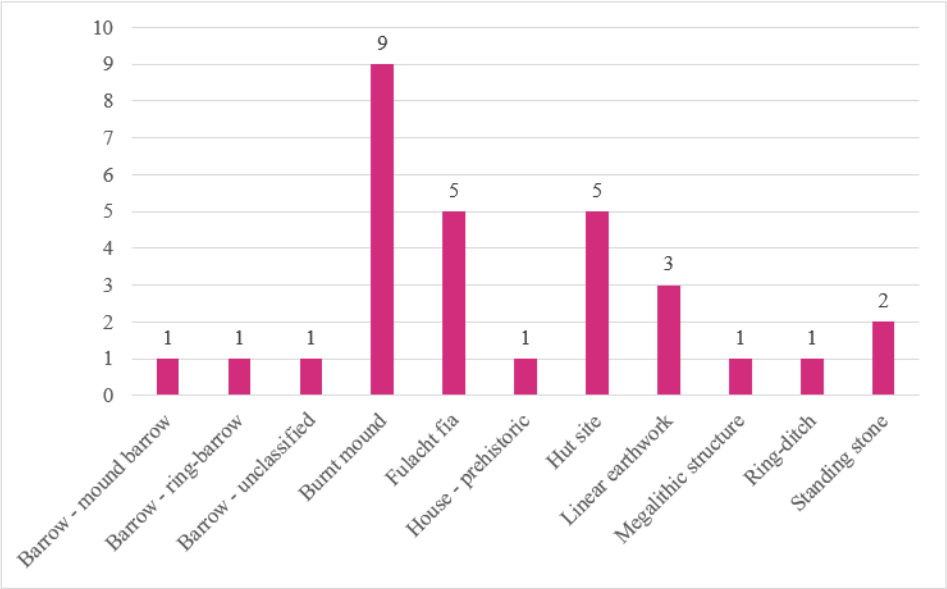

Plate 4.10.2 Number of Prehistoric Sites Located within the Study Area

Early Medieval Period (AD 500-1100)

A total of ten site classifications are included within the early medieval category Plate 4.10.3. By far the most numerous site types are ringforts, totalling 225 sites out of a total of 264. This is unsurprising as there are almost 60,000 sites of this type located across Ireland. They represent fortified rural farmsteads and can vary in size from a simple, single enclosing bank and ditch, to a large enclosure surrounded by multiple enclosing elements. There are no specific concentrations of early medieval sites within the Study Area with ringforts located across the overall area.

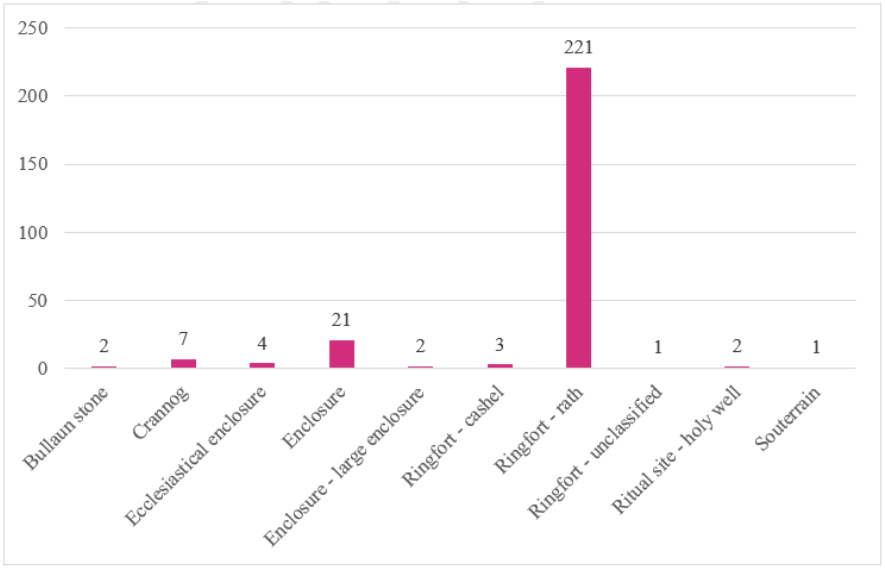

Plate 4.10.3 Number of Early Medieval Sites Located within the Study Area

Medieval Period (AD 1100-1600)

A total of seven site classifications are included within the medieval category, see Plate 4.10.4. The most numerous site type consists of churches, with six probable medieval churches located within the study area. Five of the churches are associated with a burial ground or graveyard, whereas one of the sites (AH115) may actually represent a medieval grange building, rather than a church site. It is possible that some of the church and graveyard sites are earlier in date, although for the purpose of the Constraints Study a medieval date has been assumed. There are no specific concentrations of medieval sites identified within the Study Area.

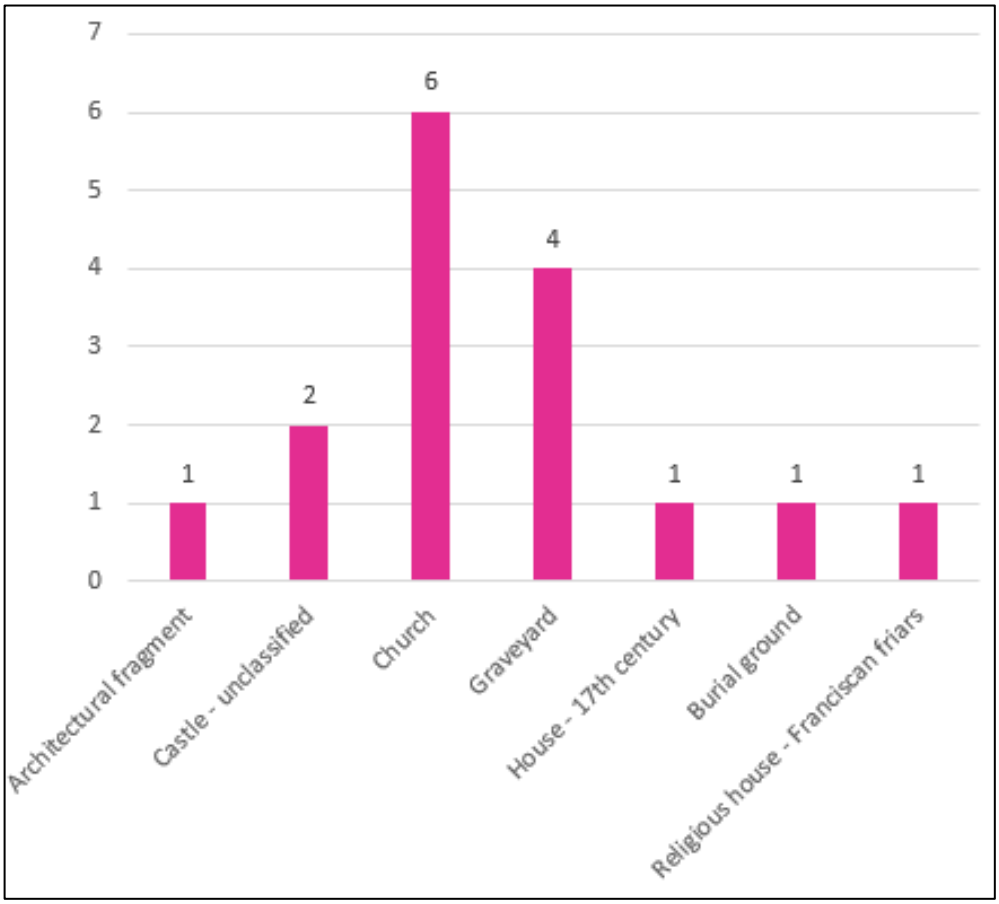

Plate 4.10.4 Number of Medieval Sites Located within the Study Area

Post-medieval Period (AD 1600-1900)

A total of 13 site classifications are included within the post-medieval category, see Plate 4.10.5. Bridges represent the most numerous site type with six recorded within the Study Area. The remaining categories are not as well represented within the archaeological record, due to an inconsistency as to whether post-medieval sites are recorded as 'archaeological' by the Archaeological Survey of Ireland.

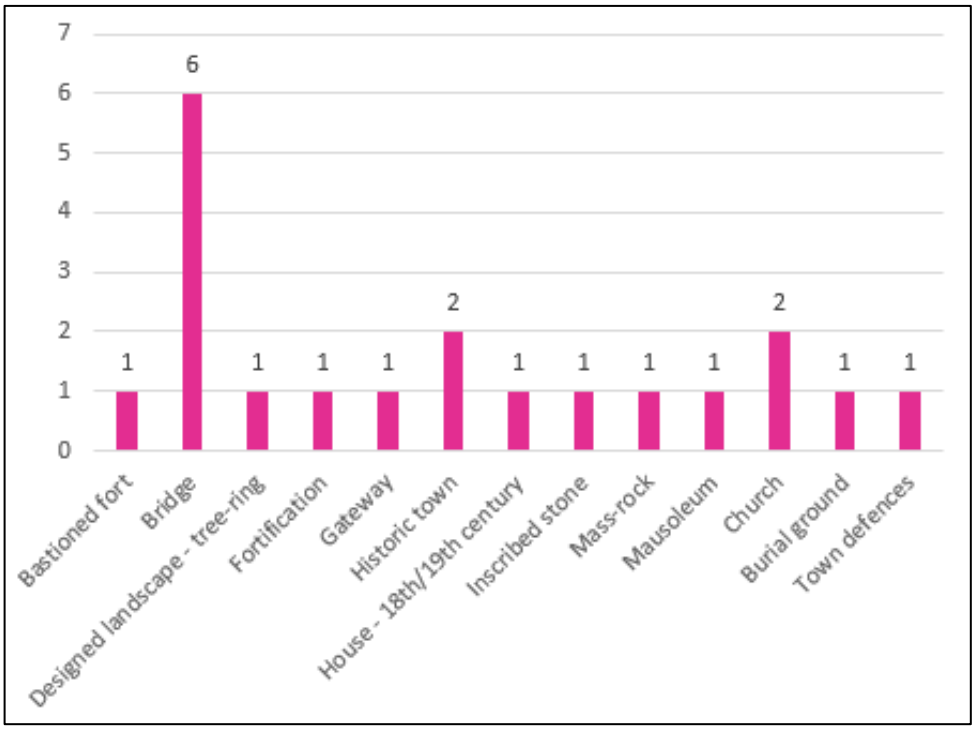

Plate 4.10.5 Number of Post-medieval Sites Located within the Study Area

A total of six site classifications are included within the sites of indeterminate date category (See Plate 4.10.6).

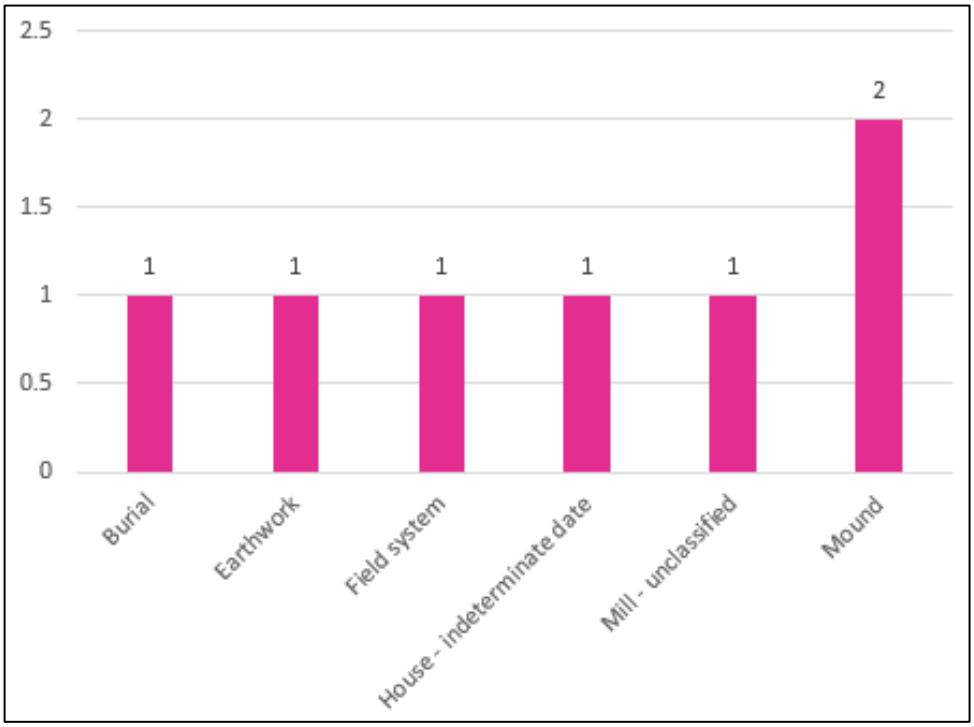

Plate 4.10.6 Number of Miscellaneous Sites Located within the Study Area

Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970-2021) has revealed that a number of archaeological investigations have been carried out within the study area. These have been assigned an Excavation (EX) number. Where these have been carried out at or near known archaeological sites, or have revealed archaeological remains which have subsequently been added to the SMR, these have been cross referenced with the relevant AH sites. These are summarised in Table 4.10.2 and EX numbers are also included in Table 4.10.1.

Table 4.10.2 Archaeological Excavations within the Study Area

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 1	99E0193 and ext.	Bennett 1999:765 and 2000:0849	Advance works for the realignment of the N4 between Boyle and Carrick-on-Shannon excavated a medieval enclosure. An Iron Age settlement comprising eight structures, an early medieval rath, a fulacht fiadh, and a burnt mound were also identified during the works.	Cloongownagh	AH 8/10
	99E0309 and ext.	Bennett 1999:774 and 2000:0847	Monitoring for the realignment of the N4 identified a fulacht fiadh in Hughestown. Two additional fulacht fiadh were identified and excavated.	Rockingham to Cortober	-
	99E0401	Bennett 1999:768	Realignment of the N4. Excavated a fulacht fiadh, two burnt mounds, a wooden trough, and three stone pathways to the immediate west of the study area.	Hughestown	-
EX 2	03E1374	Bennett 2003:1579	Monitoring of the realignment of the N4 from Hughestown to Meera identified a number of archaeological sites. Two burnt mounds were identified in Cloongownagh and two in Cuiltyconeen, all were preserved in situ.	Hughestown to Meera	AH 10/15
	03E1769	Bennett 2003:1560	Site 1 - burnt mound carbon dated to the Bronze Age.	Woodbrook	AH 2
	03E1770	Bennett 2003:1561	Site 2 - pit underlying a layer of broken stones and charred material.	Cloongownagh	AH 8

EX No.	Licence	Reference	Description	Townland	AH Ref.
			Site 3 - rectangular pit with shallow fill of charcoal. Possibly part of a corn-drying kiln.	Cloongownagh	AH 8
			Site 4 - truncated pit, possibly contemporary with Site 3.	Cloongownagh	AH 7
	03E1771	Bennett 2003:1562	Site 5 - burnt mound containing horse bones, no evidence of a trough.	Cloongownagh	AH 10
			Site 6 - a possible corn-drying kiln and industrial surface. Preserved in-situ.	Cloongownagh	AH 4
	03E1841	Bennett 2003:1563	Site 7 - burnt mound dated to the Bronze Age.	Woodbrook, Cloonagownagh	AH 3
	04E0375	Bennett 2004:1452	Site 8 - pit filled with charred organic material, preserved in situ and rectangular pit containing charcoal-rich material.	Cloongownagh	AH 5
EX 3	00E0180	Bennett 2000:0864	Pre-development testing between two enclosures did not identify any archaeological features.	Sroankeeragh	AH 29/30
EX 4	04E1597	Bennett 2004:1443	Testing for a proposed supermarket development failed to identify any features of archaeological significance.	Drishoge	-
	05E1337	Bennett 2005:1330			-
EX 5	07E0825	Bennett 2007:1489	Testing for a proposed development failed to identify any features of archaeological significance.	Cortober	-
EX 6	05E0592	Bennett 2005:1343	Testing for a proposed residential development failed to identify any archaeological features.	Mullaghmore	-
EX 7	11E033	Bennett 2011:523	Testing for the N4 Carrick to Dromod Road Scheme adjacent to a ringfort did not identify any archaeological features.	Cloonmaan	AH 22

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 8	07E0747	Bennett 2008:757	Monitoring of a sewage development in and around Carrick-on-Shannon identified three archaeological areas. The face of an old quay wall was identified at the Harbour. A wooden beam possibly associated with a post-medieval bridge over the Shannon at the Quay Road carpark. Material associated with the 17th-century O'Rourke castle on the Bypass Road.	Attifinlay, Ballynamony, Cloonsheebane, Drummagh, Keenaghan, Kilboderry, Lisnabrack, Townparks	AH 63/64
		Bennett 2008:1030	Monitoring of the sewage development near Carrick-on-Shannon in Co. Roscommon did not identify any archaeological features.	Cloonskeeveen, Cortober, Drishoge	-
EX 9	09E0526	Bennett 2010:575	An unauthorised development at the southern terminus of the Doon of Drumsna required monitoring of restoration works. No archaeological remains were exposed.	Cuiltyconway	AH 195
EX 10	06E1187	Bennett 2006:1717	A residential development adjacent to a ringfort did not uncover any archaeological features.	Cloonavery	AH 242
EX 11	05E0386 and ext.	Bennett 2005:1331 and 2005:1332	Testing for two single-house developments identified a ring-ditch, possibly represents enclosure (RO011-057) depicted on the first edition OS maps.	Drumcleavry	AH 243
EX 12	97E0347	Bennett 1997:452	Excavation near the inner bank of the Doon of Drumsna failed to identify any archaeological features.	Ardanaffrin	AH 244
	99E0029	Bennett 1999:759	Pre-development testing adjacent to the inner bank failed to produce archaeological material.	Ardanaffrin	AH 244
EX 13	19R0147	Leigh 2019	Geophysical survey disproved the presence of a recorded enclosure but identified a possible rectangular enclosure.	Cloonavery	AH 248
EX 14	04E1301	Bennett 2004:1430	Testing in the vicinity of the Doon of Drumsna failed to	Ardanaffrin	AH 244

EX No.	Licence	Reference	Description	Townland	AH Ref.
			uncover archaeological deposits.		
EX 15	03E1250	Bennett 2003:1564	Monitoring of development works on the east bank of the River Shannon, upstream of Jamestown Bridge did not identify archaeological features.	Cloonavery	AH 177/178
EX 16	94E0158	Bennett 1994:147	Monitoring of the Drumsna-Jamestown bypass exposed an area of burnt stone. Excavation identified the feature as a fulacht fiadh with a trough and associated hearth.	Drumsna	-
	94E0051	Bennett 1994:148	Testing was carried out at five sites along the Drumsna-Jamestown bypass. Site 1 - testing along the road take to the north of two churches. Recovered charcoal flecks, a lens of burning, and a clay pipe bowl. Site 2 - clear surface remains of ringfort to west of road take. No remains within road take. Site 3 - targeted possible settlement platform in road take. Natural feature. Site 4 - targeted possible enclosure, determined to be modern feature. Site 5 - Settlement platform visible to south of road take. No associated remains extended into road take. French drain identified during testing.	Annaduff, Drumsna, Kildorragh, Kiltycarney, Tully	AH 288/270
	94E0123	Bennett 1994:149	An archaeological site identified during monitoring of the N4 was excavated. This revealed a circular hut site and fulacht fiadh dated to the Late Neolithic / Early Bronze Age.	Kildorragh	AH 154
	94E0097	Bennett 1994:150	Monitoring for the Drumsna-Jamestown bypass exposed a burnt spread. Excavation determined the feature comprised a fulacht fiadh and trough.	Kiltycarney	AH 151
	94E0171	Bennett 1994:151	Testing adjacent to a ringfort in advance of the Drumsna-Jamestown bypass did not	Lisseeghan	AH 143

EX No.	Licence	Reference	Description	Townland	AH Ref.
			identify any archaeological features.		
	94E0100	Bennett 1994:152	Monitoring for the N4 Drumsna-Jamestown Bypass exposed and excavated a spread of burnt material	Minkill	AH 153
	94E0041	Bennett 1994:153	A fulacht fiadh was exposed and excavated during monitoring for the N4.	Tully	AH 150
EX 17		Bennett 1990:099	Examination of a section of the Doon of Drumsna suggested that the feature comprised a primary bank that was later enlarged and heightened by dumping.	Lackagh, Drumcleavry	AH 244
EX 18	01E0702	Bennett 2001:725	Testing adjacent to an enclosure, no archaeological features.	Lisnagat	AH 74
EX 19	05E1267	Bennett 2005:942	Testing for a residential development identified a prehistoric hut site.	Lisnagat	AH 74
EX 20	08E0851	Bennett 2008:755	Testing adjacent to a ringfort failed to identify any archaeological features.	Cartown	AH 76
EX 21	03E01637	Bennett 2003:1095	Monitoring at Bridge Street, no archaeological significance.	Townparks	AH 64
EX 22	04E1488	Bennett 2005:931	Monitoring of demolitions of additions to a Georgian building on Bridge Street. No archaeological significance.	Townparks	AH 64
EX 23	00E0527	Bennett 2000:0563	Monitoring of a development within Carrick-on-Shannon. No archaeological significance.	Townparks	AH 64
EX 24	01E0409	Bennett 2001:727	Testing at Priest's Lane did not identify any archaeological finds.	Townparks	AH 64
EX 25	97E0253	Bennett 1997:317	Testing off Priest's Lane did not identify any archaeological finds.	Townparks	AH 64
EX 26	98E0248	Bennett 1998:372	Testing for a commercial development within Carrick-on-Shannon failed to produce archaeological features or deposits.	Townparks	AH 64

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 27	00E0143	Bennett 2000:0562	Testing in the eastern outskirts of Carrick-on-Shannon failed to uncover anything of archaeological significance.	Townparks	-
EX 28	00E0269	Bennett 2000:0566	Testing on the east side of the Main Street, Jamestown produced no evidence of archaeology.	Jamestown	AH 177
EX 29	99E0521	Bennett 1999:470	Testing at the east end of the Main Street in Carrick-on-Shannon did not identify any archaeological features.	Townparks	AH 64
EX 30	00E0554	Bennett 2000:0567	Testing for a house along the Main Street, Jamestown recovered sherds of post-medieval pottery.	Jamestown	AH 177
EX 31	05E0389	Bennett 2005:938	Testing for a residential extension on the Main Street, Jamestown did not identify any archaeological features.	Jamestown	AH 177
EX 32	06E0117	Bennett 2006:1202	A development at Main Street and Priest's Lane, Carrick-on-Shannon did not identify any archaeological features.	Townparks	AH 64
EX 33	99E0257	Bennett 1999:469	Pre-development testing at Bridge Street, Carrick-on-Shannon failed to identify any archaeological remains.	Townparks	AH 64
EX 34	02E0039	Bennett 2002:1051	Testing at Bridge Street, Carrick-on-Shannon identified a wall foundation with a sherd of medieval pottery. The wall is possibly associated with a fortification recorded in the town.	Townparks	AH 64
		Bennett 2003:1097	Monitoring of works did not identify any further features.		
EX 35	02E1679	Bennett 2002:1052	Testing for a residential development failed to uncover archaeological features.	Townparks	AH 64
EX 36	03E0898	Bennett 2003:1098	Testing for a commercial development on the Dublin Road, Carrick-on-Shannon did not uncover archaeological features.	Townparks	AH 64
EX 37	04E0070	Bennett 2004:0954	Testing within Carrick-on-Shannon did not identify any archaeological features.	Townparks	AH 64

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 38	04E1357	Bennett 2004:0953	Testing for a proposed development to the rear of Bridge Street, Carrick-on-Shannon did not identify any archaeological remains.	Townparks	AH 64
EX 39	01E1178	Bennett 2001:724	Testing for a residential development adjacent to a ringfort failed to identify archaeological features.	Ballynamoney	AH 82
EX 40	02E0520	Bennett 2002:1049	Testing for a commercial development to the rear of Bridge Street, Carrick-on-Shannon did not uncover archaeological features.	Townparks	AH 64
EX 41	99E0223	Bennett 1999:471	Pre-development testing off Priest's Lane did not expose any archaeological remains.	Townparks	AH 64
EX 42	07E0947	Bennett 2007:1078	Monitoring for works for the Carrick-on-Shannon sewage scheme identified two dressed limestone blocks at the quayside.	Attifinlay, Ballynamony, Cloonsheebane, Drummagh, Keenaghan, Kilboderry, Lisnabrack, Townparks, Cloonskeeveen, Cortober, Drishoge	AH 64
EX 43	01E0332	Bennett 2001:726	Testing and monitoring for a commercial development on Bridge Street exposed a stone surface of large slabs, which was preserved in situ. Monitoring uncovered evidence of 18th / 19th century efforts to raise the ground level.	Townparks	AH 64
EX 44	02E0359	Bennett 2002:1050	Monitoring for an accessway at New Public Road, Carrick-on-Shannon did not reveal archaeological features or finds.	Townparks	AH 64
EX 45	03E0652	Bennett 2003:1096	Monitoring and testing for a proposed development at Bridge Street and Quay Lane, Carrick-on-Shannon did not uncover archaeological features.	Townparks	AH 64

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 46	03E1193	Bennett 2003:1100	A development to the rear of the Bush Hotel, Main Street, Carrick-on-Shannon was tested. No features were identified.	Townparks	AH 64
EX 47	04E0133	Bennett 2004:0947	A rough stone surface, interpreted as the remains of a cattle byre, was uncovered during monitoring and testing for a residential development.	Attirory	-
	04E0133 ext.	Bennett 2004:0948	Continued monitoring did not identify any archaeological remains.	Attirory	-
	06E0344	Bennett 2006:1201	A final phase of monitoring failed to identify any archaeological features.	Attirory	-
EX 48	03E1788	Bennett 2003:1094	A residential development adjacent to an early medieval church site was monitored. No archaeological activity was exposed.	Attiror	AH 142
EX 49	18E0707	Bennett 2019:075	Testing for a proposed development identified two sections of an ecclesiastical enclosure. A series of post-holes and pits were uncovered within the interior suggesting the ecclesiastical site was for industrial activity including metalworking.	Attirory	AH 142
EX 50	96E0216	Bennett 1996:228	Testing within the stable yard of Jamestown House uncovered a post-medieval cobbled yard.	Jamestown	AH 177
EX 51	97E0306	Bennett 1997:319	Testing outside the north wall of Jamestown did not identify anything of archaeological significance.	Jamestown	AH 177
EX 52	01E1191	Bennett 2001:735	Pre-development testing identified a section of the western town wall.	Jamestown	AH 177
EX 53	04E1549	Bennett 2004:0958	Monitoring for a residential development outside the north wall of Jamestown did not reveal any archaeological remains.	Jamestown	AH 177

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 54	05E0593	Bennett 2005:937	Testing for a residential development to the immediate north of the walled town of Jamestown failed to reveal archaeological features.	Jamestown	AH 177
EX 55	06E1101	Bennett 2006:AD16	Pre-development testing in the vicinity of an enclosure and ringfort identified post-medieval finds near the ringfort.	Jamestown, Tully	AH 159/172
EX 56	C177, E2895	Bennett 2007:1084	Testing was carried out for a sewerage pipeline along the Main Street in Jamestown. A cobbled surface, interpreted as a post-medieval road, was encountered at the southern end.	Jamestown	AH 177
EX 57	07E1089	Bennett 2007:1158	Pre-development testing, no archaeological significance.	Lisduff	-
EX 58	10E0244	Bennett 2010:435	Testing for route selection of the N4 Carrick-on-Shannon to Dromod Road Scheme adjacent to a ringfort did not encounter archaeological features.	Cornaslieve	AH 111
	10E0243	Bennett 2010:436	Testing for route selection of the N4 Carrick-on-Shannon to Dromod Road Scheme adjacent to a ringfort uncovered an undated possible pit feature.	Dromore	AH 110
EX 59	01E0069	Bennett 2001:730	Pre-development testing near an enclosure and graveyard did not expose any features.	Drumsna	AH 274
EX 60	01E0106	Bennett 2001:731	Monitoring of a sewage scheme in Drumsna recovered sherds of post-medieval pottery and clay pipe fragments.	Drumsna	-
EX 61	03E1377	Bennett 2003:1110	A residential development at Drumsna did not identify any archaeological features.	Drumsna	-
EX 62	02E1235	Bennett 2002:1054	Monitoring of a residential development near a ringfort did not identify archaeological remains.	Drumsna	AH 276

EX No.	Licence	Reference	Description	Townland	AH Ref.
EX 63	94E0141	Bennett 1994:145	Monitoring for a road identified a spread of burnt material. Excavation determined it was due to tree clearance activity.	Crickeen	-
EX 64	09E0182	Bennett 2009:519	Monitoring of treatment plants for a sewage scheme in Ballinagleragh, Cloone, Dromahaire, Drumcong, Drumkeeran, Jamestown, Killarga, Kiltyclogher, Kinlough, and Roosky did not uncover archaeological features.		-
EX 65	05E0983	Bennett 2006:1214	Pre-development testing for the N4 Dromod Roosky bypass identified 25 sites of archaeological interest.	Fearnaght to Edercloon	-
	A031/001, E3288	Bennett 2006:1215	Excavated the badly disturbed remains of a post-medieval kiln.	Faulties	-

Areas of Archaeological Potential

Areas of Archaeological Potential (AAPs) can be defined as parts of the landscape that possess the potential to contain archaeological remains due to the presence of topographic features such as rivers, lakes, turloughs, high defendable ground and bog. Rivers and lakes are a focus for human habitation due to the obvious transport and food resources. Rivers, lakes and bogs also have the potential to preserve organic archaeological deposits or artefacts such as wood or leather, which do not usually survive within the alkaline conditions associated with terrestrial archaeology. Wooden trackways dating to the Bronze Age period and later have been excavated within bogland throughout Ireland. Rivers and lakes may have also played a role in prehistoric ritual, as significant artefacts from the prehistoric periods and into the early medieval period, are often found within riverbed deposits. All areas of bog/peat, rivers, streams, and bodies of water (both fresh and saltwater), and their margins, within the study area should be considered as possessing archaeological potential.

Within the Study Area, the main Area of Archaeological Potential is characterised by the River Shannon, its associated loughs (Lough Corry and Lough Tap) and riverine margins, which are often boggy or waterlogged in nature. In the eastern section of the Study Area is Lough Drumgilra (or Gortinty Lough), which is linked to the River Shannon. The smaller loughs of Cartron and Lowfield are located to the west of Lough Tap. In addition, there are multiple small watercourses crossing the landscape.

4.10.3.2 Architectural Heritage

A total of 112 structures of architectural heritage significance have been identified within the study area. These are either listed within the RPS (in the County Development Plans for Leitrim and Roscommon)[13] [14] or have been identified as part of the architecture survey carried out by the NIAH.[91]

Structures and sites that are included within the RMP and RPS are subject to statutory protection under both the National Monuments Act and the Planning and Development Act.

The NIAH rating values are International, National, Regional, Local, and Record Only (I, N, R, L, O). Structures which are considered of International, National, and Regional significance are recommended by the Minister to the relevant planning authority for inclusion in their RPS.[92]

International: Structures or sites of sufficient architectural heritage importance to be considered in an international context. These are exceptional structures that can be compared to and contrasted with the finest architectural heritage in other countries.

National: Structures or sites that make a significant contribution to the architectural heritage of Ireland. These are structures and sites that are considered to be of great architectural heritage significance in an Irish context.

Regional: Structures or sites that make a significant contribution to the architectural heritage within their region or area. They also stand in comparison with similar structures or sites in other regions or areas within Ireland. Increasingly, structures that need to be protected include structures or sites that make a significant contribution to the architectural heritage within their own locality. Examples of these would include modest terraces and timber shopfronts.

Local: These are structures or sites of some vintage that make a contribution to the architectural heritage, but this may not merit their being placed in the RPS separately. Such structures may have lost much of their original fabric.

Record Only: These are structures or sites that are not deemed to have sufficient presence or inherent architectural, or other, importance at the time of recording to warrant a higher rating. It is acknowledged, however, that they might be considered further at a future time.

Overall, there are 112 RPS and/or NIAH structures located within the Study Area, these have been grouped into 16 Built Heritage (BH) constraints and are marked as BH on the accompanying figures (Table 4.10.3 and Figures 4.10.1.0 to 4.10.1.5). A large portion of the structures are located within the urban centre of Carrick-on-Shannon (BH 4). Of the 112 structures, 76 are Protected Structures. These consist for the most part of country houses and elements of their associated demesnes,

[91] National Inventory of Architectural Heritage (NIAH), 2022. Available at: https://www.buildingsofireland.ie/
[92] Department of Culture, Heritage, and the Gaeltacht, 2017. NIAH Handbook. Available at: https://www.buildingsofireland.ie/app/uploads/2019/10/NIAH-Handbook-Edition-September-2017.pdf

vernacular houses, churches, railway infrastructure and bridges. Occasionally items such as water pumps and towers, steps and post boxes have been included within the record.

Table 4.10.3 Built Heritage Sites within the Study Area

BH No	RPS	NIAH	Name / Type	Townland	Statutory Protection
BH 1	00700105		Woodbrook House	Usna	RPS
BH 2	01100391	31807008	Carrick-on-Shannon Railway Station Foot bridge	Cortober	RPS
	01100392	31807009	Carrick-on-Shannon Railway Station	Cortober	RPS
	01100393	31807010	Carrick-on-Shannon Railway Station Waiting Room	Cortober	RPS
	01100394	31807011	Carrick-on-Shannon Railway Station Signal Box	Cortober	RPS
	01100396	31807013	Carrick-on-Shannon Railway Station Goods Shed	Cortober	RPS
	01100397	31807014	Carrick-on-Shannon Railway Station Warehouse	Cortober	RPS
		31807012	Carrick-on-Shannon Railway Station Water Tower	Cortober	None
BH 3	01100315		Semi-detached houses	Cortober	RPS
	01100316	31807005	Pair of semi-detached houses	Cortober	RPS
	01100389		Pair of semi-detached houses	Cortober	RPS
	01100390		Semi-detached houses	Cortober	RPS
		31807006	House	Cortober	None
BH 4	30813002	30813002	Old Barrel Store / Carrick-on-Shannon Tourist Information	Townparks	RPS
	30813005	30813005	Town Hall	Townparks	RPS
	30813007	30813007	National Irish Bank	Townparks	RPS
	30813012	30813012	Leitrim County Council (Gaol)	Townparks	RPS
	30813013	30813013	Governor House	Townparks	RPS
	30813014	30813014	Old Court House	Townparks	RPS
	30813015	30813015	Hatley Manor	Townparks	RPS
	30813016	30813016	Terrace House	Townparks	RPS
	30813017	30813017	Carrick-on-Shannon Post Office	Townparks	RPS
	30813018	30813018	Mc Cann Memorial Clock	Townparks	RPS
	30813020	30813020	Costello Memorial Chapel	Townparks	RPS
	30813021	30813021	P. Flynn & Co. end of terrace six bay three storey public house	Townparks	RPS

BH No	RPS	NIAH	Name / Type	Townland	Statutory Protection
	30813024	30813024	Reynold's Butchers / Moonstone Jewellers End of terrace 4 bay, 2 storey house	Townparks	RPS
	30813025	30813025	St. Mary's Catholic Church	Townparks	RPS
	30813026	30813026	James McGuire End of terrace three bay two storey former presbytery	Townparks	RPS
	30813027	30813027	Raval, End of terrace three bay two storey house	Townparks	RPS
	30813029	30813029	St. George Mausoleum	Townparks	RPS
	30813030	30813030	St. George's Church of Ireland Church (also AH 64)	Townparks	RPS
	30813039	30813039	Former District Hospital	Townparks	RPS
	30813040	30813040	Post Box	Townparks	RPS
	30813042	30813042	Summerhill Lodge	Townparks	RPS
	30813043	30813043	Infirmary, St. Patrick's Hospital (workhouse)	Townparks	RPS
	30813044	30813044	Carrick-on-Shannon Court House	Townparks	RPS
	01100386	31807002	Limestone steps	Cortober	RPS
	01100387	31807003	Post Box	Cortober	RPS
	01100388	31807004	Hollywell House	Cortober	RPS
		30813028	Just For Men / Paul Byron Shoes (house)	Townparks	None
		30813003	Campbell's Londis Supermarket	Townparks	None
		30813004	Frances Fashions (house)	Townparks	None
		30813006	Milestone / milepost	Townparks	None
		30813008	Victoria Parochial Hall	Townparks	None
		30813010	Carrick-on-Shannon Lawn Tennis Club (gates / railings / walls)	Townparks	None
		30813011	College	Townparks	None
		30813019	Armstrong (house)	Townparks	None
		30813022	Dunne's (house)	Townparks	None
		30813023	Allied Irish Bank	Townparks	None
		30813031	House	Townparks	None
		30813032	Aidan's Family Butcher (house)	Townparks	None
		30813033	House	Townparks	None
		30813034	Chez Fi Boutique (house)	Townparks	None
		30813035	Bank of Ireland (house)	Townparks	None

BH No	RPS	NIAH	Name / Type	Townland	Statutory Protection
		30813036	Tots to Teens / Irish House	Townparks	None
		30813037	Carrick-on-Shannon Rectory	Townparks	None
		30813038	House	Townparks	None
		30813041	Hillcrest Lodge	Townparks	None
		30813001, 31807001	Carrick-on-Shannon Bridge (alos AH 63)	Townparks, Cortober	None
	30500062		Former Dispensary	Townparks	RPS
	30500098		Water Tower	Townparks	RPS
	30500128		Post Box	Townparks	RPS
	30501006		Stable Folly, Hatley Manor	Townparks	RPS
	30501008		Glasshouse, Hatley Manor	Townparks	RPS
	30501036		End of terrace three bay two storey former presbytery	Townparks	RPS
	30501060		Carved Stone Plaque, Saint Georges Church Grounds	Townparks	RPS
	30501061		Peyton Tomb, Saint Georges Church Grounds	Townparks	RPS
	30501063		Wills Tomb, Saint Georges Church Grounds	Townland	RPS
	30501155		Old Quay Walls, Quayside	Townparks	RPS
	30501159		Remains of Tower (also AH 64)	Townparks	RPS
	30501170		Hoist, Quayside	Townparks	RPS
	30501204		Market Yard & Buildings	Townparks	RPS
	30501226		Teagasc	Townparks	RPS
	30501273		Presentation House - detached eight bay three storey former barracks	Townparks	RPS
	30501277		Presentation House - freestanding two bay single storey outbuilding	Townparks	RPS
	-		The Lodge	Townparks	RPS
BH 5		30931001	House	Cloonsheebane	None
BH 6	30800505	30814006	West Wall (Also AH 177)	Jamestown	RPS
	30814002	30814002	Weir - 4 bay sluice bridge	Jamestown, Charlestown	RPS
	30814003	30814003	Former Workhouse	Jamestown	RPS
	30814006	30814006	Jamestown Arch - North Gate (also AH 177)	Jamestown	RPS
	30814009	30814009	Inkwell, The Coach House (folly)	Jamestown	RPS

BH No	RPS	NIAH	Name / Type	Townland	Statutory Protection
	30814010	30814010	Jamestown Roman Catholic Church	Jamestown	RPS
	30814011	30814011	2 Storey L Shaped Plan House	Jamestown	RPS
	30814012	30814012	Stable Block, The Coach House (Jamestown House Outbuildings)	Jamestown	RPS
	30814015	30814015	Jamestown House Lodge	Jamestown	RPS
		30814005	Jamestown Roman Catholic Cemetery (also AH 177)	Jamestown	None
		30814008	Post box	Jamestown	None
		30814013	Jamestown House	Jamestown	None
		30814014	Water pump	Jamestown	None
		30814016	Jamestown Bridge	Jamestown	RMP
BH 7	30800516		Drumsna Quay	Drumsna	RPS
	30815001	30815001	St. Mary's Roman Catholic Church	Drumsna	RPS
	30815004	30815004	Cut Stone Gateway, Charlestown House	Drumsna	RPS
	30815009	30815009	3 Bay Two storey House, Quay Street	Drumsna	RPS
		30815002	Graveyard / cemetery (also AH 274)	Drumsna	None
		30815003	Milestone / milepost	Drumsna	None
		30815005	T. J. McLoughlin (house)	Drumsna	None
		30815006	House	Drumsna	None
		30815007	Drumsna Bridge	Drumsna	None
		30815008	House	Drumsna	None
		30815010	House	Drumsna	None
BH 8		30815011	Drumsna National School	Drumsna	None
BH 9	30815012	30815012	St. Ann's Church of Ireland Church	Annaduff	RPS
	30903203		Nesbitt Mausoleum	Annaduff	RPS
BH 10	01200549	31912002	Jamestown Canal Bridge	Corry	RPS
BH 11	01200548	31912001	Albert Lock	Cloonteem	RPS
BH 12	30903204		Shannon Bridge - Arched train viaduct over river	Derrylaur	RPS
BH 13	01100186		Church of St. Brigid	Dangan	RPS
BH 14	01800187	31918002	The Auld Thatch Cabin	Kilmore	RPS
BH 15	30935002	30935002	St. Mary's Roman Catholic Church	Aghamore	RPS

BH No	RPS	NIAH	Name / Type	Townland	Statutory Protection
BH 16	30903502		Two-storey house	Faulties	RPS

Architectural Conservation Areas (ACAs)

There are two ACAs within the Study Area; Carrick-on-Shannon ACA and Jamestown ACA. These are situated within the townlands of Townparks and Jamestown respectively in County Leitrim.

4.10.3.3 Designed Landscapes

A total of 16 designed landscapes have been identified from the desktop resource. These are listed in Table 4.10.4 and are marked as 'DL' on the accompanying figures. The NIAH[93] has carried out a desk-based survey of identifiable demesnes within Counties Leitrim and Roscommon The NIAH survey should not be considered as a full survey, as some landscapes are not included in the survey results. In this instance only eight of the 16 identifiable demesnes are included within the NIAH survey. Of these landscapes two are associated with Protected Structures and therefore have the potential to fall within the remit of the Planning and Development Act 2000.

Table 4.10.4 Designed Landscapes within the Study Area

DL Ref.	Demesne Name	Townland	NIAH Garden	Statutory Protection	Condition
DL 1	Woodbrook House	Usna, Hughestown	4626	RPS	Principal building (BH 1) and parkland retained.
DL 2	Danesfort	Danesfort	4531	None	Footprint of principal building and site footprint are visible.
DL 3	Castlecarra	Aghancarra, Aghameeny	N/A	None	Principal building retained; site footprint visible.
DL 4	Jamestown Lodge	Jamestown	N/A	RPS	Principal building (BH 6) retained; site footprint visible.
DL 5	Charlestown House	Charlestown, Cloonavery	4513	None	Building and woodland indicated, principal building no longer survives.
DL 6	Mountcampbell House	Mountcampbell, Cricken	4475	None	Woodland indicated; principal building no longer survives. Major road runs through site.
DL 7	Belmont	Drumsna	N/A	None	Site footprint visible, no structures survive.

[93] National Inventory of Architectural Heritage, 2022. Garden Survey Data Download. Available at: https://www.buildingsofireland.ie/resources/

DL Ref.	Demesne Name	Townland	NIAH Garden	Statutory Protection	Condition
					Development within site.
DL 8	Lismoyle	Lismoyle	N/A	None	Principal structure survives and site footprint visible.
DL 9	Cloonteem Cottage	Cloonteem, Corry	4525	None	No surviving architectural features, woodland indicated.
DL 10	Glebe House	Carrowcuil	N/A	None	Principal building and site boundary survive. Rectory on later OS mapping.
DL 11	Aghaward	Kilmore, Skeagh	4485	None	Named Kilmore on later OS mapping. Principal structure survives. Northern half of demesne contains significant development.
DL 12	Headford House	Headford, Annaduff Glebe	4459	None	Site footprint visible but nothing else remains.
DL 13	Glebe House	Annaduff Glebe	4449	None	Principal building retained and site boundary visible. Annaduff Rectory on later OS mapping.
DL 14	Hartley House	Hartley	N/A	None	Boundaries visible, house no longer extant and eastern half of demesne now occupied by modern housing.
DL 15	Drumlumman	Drumlumman	N/A	None	Boundaries visible, house may survive. Mature planting along boundaries still extant.
DL 16	Shannon Lodge	Carrick-on-Shannon	N/A	None	Shown with formal garden and scattered planting on 1st edition map. Area now occupied by modern housing; no trace of demesne remains

4.10.4 Summary

The purpose of this Constraints Study is to provide analysis of the archaeological, architectural, and cultural heritage resources within the study area in order to identify the key heritage constraints. The results of this study then inform the design of potential alternatives and options for the N4 Carrick-on-Shannon to Dromod

Project. The study area is located within Counties Leitrim and Roscommon and covers an approximate area of 78km^2. The study has shown that there is a large cultural heritage resource within the area. The sites and areas listed within this chapter are shown on Figures 4.10.1.0 to 4.10.1.5 and should be considered as key constraints during the design process.

With the exception of the settlements of Carrick-on-Shannon, Jamestown, Drumsna, Dromod, Cortober and Aghamore, the remaining landscape is rural in nature containing some scattered settlement, small to large pastoral farming enterprises with some marginal scrubby areas. A total of 364 individual RMP/SMR sites dating from the prehistoric period through to the post-medieval period, are listed within the study area indicating a continuance of activity and settlement in the region. A substantial percentage of these sites, 73%, can be ascribed to the early medieval period, with ringforts being most frequent. The recorded archaeological resource is distributed relatively evenly across the study area, although marginal ground tends to be less active in terms of known archaeology (due to waterlogged nature of the environment). None of the recorded monuments are protected with Preservation Orders or are listed as National Monuments. All recorded archaeological sites should be considered as cultural heritage constraints during the design of potential alternatives and options and avoided where possible.

A survey of the Excavations Bulletin (1970-2021) has revealed that a number of investigations have taken place within the study area. A total of 69 individual or groups of investigations have been recorded. The majority of archaeological works are located along existing roads or are associated with modern housing developments associated with existing settlement centres.

There are numerous Areas of Archaeological Potential (AAPs) within the study area. These are characterised by the River Shannon, associated loughs and marginal ground, smaller loughs and multiple small watercourses. All AAPs should be considered as archaeological constraints and avoided where possible. Where avoidance is not possible, potential impacts should be minimised through design. This includes the use of clear span structures across waterways.

An analysis of the built heritage within the study area has provided a holistic view of the built heritage resource, with the later years of the post-medieval period well represented by the presence of a number of country houses and demesnes, vernacular houses, bridges, railway infrastructure and churches. Structures that are architecturally and socially important are listed within the development plans and NIAH surveys of Counties Leitrim and Roscommon. A total of 112 individual built heritage structures are located within the study area, with a large portion recorded within the urban centre of Carrick-on-Shannon. All protected structures and NIAH structures should be considered as cultural heritage constraints during the design of the N4 Carrick-on-Shannon to Dromod Project with direct impacts and impacts on settings avoided where possible.

In addition, two Architectural Conservation Areas have been identified within the study area; the Carrick-on-Shannon ACA and the Jamestown ACA. The Jamestown ACA focusses on the village of Jamestown and includes the demesne landscape of Jamestown Lodge.

A total of 16 Designed Landscapes have been identified from the desktop resource within the study area, eight of which are included on the NIAH Garden Survey. Some of these landscapes retain their principal building and/or outbuildings, whereas others (such as Mount Campbell House and Charlestown House) have lost their houses and a large portion of the original designed landscape elements. Where the principal does survive, and is listed as a protected structure, the demesne can be viewed as attendant grounds to the same. These landscapes should be considered as cultural heritage constraints during the development of potential alternatives and options with demesnes retaining their principal structures being considered as key constraints

4.11 Landscape and Visual

4.11.1 Introduction

This section describes the landscape and visual constraints within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the landscape and visual constraints shown on, Figures 4.11.1.0 to 4.11.1.5.

This constraints study examines the existing landscape and highlights landscape and visual features of significance and sensitivity that may influence the development of feasible options. The landscape and visual environment comprise both natural and built elements which include topography, water bodies, vegetation, wildlife habitats, open spaces, developed lands, buildings and structures and views to and from such elements.

Sections 4.11.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.11.3 describes the landscape and visual constraints within the study area. A summary is presented in Section 4.11.4.

4.11.2 Methodology and Sources of Information

The landscape and visual constraints assessment involved desktop studies and fieldwork comprising professional evaluation by experienced landscape specialists.

The assessment is based on understanding the character of the existing landscape with specific reference to the Landscape Character Assessment of County Leitrim (and Section 4.8.6 of the Leitrim County Development Plan 2015-2021[13] and the Landscape Character Assessment of County Roscommon (Volume II of Roscommon County Development Plan 2014-2020[14]), to other landscape and visual references in the County Development Plans, and to a site-based review of the landscape and visual environment.

The assessment has had regard to the following documents and data sources:

- Draft Advice Notes for Preparing Environmental Impact Statements, September 2015[23]
- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft August 2017[21]
- Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013[94]
- Leitrim County Development Plan 2015-2021[13]
- Landscape Character Assessment for County Leitrim[95] [96]
- Draft Leitrim County Development Plan 2023-2029[17]

[94] Landscape Institute, 2013. Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013. Landscape Institute & Institute of Environmental Management and Assessment. London
[95] Environmental Resources Management, 2002. Comhairle Chontae Liatroma, Landscape Assessment of County Leitrim Reference 17896
[96] RPS, 2020. Leitrim Landscape Character Assessment 2019. Leitrim County Council

- Carrick-on-Shannon Local Area Plan 2010-2019**Error! Bookmark not d efined.**
- Roscommon County Development Plan 2022-2028[18]
- Landscape Character Assessment for County Roscommon, 2008, (Volume II of Roscommon County Development Plan 2014-2020)[97]
- Landscape Character Assessment for Draft County Roscommon, 2022 (Roscommon County Development Plan 2022-2028)[18]
- Cortober Local Area Plan 2014-2020[16]
- Ordnance Survey Ireland Geohive (http://map.geohive.ie/mapviewer.html)[98]
- Environmental Protection Agency GIS Mapping (https://gis.epa.ie/EPAMaps/)[99]
- Google Aerial Photography and Mapping (https://www.google.ie/maps)[33]

4.11.3 Existing Environment

The majority of the study area comprises a broad lowland valley bisected by the meandering corridor of the River Shannon. The River Shannon flows northwest to southeast through a series of online lakes and Carrick-on-Shannon, the principal town and urban settlement within the study area. This lowland valley is partly enclosed by rising Drumlins (70-80m above ordnance datum (AOD)) to the southwest and northeast of Carrick-on-Shannon, while the valley is more noticeably enclosed by an area of pronounced upland at Aghamore (80-85m AOD) near the eastern end of the study area.

The River Shannon only falls slightly in elevation (i.e. one to two metres) from northwest to southeast through the centre of the study area, accordingly, while often broad and impressive, the river is also slow moving. Despite the lowland nature of the broader river valley, it includes numerous low drumlin features (generally less than 70m AOD), which influences the meandering nature of the River Shannon through the study area. The prevailing alignment of the drumlin and ridge features is northeast/southwest.

The River Shannon is the primary watercourse/waterbody and major cruising and water-based amenity in the study area. The river includes many notable lakes – Lough Tap, Lough Nanoge and Lough Corry; with a number of other lakes in the immediate lowland valley (i.e. Drumgilra (or Gortinty) Lough, Lowfield Lough,

[97] MosArt Landscape-Architecture-Research, Macroworks, Judy Osborne et. al., 2008. Landscape Character Assessment of County Roscommon. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/Archived-Plans/County_Development_Plan_2008-2014_and_Variations/Landscape_Character_Assessment/
[98] Ordnance Survey Ireland, 2022. GeoHive Mapping Service. Available at: http://map.geohive.ie/mapviewer.html
[99] Environmental Protection Agency (EPA), 2022. EPA Webmapping Service Available at: https://gis.epa.ie/EPAMaps/

Cartron Lough, Gortconnellan (or Spa) Lough, Ballagh Lough and Kiltycarney Lough).

The predominant land use is grass-based agriculture, with some forestry, areas of peatland and native scrubland. Most low-lying and inter-drumlin areas are poorly drained and lands along the River Shannon are liable to flooding.

As the county town of Leitrim Carrick-on-Shannon, with a population of circa 5,000 persons, is the main urban settlement. The town is located to the northeast of the bridge over the River Shannon. Cortober is located in County Roscommon to the south-west of the River Shannon Bridge. Drumsna and Jamestown are attractive villages on the River Shannon and a small settlement is located on the N4 Aghamore overlooking the River Shannon and its lowland valley. Residential properties, either in clusters or more dispersed, are a notable feature along local roads throughout the study area.

While the majority of commerce and industry is located in Carrick-on-Shannon and Cortober, Masonite is a major industrial facility prominently located on an area of higher ground located between Drumgilra (or Gortinty) Lough to the east and the River Shannon to the west. Other smaller scale industries are also located in the rural landscape, e.g. Rosderra Meats (Jamestown) and Connaught Gold Western Rural Development Company Limited (Farnagh, Carrick-on-Shannon).

4.11.3.1 Leitrim County Development Plan 2015-2021

The Leitrim County Development Plan (LCDP) 2015-2021[13] incorporates policies and objectives that are relevant to the landscape and visual environment of the area east of the River Shannon. The Draft Leitrim County Development Plan 2023-2029[17] (DLCDP: January 2022) incorporates some changes to landscape and visual aspects – the principal change is referenced under Objective 82 in Table 4.11.1. The key policies and objectives (LCDP) identified are listed in Table 4.11.1.

Table 4.11.1 Key Landscape and Visual related Policies and Objectives (extract from LCDP 2015-2021)

Policy / Objective	Description
Policies and Objectives for Protection of the Natural Environment / Natural Heritage	
Objective 63	It is an objective of the Council to protect the character, appearance and quality of the habitats and semi-natural features in County Leitrim such as woodlands, hedgerows, peatlands, wetlands and artificial waterways of historic or ecological importance.
Objective 74	It is an objective of the Council to conserve peatlands and protect peatland landscapes within the County.
Policy 83	It is the Council's policy to ensure the preservation of sound deciduous trees, woodlands and native hedgerows, without excessively inhibiting development.
Objective 76	It is an objective of the Council to discourage the felling of healthy mature trees to facilitate development and to encourage the retention of healthy mature trees within developments.

Policy / Objective	Description
Objective 78	It is an objective of the Council to protect and preserve existing hedgerows and minimise their removal. Where their removal is necessary to seek their replacement with new hedgerow material native to the area.
Policy 85	It is the policy of the Council not to permit development on a floodplain other than in exceptional circumstances (where the development is of significant importance for the local community).
Policy 99	It is the policy of the Council to protect the floodplain of the Shannon. Planning permission for development on the floodplain will only be granted in exceptional circumstances and where the Council is satisfied that downstream (and upstream) consequences are insignificant. The Council must be satisfied that all floor levels in such developments are sufficiently high above the maximum recorded flood levels.
Policy 101	It is the policy of the Council to permit development in an area of High Visual Amenity only where the applicant has demonstrated a very high standard of site selection, site layout and design and where the planning authority is satisfied that the development could not be accommodated in a less-sensitive location.
Objective 81	It is an objective of the Council to protect the following Areas of High Visual Amenity, (Table 19 refers). (Table 19 includes **B11: River Shannon, Derrycarne and environs** – in effect the majority of the lands within County Leitrim adjoining the River Shannon).
Policy 102	It is the Council's policy to protect these views from intrusive development and enhance them by the removal of dereliction and eyesores. Lay-bys and viewing areas will be developed, as appropriate and as funds allow.
Objective 82	It is an objective of the Council to protect the following Views and Prospects, Table 20 of the Plan refers. (Table 20 of the LCDP 2015-2021 Plan includes the following protected views and prospects in the study area: **V25 View of River Shannon from the N4 Faulties to Aughamore** **V27 View of River Shannon from Local Road LS07426** **V28 View of River Shannon from the N4 in the townlands of Munkil** [sic – Minkill] **and Tully**.) It is noted that the three above views and prospects are recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029[17] (January 2022).
Policies and Objectives for Protection of the Built Environment	
Policy 104	It is the policy of the Council to protect all structures in the Record of Protected Structures (Appendix A Volume 2 of this plan).
Objective 84	It is an objective of the Council to seek the protection of all structures within the County that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.
Objective 90	It is an objective of the Council to protect and enhance the areas identified as Architectural Conservation Areas. (The town centre of **Carrick-on-Shannon is identified as an Architectural Conservation Area** on Map 4.13 of LCDP).

Policy / Objective	Description
Policy 105	It is the policy of the Council to promote public awareness of the rich archaeological heritage that exists in County Leitrim.
Objective 93	It is an objective of the Council to ensure that any development (above or below ground), within the vicinity of a site of archaeological interest shall not be detrimental to the character of the archaeological site or its setting.
Policy 107	It is the policy of the Council to protect and enhance public accessibility to the County's industrial heritage.
Policies and Objectives for Recreation, Sports and Amenity	
Objective 97	It is an objective of the Council to improve and develop safe public access to the rivers and lakeshores.
Objective 98	It is an objective of the Council to protect the rivers, lakes and canals from ecological damage.
Policy 110	It is the policy of the Council to promote and protect managed public access to the County's rivers and lakes and to ensure appropriate environmental safeguards are put in place in the provision of such accessibility.
Policy 116	It is the policy of the Council to preserve public rights of way and to create new rights of way, where appropriate.
Objective 109	It is an objective of the Council to maintain and signpost walking routes.
Objective 112	It is an objective of the Council to maintain and signpost cycle routes.

4.11.3.2 Landscape Character Assessment of County Leitrim

A Landscape Character Assessment of County Leitrim was prepared in 2002 and reviewed in 2020[100]. The review, which provided for ground truthing and updating of the original assessment is included at Appendix VI of the current Draft Leitrim County Development Plan 2023-2029[17]. The assessment (2020) divides the county into 17 generic Landscape Character Types (LCT) and 14 distinct Landscape Character Areas (LCA). The study area in County Leitrim lies within LCT 9: Drumlin Farmland and LCT 12: River Floodplain and within LCA 13: South Leitrim Drumlins and Shannon Basin.

LCT 9 Drumlin Farmland is described as:

> *"The Drumlin Farmland occupies a large part of the southern part of the county and features a distinctive drumlin hill topography. The consistent orientation of the hills gives the landscape a uniform grain and has its origins from the direction of ice flows during glaciation. The pattern or grain can be difficult to appreciate, being masked largely by the abundant mature hedgerows which race up and down the hillsides forming a patchwork pattern usually of small-scale. The drumlins have steep sides with broad rounded tops although their size and shape vary considerably throughout. Land cover is generally pasture with marshy areas within the inter drumlin hollows. Patches of commercial coniferous forestry are*

[100] Environmental Resources Management, 2002. Comhairle Chontae Liatroma, Landscape Assessment of County Leitrim Reference 17896.

dispersed throughout this landscape, some areas being fairly extensive in size. The plantation coniferous forest is a frequent feature and has become influential in the local landscape character."

LCT 12 River Floodplain is described as:

"…a flat, low lying pastoral river landscape associated with the Shannon. The river system comprises a number of loughs mostly connected with sluggish river sections. The drainage pattern features small feeder channels which drain the surrounding drumlin swarms and mountains. Water, both in the river channel and loughs, is an important landscape element. The meandering course of the Shannon is bordered by flat floodplains, gently sloping grazed banks, meadows and rough grazing. Landform is typically flat although slight undulations are present. Occasional floodplain trees such as Alder, Ash and Willow stand out as features. Pasture, grazed by cows in drier months, occurs in open fields bordering some stretches of the river. Field boundaries are typically defined by post and wire fences, often colonised by scrub species and ranker growth, giving the appearance of established hedgerows. There is virtually no settlement within this LCT. Roads are also generally absent. A small number of isolated houses do exist, occupying small undulating areas of land to escape flooding. These isolated dwellings tend to be accessed by narrow winding lanes and often enclosed by tall species rich hedgerows."

LCA 13 South Leitrim Drumlins & Shannon Basin is described as:

"…extensive lowland in the southern part of County Leitrim. Its boundary is formed by Lough Allen, the foothills of Sliabh an Iarainn and the Ballinamore Loughlands in the north and by the Corriga Uplands in the east. The southern part of this LCA is relatively flat and features pastoral farmland, peat bogs, marshy areas, small loughs and streams. Further north, the topography changes to distinctive drumlin hills. Mature hedgerows enclose a small-scale field pattern resulting in an intimate landscape. Occasionally enclosure is defined by post and wire fences and in some cases, stone walls. Lough of varying size feature throughout, the largest of which is Lough Rynn. Elevated views are possible across extensive areas from the top of some drumlins and isolated rocky outcrops which rise above the surrounding landscape."

Key Characteristics include:

- *"Flat to undulating topography in the southern tip of the county transitions to become a more pronounced drumlin hill landscape further north of Drumod [sic – Dromod] and Lough Rynn. Drumlins vary in size, shape and orientation;*
- *Farmed landscape dominated by pastoral land textured with areas of rush and pasture on hills above surrounding damp lowlands, wetlands, loughs and raised peat bogs;*
- *Some large settlements and larger scale dwellings located along, or at junctions of major communication routes;*

- *River Shannon dominates the drainage pattern of the area and is a popular tourist and recreational resource;"*

County Landscape Designations, Views and Prospects include:

- *"Area of High Visual Amenity (AHVA) B11 River Shannon, Derrycarne and Environs;*
- *V25 View of River Shannon from the N4 Faulties to Aughamore;*
- *V27 View of River Shannon from Local Road LS07426; and*
- *V28 View of River Shannon from the N4 in the townlands of Munkil [sic – Minkill] and Tully."*

NOTE: The three above views and prospects (V25, V27, V28) are recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029 [17].

Valued and Sensitive Attributes include:

- *Intimate Lake-land landscapes valued for their scenic quality, in particular Lough Rynn;*
- *Rural and tranquil wooded drumlin farmed landscape;*
- *River Shannon landscape as popular scenic destination;"*

4.11.3.3 Carrick-on-Shannon Local Area Plan 2010-2019

The Carrick-on-Shannon Local Area Plan 2010-2019[15] includes policies and objectives that are relevant to the landscape and visual environment of Carrick-on-Shannon and surrounding area within County Leitrim. The key policies and objectives identified include:

- Designation of lands along the River Shannon for either 'River Navigation and Amenity', 'Riverside Development' or 'Open Space and Amenity'
- Identification of 'Protected Views and Prospects' east and west from Carrick-on-Shannon Bridge and northwest and southeast from Hatley Manor in the town

4.11.3.4 Roscommon County Development Plan

The Roscommon County Development Plan (RCDP) 2022-2028[18] includes policies and objectives that are relevant to the landscape and visual environment of the study area, west of the River Shannon. There are no appreciable changes to landscape and visual considerations in the Draft Roscommon County Development Plan 2021-2027. The key policies and objectives identified are as follows:

Chapter 10 (Natural Heritage) of the development plan addresses a wide range of natural heritage and biodiversity assets of value. Many of these are considered in the Biodiversity Assessment (Chapter 4.XX of this Report) and / or the Heritage Assessment (Chapter 4.XX of this Report) for the proposed project. Therefore, the following only consider those directly referencing the landscape / visual aspects.

It is a policy objective of Roscommon County Council to:

NH10.11 Preserve and protect sites of county geological importance from inappropriate development where they comprise designated sites or national heritage areas.

NH10.13 Encourage the retention of hedgerows and other distinctive boundary treatments in rural areas and prevent loss and fragmentation, where practically possible. Where removal of a hedgerow, stone wall or other distinctive boundary treatment is unavoidable, mitigation by provision of the same type of boundary will be required.

NH10.14 Promote and encourage planting of native hedgerow species in new developments.

NH10.25 Minimise visual impacts on areas categorised within the County Roscommon Landscape Character Assessment including "moderate value"," high value", "very high value" and with special emphasis on areas classified as "exceptional value" and where deemed necessary, require the use of Visual Impact Assessment where proposed development may have significant effect on such designated areas.

NH10.26 Protect important views and prospects in the rural landscape and visual linkage between established landmarks, landscape features and views in urban areas.

4.11.3.5 Roscommon Landscape Character Assessment

A Landscape Character Assessment of County Roscommon is included in Volume II of the RCDP, 2014-2020[14]. The assessment divides the county into seven generic Landscape Character Types (LCT), and 36 distinct Landscape Character Areas (LCA), to which it applies a landscape value rating of either 'Moderate', 'High', 'Very High' or 'Exceptional'.

The Landscape Character Assessment of County Roscommon, which forms part of the County Development Plan, divides the county into 36 separate LCAs. The study area for the proposed development spans the boundary between LCA No. 3: Lough Corry Drumlin Landscape and No. 4: Kilglass Drumlin Landscape. Both LCAs are located within the 'river corridor' landscape character type (LCT) and are described as having 'very high landscape value' (refer to Figures 6, 7 & 8 of the Landscape Character Assessment of County Roscommon).

LCA 3: Lough Corry Drumlin Landscape (Very High Value)

The western portion of the study area within County Roscommon (west from Corgullion) and including Cortober, is located within LCA: 3, which is described as:

> *"The drainage pattern reflects the general alignment of drumlins which are arranged on a southwest to northeast alignment. The predominant land cover is dry grassland but there are areas of wet grassland as well as reclaimed blanket bog throughout. The latter two land cover types are typically found in the drumlin flats and hollows. Hedgerows comprise*

mostly broadleaf species including ash. In some areas there is a strong sense of openness created by loose light hedgerows."

"While there are no large settlements in this LCA, the town of Carrick-on-Shannon spills over the Shannon River into the northeastern corner and brings with it both residential and commercial development."

"The overall image of this LCA is of a relatively well drained drumlin farmland, with strong tourist amenities along the River Shannon including Lough Corry."

The landscape value is described as:

"The Lough Corry Drumlin Basin is classified as Very High Value to reflect the boating, fishing and scenic amenities along the River Shannon. It is valued by tourists for its peaceful and largely undeveloped condition."

The forces of change within this LCA are described as:

"Inappropriate and poorly sited development on the shoreline of Lough Corry and along the River Shannon would have a negative visual and environmental impact on the wetland landscape. There is increasing development pressure along the R370 leading into Carrick-on-Shannon which is contributing to the erosion of the rural character of the area."

LCA 4: Kilglass Drumlin Landscape (Very High Value)

The eastern portion of the study area within County Roscommon (east from Corgullion) and including the Albert Canal, is located within LCA: 4, which is described as:

"The area comprises low undulating drumlins which are well drained in the north and interspersed with a number of large lakes,"… "The drumlins are aligned on a northeast southwest axis and this arrangement determines the pattern of lakes in the greater area. The lakes fan out from east to west similar to fingers extending into the rolling drumlin landscape. The effect of this pattern of lake and hill is unique in the context of the county."

"The image of this landscape character area is of a drowned and dramatic drumlin lakeland and floodplain offering a tranquil boating amenity."

The landscape value is described as:

"The Kilglass Drumlin Lakeland area is considered to be of Very High Value due to it its tourist amenities including fishing, boating and extensive scenic views."

The forces of change within this LCA are described as:

"The area is of very high visual amenity and thus tends to attract considerable interest in people wishing to build single rural dwellings. There are several locations where houses have been built in the recent past overlooking the lakes and this trend is likely to continue unless measures are put in place to afford greater protection to the landscape. There is also likely to be an increase in the extent of afforestation in this landscape due

to the marginal quality of farmland. The N5 [sic N4] *is due to be realigned over a 32 kilometre length and therefore it may be anticipated that there will be increased demand for quarrying in the area."*

Scenic Routes and Scenic Views

The Landscape Character Assessment of County Roscommon identifies nine Scenic Routes in the county, none of which is located within the study area. The assessment also identifies 26 Scenic Views in the county, one of which is relevant to the study area (refer to Appendix 1, and specifically Figure 13, of Landscape Character Assessment of County Roscommon):

- View V8 is an almost 180° view northwest, west and southwest from Harltey Bridge (north of Carrick-on-Shannon). In the landscape character assessment that accompanied the previous development plan (Roscommon County Development Plan 2010-2020), the same view (V8) was described as:

  "View from Hartly Bridge to north to Slieve Anierin, Eidin Lake to the south and windfarm on Kilronan Mountain to the northwest. Low undulating sparsely populated landscape in the foreground."

4.11.3.6 Cortober Local Area Plan, 2014-2020

The Cortober Local Area Plan 2014-2020[16] references the County LCA (as discussed in section 4.11.3.5) noting that Cortober lies within the Very High Value LCA 3: Lough Corry Drumlin Basin, stating:

"*The predominant land cover is dry grassland but there are areas of wet grassland as well as reclaimed blanket bog throughout. The latter two land cover types are typically found in the drumlin flats and hollows. Hedgerows comprise mostly broadleaf species including ash. In some areas there is a strung [sic] sense of openness created by loose light hedgerows. This drumlin landscape is well drained and relatively dry compared to the drumlin landscapes found both in the north and south."*

4.11.3.7 Landscape Context

The key landscape constraints in the study area are:

- The River Shannon watercourse/waterbody (including Albert Canal/Lock) and adjoining lowland, drumlins and lakes and water-related amenities and marinas
- High Visual Amenity Areas along the River Shannon in County Leitrim
- The 'Very High Value' landscape character areas (i.e. LCA 3 Lough Corry Drumlin Basin and LCA 4 Kilglass Drumlin Lakelands) – especially within the 'River Corridor' landscape character type
- Elevated lands at Aghamore and higher ridgelines generally
- Clustered and dispersed residential properties in the landscape
- Town of Carrick-on-Shannon, Drumsna and Jamestown Villages and Aghamore settlement

- Amenity/Sports Facilities, including water-based activities/amenities/marinas, Killukin Waterfall and Annaduff/Leitrim GAA Facility (Aghamore), Carrick-on-Shannon Rugby Grounds (Keenaghan), Páirc Seán Mac Diarmada & St. Mary's Grounds (Carrick-on-Shannon) and Bull Field Sports Grounds (Cortober)
- Former demesne landscapes – notably remaining structures, entrances, boundaries, parkland, trees and woodlands
- High number of prominent archaeological sites (e.g. ringforts) in the landscape – many of which are located on drumlins and are densely planted

4.11.3.8 Visual Context

The key visual constraints in the study area are:

- Views to and from the River Shannon (and Albert Canal/Lock) watercourse/waterbody and its adjoining lowland, drumlin features, lakes and water-related amenities and marinas
- Protected Views and Prospects V25 (Aghamore-Faulties) and V27 and V28 (Minkull, Tully) within County Leitrim (It is noted that these views and prospects are recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029)[17]
- Protected Scenic View V8 (Hartley Bridge, north of Carrick-on-Shannon) within County Roscommon
- Protected Views (from Bridge, and Hatley Manor) in Carrick-on-Shannon
- Views from clustered and dispersed residential properties in the landscape
- Views from Carrick-on-Shannon, Drumsna and Jamestown – particularly to the River Shannon corridor and from the bridges over the river
- Views to and from the many prominent archaeological sites (e.g. ringforts) in the landscape – many of which are located on drumlins
- Views to and from the cultural heritage structures and properties in the landscape, including bridges, churches, protected structures

4.11.4 Summary

The study area is a high value, primarily lowland landscape, dominated by the corridor of the River Shannon and the associated towns and villages of Carrick-on-Shannon, Drumsna and Jamestown. The key landscape and visual constraints relate to the River Shannon and its settlements, its landscape and visual designations, and to the location of residential property clustered and dispersed throughout the landscape.

4.12 Biodiversity

4.12.1 Introduction

This section describes the biodiversity (flora and fauna) constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the biodiversity constraints presented in Figures 4.12.1.0 to 4.12.2.5.

Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Alongside the term "biodiversity", the terms "ecology" and "ecological" are also used throughout this section of the report as a broader term to refer to the relationships of biodiversity receptors to one another and to their environment.

Section 4.12.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.12.3 describes the biodiversity constraints within the scheme study area. A summary is presented in Section 4.12.4.

4.12.2 Methodology and Sources of Information

This section describes the background legislation, policy context and guidance along with a summary of the methods used to collate information on the biodiversity constraints.

4.12.2.1 Relevant Legislation, Policy Documents and Plans, and Guidance Documents

The collation of baseline biodiversity data and the preparation of this section has had regard to the following legislation, policy and plans, and guidance documents.

Legislation:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (hereafter referred to as 'the Habitats Directive')[101]
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (hereafter referred to as 'the Birds Directive')[102]
- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of

[101] European Union, 1992. Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

[102] European Union, 2009. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147

certain public and private projects on the environment (hereafter referred to as 'the EIA Directive')[103]

- European Communities (Birds and Natural Habitats) Regulations, 2011 (SI No. 477 of 2011) (as amended), (hereafter referred to as 'the Birds and Habitats Regulations')[104]
- Planning & Development Acts 2000 to 2023 (hereafter referred to as 'the Planning and Development Acts')[105]
- Wildlife Acts 1976 to 2022 (hereafter referred to as 'the Wildlife Acts')[106] [107] [108] [109] [110] [111]
- Flora (Protection) Order, 2022 (SI No. 356 of 2015)[112]
- Fisheries (Consolidation) Act, 1959, as amended (hereafter referred to as 'the Fisheries Act')[113]

Policies and Plans:

- National Biodiversity Action Plan 2017-2021[114]
- River Basin Management Plan for Ireland 2018-2021
- Leitrim County Development Plan 2015-2021[13]
- Roscommon County Development Plan 2014-2020[14]

[103] European Union, 2014. Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052
[104] Government of Ireland, 2011. S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011. Available at: http://www.irishstatutebook.ie/eli/2011/si/477/made/en/print
[105] Department of Housing, Local Government and Heritage, 2023. Planning and Development Act 2000. Available at: https://www.gov.ie/en/publication/c0ac2-planning-legislation-primary-legislation/
[106] Government of Ireland, 1976. Wildlife Act, 1976. Available at: http://www.irishstatutebook.ie/eli/1976/act/39/enacted/en/html
[107] Government of Ireland, 2000. Wildlife (Amendment) Act, 2000. Available at: http://www.irishstatutebook.ie/eli/2000/act/38/enacted/en/html
[108] Government of Ireland, 2010. Wildlife (Amendment) Act 2010. Available at: http://www.irishstatutebook.ie/eli/2010/act/19/enacted/en/html
[109] Government of Ireland 2012. Wildlife (Amendment) Act 2012. Available at: http://www.irishstatutebook.ie/eli/2012/act/29/enacted/en/html
[110] Government of Ireland, 2018. Heritage Act 2018. Available at: http://www.irishstatutebook.ie/eli/2018/act/15/enacted/en/html
[111] Government of Ireland, 2021. Planning and Development, Heritage and Broadcasting (Amendment) Act 2021. Available at: http://www.irishstatutebook.ie/eli/2021/act/11/enacted/en/html
[112] Government of Ireland, 2022. S.I. No. 235/2022 - Flora (Protection) Order, 2022. Available at: irishstatuteboohttps://www.irishstatutebook.ie/eli/2022/si/235/made/en/pdfk.ie
[113] Government of Ireland, 1959. Fisheries (Consolidation) Act, 1959. Available at: http://www.irishstatutebook.ie/eli/1959/act/14/enacted/en/html
[114] Department of Culture, Heritage and the Gaeltacht (2017) National Biodiversity Action Plan 2017 – 2021. Available at: https://www.npws.ie/sites/default/files/publications/pdf/National%20Biodiversity%20Action%20Plan%20English.pdf

- Nature and Wildlife in Roscommon, Action for Biodiversity[115]
- County Roscommon Hedgerow Survey Report[116]
- Kearney, P. (2011) Survey & Mapping of Habitats in County Roscommon. [Not available on-line, requested from Roscommon County Council]
- County Roscommon Heritage Plan 2017-2021, Incorporating County Roscommon Biodiversity Plan[117]
- Carrick-on-Shannon Local Area Plan 2010-2019**Error! Bookmark not d efined.**

Guidance Documents:

- Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports[21]
- Draft Advice Notes for Preparing Environmental Impact Statements[23]
- Guidelines on the Information to be contained in Environmental Impact Statements[20]
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements[22]
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine[118]
- Environmental Impact Assessment of National Road Schemes – A Practical Guide[24]
- Guidelines for Assessment of Ecological Impacts of National Road Schemes[119]
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes[120]

[115] Roscommon County Council, 2012. Nature and Wildlife in Roscommon, Action for Biodiversity. Available at: https://www.yumpu.com/en/document/read/25848958/nature-and-wildlife-in-roscommon-roscommon-county-council

[116] Roscommon County Council, 2005. County Roscommon Hedgerow Survey Report. Available at: https://www.roscommoncoco.ie/en/download-it/heritage-publications/county-roscommon-hedgerow-survey-report.pdf

[117] Roscommon County Council, 2017. County Roscommon Heritage Plan 2017 – 2021, Incorporating County Roscommon Biodiversity Plan. Available at: http://www.roscommoncoco.ie/en/Services/Community/Heritage/Heritage/County-Roscommon-Heritage-Plan-2017-2021/

[118] Chartered Institute of Ecology and Environmental Management, 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/

[119] National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

[120] National Roads Authority, 2008. Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Ecological-Surveying-Techniques-for-Protected-Flora-and-Fauna-during-the-Planning-of-National-Road-Schemes.pdf

- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes[121]
- Circular NPWS 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities[122]
- Circular Letter PD 2/07 and NPWS 1/07 Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites[123]
- Circular Letter NPWS 2/07 Guidance on compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences[124]

4.12.2.2 Study Area and Zone of Influence

The objective of the constraints study is to identify, at an early stage of a proposed road project, the international, national, county and local issues that must be taken into account when planning and designing a road in the follow-on phases of the project as per TII guidance. Following on from an evaluation of desk material (see section 4.12.2.3) and review of aerial orthophotography, walkover visits to publicly accessible parts of the study area were visited as part of the constraints study. Follow up walkover survey to confirm the identification of habitats that are identified as ecological sites are undertaken during the assessment of option corridors. These may in themselves provide supporting habitat/features for mobile wildlife, but in the absence of design development details and detailed biodiversity surveys, the Zone of Influence (ZoI) of the constraints study largely focusses on the study area, with consideration of various impacts that might affect identified/confirmed biodiversity features. All the ecological receptors are largely identified from within the study area, potential impact pathways to biodiversity outside of the study area were also considered and can include features such as hydrologically or hydrogeologically connected habitats and/or species, particularly in respect to mobile species that are associated with nearby designated sites (European, National etc.) as documented in the report.

[121] National Roads Authority, 2006. Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Best_Practice_Guidelines_for_the_Conservation_of_Bats_in_the_Planning_of_National_Road_Schemes.pdf

[122] National Parks & Wildlife Service, 2010. Circular NPWS 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Available at: https://www.npws.ie/sites/default/files/general/Circular%20NPW1-10%20%26%20PSSP2-10%20Final.pdf

[123] National Parks & Wildlife Service, 2007. Circular Letter PD 2/07 and NPWS 1/07 Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites. Available at: https://www.npws.ie/sites/default/files/general/circular-pd-02-07.pdf

[124] National Parks & Wildlife Service, 2007. Circular Letter NPWS 2/07 Guidance on compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences. Available at: https://www.npws.ie/sites/default/files/general/circular-npws-2-07-reg-23-compliance.pdf

4.12.2.3 Desk Study and Data Sources

The desktop study involved the collection and review of relevant published and unpublished sources of biodiversity information and data.

The following information sources and datasets were reviewed as part of this constraints study:

- On-line data available from the National Parks and Wildlife Service (NPWS) on Natura 2000 sites (hereafter referred to as European sites) [125] and other Designated Sites protected at the national level (i.e. Natural Heritage Areas, or NHAs, and proposed Natural Heritage Areas, or pNHAs) [126]
- Records of rare and protected species from the NPWS for the 10km grid squares [G80, G90, H00, M89, M99 and N09] [127]
- National Biodiversity Data Centre (NBDC) Search of On-line Database for 10km Grid Squares [G80, G90, H00, M89, M99 and N09] [128]
- Orthophotography[129]. Recent orthophotographs were reviewed and interpreted to initially identify and define sites of potential biodiversity value for the habitats present (hereafter referred to as 'ecological sites'). The final definition, description and evaluation of these ecological sites also takes into account the other habitat information collated as part of the desk study
- Information provided by Leitrim County Council on surveys to inform a previous road scheme through the study area in the early 2010's

Habitat GIS datasets available to download from the NPWS website, as follows:

- Ancient and Long-Established Woodland (updated 2012) [130]

[125] European sites are defined under the Habitats Directive (Article 3) as a European ecological network of Special Areas of Conservation and Special Protection Areas, composed of sites which host the natural habitat types listed in Annex I and habitats of the protected species listed in Annex II. The aim of the network is to aid the long-term survival of Europe's most vulnerable and threatened species and habitats. In Ireland, these sites are designated as European sites – defined under the Planning Acts and/or Birds and Habitats Regulations as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. They are commonly referred to in Ireland as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)

[126] NPWS, 2020. Protected Sites in Ireland. Available at: www.npws.ie/protectedsites/ and http://webgis.npws.ie/npwsviewer/

[127] NPWS, 2022. Unpublished records and records published on the NPWS Online Map Viewer. Available at: http://webgis.npws.ie/npwsviewer/. And the Flora Protection Order bryophyte map viewer available at: https://www.npws.ie/maps-and-data/flora-protection-order-map-viewer-bryophytes

[128] National Biodiversity Data Centre, 2020. Online Database. Available at: https://maps.biodiversityireland.ie/Map

[129] Google Maps, 2022. Online orthophotography. Available at: https://www.google.com/maps and Bing Maps, 2022. Available at: https://www.bing.com/maps , and Ordnance Survey Ireland orthophotography

[130] NPWS, 2012. GIS Dataset for Ancient and Long-Established Woodland. Available at: https://www.npws.ie/maps-and-data/habitat-and-species-data

- National Survey of Native Woodlands 2003-2008 (updated 2012) [131]
- Article 17 Data for Annex I habitats (2019) [132]

Spatial data relating to watercourses and lakes, downloaded from the Environmental Protection Agency's (EPA) online Geo Portal[133], specifically, the following datasets:

- WFD River Water Bodies - 27/04/2017
- New Lake Water Bodies - 19/02/2016

Other available sources of habitat or species information, specifically the following publications:

- Online map of Irish wetlands [134]

4.12.2.4 Consultation

The following organisations/individuals with relevance to collating information on biodiversity constraints were consulted as part of the constraints study:

- NPWS [via the Development Applications Unit] – protected species records spreadsheet; response received on 3 September 2020
- NPWS [via virtual meeting consultation] on 22 October 2021
- Inland Fisheries Ireland (IFI) – response received on 21 December 2020
- Bat Conservation Ireland (BCI) – roost information obtained from BCI database
- BirdWatch Ireland (BWI)
- Botanical Society of Britain & Ireland (BSBI)]

Further details of the data received is presented in Section 4.12.3 below.

4.12.2.5 Field Surveys

The following ecological field surveys were carried out to supplement the information collated during the desk study and consultations:

- Walkover surveys of ecological sites within the study area to ground truth and verify the orthophotography interpretation
- Habitat survey of lands within the River Shannon floodplain to the north-west of Carrick-on-Shannon

[131] NPWS, 2012. GIS Dataset for the National Survey of Native Woodland 2003-2008. Available at: https://www.npws.ie/maps-and-data/habitat-and-species-data
[132] NPWS, 2019. Article 17 Data for Annex I habitats. Available at: https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17
[133] Environmental Protection Agency, 2022. EPA Water Framework Directive (WFD) river water bodies and lake water bodies datasets. Available at: http://gis.epa.ie/GetData/Download
[134] Wetland Surveys Ireland, 2021. Map of Irish Wetlands. Available at: http://www.wetlandsurveysireland.com/wetlands/map-of-irish-wetlands--/map-of-irish-wetlands---map/index.html

- Habitat survey of lands within the River Shannon floodplain to the south of Carrick-on-Shannon

4.12.2.6 Walkover Surveys and Evaluation of Ecological Sites

A walkover survey of the ecological sites that lie within the study area was undertaken by Scott Cawley Ltd. in August and September 2020 to verify the orthophotography interpretation and selection of ecological sites, refine site boundaries identified during the desk study and to capture additional ecological information not identified during the desk study.

Where access allowed, the sites were walked, and notes taken on the habitats present. Where access was limited, ecological sites were viewed from the nearest accessible vantage point using binoculars. In some cases, due to the local topography or limited access, views of ecological sites were restricted. However, assumptions have been made on the value of those ecological sites based on professional judgement of orthophotography interpretation and local information gathered during the field surveys and desk study.

Where possible habitat types were classified using A Guide to Habitats in Ireland135. The likelihood/potential for Annex I habitat types was inferred where possible based on the professional judgement of the surveyor, with reference to the Interpretation manual of European Union Habitats EUR 28[136] and definitions of Annex I habitat types published in the corresponding national habitat survey reports and NPWS wildlife manuals, as applicable. The nomenclature for Annex I habitats follows that of the Interpretation manual of European Union Habitats EUR28[136] with abbreviated names after those used in The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview[137]. A precautionary approach was adopted with regards to the identification of the potential presence of Annex I habitats within an ecological site.

Ecological sites have been valued with regard to ecological valuation set out in Guidelines for Assessment of Ecological Impacts of National Road Schemes[119] and Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine[118]. The overall ecological valuation for each of the ecological sites was based upon the highest value receptor known to be present, or potentially present, within the ecological site at the time of this study.

All Annex I habitats that lie outside of European sites, are valued as being of national importance, given that these habitats are of high conservation concern. However, priority Annex I habitat types, (where they are confirmed or are on a precautionary basis considered to be present owing to conditions that could support their presence) are valued as being of international importance given that they are

[135] Fossitt, J.A. 2000. A Guide to Habitats in Ireland. Heritage Council, Kilkenny.
[136] CEC (Commission of the European Communities), 2013. Interpretation manual of European Union Habitats EUR28. European Commission, DG Environment. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf
[137] NPWS, 2019. The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview. NPWS report., available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol1_Summary_Article17.pdf

of the highest conservation concern at a European level (*i.e.* natural habitat types in danger of disappearance[138]).

4.12.2.7 Habitat Surveys

Habitat surveys were undertaken by Scott Cawley Ltd. at two locations within the River Shannon floodplain (see Figures 4.12.1.0 to 4.12.1.5):

- To the northwest of Carrick-on-Shannon in the townlands of Corryolus and Cloonman (which includes part of Lough Eidin pNHA)
- To the south of Carrick-on-Shannon in the townlands of Cortober, Cordrehid, Attirory, Rinnacurreen and Drumkeeran

The surveys were undertaken by Dr John Conaghan, in August and September 2020, following the methodology described in Best Practice Guidance for Habitat Survey and Mapping[139.] All habitat types were classified using the Guide to Habitats in Ireland, recording the indicator species and abundance using the DAFOR scale[140] and recording any species of conservation interest. Vascular and bryophyte plant nomenclature generally follow that of The National Vegetation Database[141], having regard to more recent taxonomic changes to species names after the New Flora of the British Isles[142] and the British Bryological Society's Mosses and Liverworts of Britain and Ireland: A Field Guide[143]. Annex I habitat types were classified after the Interpretation manual of European Union Habitats EUR28[136] with reference to the corresponding national habitat survey reports and NPWS wildlife manuals, as applicable. The nomenclature for Annex I habitats follows that of the Interpretation manual of European Union Habitats EUR28 with abbreviated names after those used in The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview.[137]

4.12.2.8 Barn Owl Surveys

Dedicated Barn Owl surveys were undertaken by John Lusby within the study area for the project between March and July 2021. The methodology followed was that as defined by TII Standards (TII, 2021) and under licence to the National Parks and Wildlife Service (Licence No: 33/2021). A suitability assessment of all buildings and other potentially suitable structures within the study area was undertaken from public roads to determine whether the site was potentially suitable or unsuitable for breeding barn owls. Following this, all suitable sites received either a daytime or

[138] From the definition of "*priority natural habitat types*" in Article 1(d) of the Habitats Directive.
[139] Smith, G.F., O'Donoghue, P., O'Hora, K. & Delaney, E., 2011. Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council Church Lane, Kilkenny, Ireland
[140] The DAFOR scale is an ordinal or semi-quantitative scale for recording the relative abundance of plant species. The name DAFOR is an acronym for the abundance levels recorded: Dominant, Abundant, Frequent, Occasional and Rare
[141] Weekes, L.C. & FitzPatrick, Ú., 2010. The National Vegetation Database: Guidelines and Standards for the Collection and Storage of Vegetation Data in Ireland. Version 1.0. Irish Wildlife Manuals, No. 49. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland
[142] Stace, C., 2019. New Flora of the British Isles. 4th Edition. C&M Floristics.
[143] Atherton, I., Bosanquet, S. & Lawley, M. 2010. Mosses and Liverworts of Britain and Ireland: A Field Guide. Latimer Trend & Co., Plymouth

nocturnal survey to determine barn owl occupancy. A nocturnal survey was carried out at all sites or areas where evidence of barn owls was noted to determine the breeding status of the site. A copy of the Barn Owl Survey Report is contained in Appendix A.4.12.1.

4.12.3 Existing Environment

4.12.3.1 Desktop Study

Designated Sites

European and Nationally Designated Sites

Special Areas of Conservation (SACs) are designated under the EC Habitats Directive (92/43/EEC) for the protection of habitats listed on Annex I and/or species listed on Annex II of the Directive. Special Protection Areas (SPAs) are designated under the Birds Directive (2009/147/EC) for the protection of bird species listed on Annex I of the Directive, regularly occurring populations of migratory species (such as ducks, geese or waders), and areas of international importance for migratory birds.

Natural Heritage Areas (NHAs) are designated under the Wildlife Acts to protect habitats, species or geology of national importance. In addition to NHAs there are proposed NHAs (referred to as pNHAs), which are also sites of significance for wildlife and habitats and were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. Proposed NHAs are offered protection in the interim period under county or city development plans which requires that planning authorities give due regard to their protection in planning policies and decisions. [144]

European sites such as SACs and SPAs are of international importance from a biodiversity perspective, whilst pNHAs are regarded as being of national importance.

Several Designated Sites, including those protected at a European and national level, are located within, or downstream of, the study area. These Designated Sites are listed in Table 4.12.1 along with a brief description of the features for which the sites are designated. Designated Sites within the study area are shown on Figures 4.12.2.0 to 4.12.2.5.

There are no SAC, SPA or NHA sites located within, or in the immediate vicinity of, the study area.

The nearest SAC sites to the study area are Clooneen Bog SAC and Lough Forbes Complex SAC. Lough Forbes Complex SAC lies c.10km downstream of the study area, along the River Shannon. There are also four SAC sites at greater distances further downstream of the study area in the River Shannon catchment Lough Ree

[144] For example, Objective 66 of the Leitrim County Development Plan 2015-2021 states 'It is an objective of the Council to protect all Natural Heritage Areas and those proposed for designation either before or during the lifetime of this plan so as to recognise that the process of designation of such sites is ongoing, with new sites being added and boundaries of existing sites being adjusted, as better information becomes available.

SAC, River Shannon Callows SAC, Lough Derg North-east Shore SAC, and the Lower River Shannon SAC.

The nearest SPA site to the study area is Ballykenny-Fisherstown Bog SPA, which lies c.10km downstream. There are also four SPA sites at greater distances further downstream of the study area in the River Shannon catchment: Lough Ree SPA, Middle Shannon Callows SPA, Lough Derg (Shannon) SPA, and the River Shannon and River Fergus Estuaries SPA.

The nearest NHA site to the study area is Corracramph Bog NHA which is located c.1.9km to the south of the study area. There are two pNHA sites within the study area: Lough Eidin pNHA and Lough Boderg and Lough Bofin pNHA. There are also five pNHA sites downstream of the study area in the River Shannon catchment: Lough Ree pNHA, River Shannon Callows pNHA, Lough Derg pNHA, Fergus Estuary and Inner Shannon, North Shore pNHA and Inner Shannon Estuary - South Shore pNHA.

Table 4.12.1 Designated Sites Located within, or in the vicinity of, the Study Area

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
Special Areas of Conservation (SACs)		
Annaghmore Lough (Roscommon) SAC [001626]	Alkaline fens [7230] *Vertigo geyeri* (Geyer's whorl snail) [1013] NPWS (2019) *Conservation Objectives: Annaghmore Lough (Roscommon) SAC 001626. Version 1*. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht	c. 11.4km southwest of the study area
Bricklieve Mountains and Keishcorran SAC [001656]	* Turloughs [3180] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510] Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii) [8120] *Euphydryas aurinia* (Marsh fritillary) [1065] *Austropotamobius pallipes* (White-clawed crayfish) [1092] NPWS (2021) Conservation objectives for Bricklieve Mountains and Keishcorran SAC [001656]. Generic Version 8.0. Department of Housing, Local Government and Heritage	c. 14km northwest of the study area
Clooneen Bog SAC [002348]	Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150] * Bog woodland [91D0] NPWS (2016) *Conservation Objectives: Clooneen Bog SAC 002348. Version 1*. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.	c. 7.3km south of the study area

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
Cuilcagh - Anierin Uplands SAC [000584]	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110] Natural dystrophic lakes and ponds [3160] Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] *Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bogs (* if active bog) [7130] Transition mires and quaking bogs [7140] * Petrifying springs with tufa formation (Cratoneurion) [7220] Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110] Siliceous rocky slopes with chasmophytic vegetation [8220] *Hamatocaulis vernicosus*[145] (Slender Green Feather-moss) [6216] NPWS (2016) *Conservation Objectives: Cuilcagh - Anierin Uplands SAC 000584. Version 1.* National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.	c. 12.9km northeast of the study area
Lough Arrow SAC [001673]	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140] NPWS (2021) Conservation objectives for Lough Arrow SAC [001673]. Generic Version 8.0. Department of Housing, Local Government and Heritage	c. 11km northwest of the study area
Lough Forbes Complex SAC [001818]	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation [3150] * Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150] * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0] NPWS (2016) *Conservation Objectives: Lough Forbes Complex SAC 001818. Version 1.* National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht	c. 9.4km south, and c. 10km downstream of, the study area

[145] Recorded as *Drepanocladus vernicosus* within the conservation objectives, however name provided here as *Hamatocaulis vernicosus* to reflect updated nomenclature changes

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
Lough Ree SAC [000440]	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation [3150] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] Degraded raised bogs still capable of natural regeneration [7120] Alkaline fens [7230] *Limestone pavements [8240] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles * Bog woodland [91D0] *Lutra lutra* (Otter) [1355] NPWS (2016) Conservation Objectives: *Lough Ree SAC 000440*. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.	c. 22.8km south, and c. 27.6km downstream of, the study area
River Shannon Callows SAC [000216]	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510] Alkaline fens [7230] *Limestone pavements [8240] *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Lutra lutra* (Otter) [1355] NPWS (2021) Conservation objectives for *River Shannon Callows SAC [000216]*. Generic Version 8.0. Department of Housing, Local Government and Heritage.	c. 50.8km south, and c. 59km downstream of, the study area
Lough Derg, North-east Shore SAC [002241]	*Juniperus communis* formations on heaths or calcareous grasslands [5130] *Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7210] Alkaline fens [7230] *Limestone pavements [8240] *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] **Taxus baccata* woods of the British Isles [91J0] NPWS (2019) Conservation Objectives: *Lough Derg, North-east Shore SAC 002241*. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	c. 89.8km southwest, and c. 116km downstream of, the study area
Lower River Shannon SAC [002165]	Sandbanks which are slightly covered by sea water all the time [1110] Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] *Coastal lagoons [1150] Large shallow inlets and bays [1160]	c. 123.8km southwest, and c. 154km downstream of, the study area

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
	Reefs [1170] Perennial vegetation of stony banks [1220] Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] *Salicornia* and other annuals colonising mud and sand [1310] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] *Alluvial forests with Alnus glutinosa and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] *Petromyzon marinus* (Sea Lamprey) [1095] *Lampetra planeri* (Brook Lamprey) [1096] *Lampetra fluviatilis* (River Lamprey) [1099] *Salmo salar* (Salmon) [1106] *Tursiops truncatus* (Common Bottlenose Dolphin) [1349] *Lutra lutra* (Otter) [1355] NPWS (2012) Conservation Objectives: *Lower River Shannon SAC 002165*. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	
Special Protection Areas (SPAs)		
Lough Gara SPA [004048]	Whooper swan (*Cygnus cygnus*) [A038] Greenland white-fronted goose (*Anser albifrons flavirostris*) [A395] NPWS (2021) Conservation objectives for Lough Gara SPA [004048]. Generic Version 8.0. Department of Housing, Local Government and Heritage	c. 14.7km west of the study area
Lough Arrow SPA [004050]	Little grebe (*Tachybaptus ruficollis*) [A004] Tufted duck (*Aythya fuligula*) [A061] Wetland and Waterbirds [A999] NPWS (2021) Conservation objectives for Lough Arrow SPA [004050]. Generic Version 8.0. Department of Housing, Local Government and Heritage	c. 11.8km northwest of the study area

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
Ballykenny-Fisherstown Bog SPA [004101]	Greenland white-fronted goose (*Anser albifrons flavirostris*) [A395] NPWS (2021) Conservation objectives for Ballykenny-Fisherstown Bog SPA [004101]. Generic Version 8.0. Department of Housing, Local Government and Heritage	c. 9.3km south, and c. 10km downstream of, the study area
Proposed Natural Heritage Areas (pNHAs)		
Clooncoe Wood and Lough pNHA [000424]	Lake and associated shoreline and wetland habitats, including wet woodland and bog woodland. NPWS (2009) *Site Synopsis Clooncoe Wood and Lough pNHA*	c. 4.7km east of the study area
Lough Allen, South End and Parts pNHA [000427]	[Site synopsis not available]	c. 9.3km north of the study area
Clooneen Bog pNHA [000445]	[Site synopsis not available] See also Clooneen Bog SAC above	c. 7.3km south of the study area
Cuilcagh - Anierin Uplands pNHA [000584]	[Site synopsis not available] See also Cuilcagh - Anierin Uplands SAC above	c. 12.9km northeast of the study area
Lough Gara pNHA [000587]	[Site synopsis not available] See also Lough Gara SPA above	c. 12.1km west of the study area
Corrigeenroe Marsh pNHA [000596]	Lakeshore and marsh habitat associated with Lough Key. NPWS (2009) *Site Synopsis Corrigeenroe Marsh pNHA*	c. 8.7km northwest of study area
Kilglass and Grange Loughs pNHA [000608]	Lake and associated shoreline and wetland habitats, including marsh. Important wintering waterfowl site. NPWS (2009) *Site Synopsis Kilglass and Grange Loughs pNHA*	c. 3km south of the study area
Ardagh Bog pNHA [001222]	[Site synopsis not available]	c.14.1km southwest of the study area
Annaghearly Lough pNHA [001402]	Lake and associated shoreline and wetland habitats. NPWS (2009) *Site Synopsis Annaghearly Lough pNHA*	c. 3.8km northeast of the study area
Drumhierny Wood pNHA [001412]	Oak *Quercus robur* woodland NPWS (2009) *Site Synopsis Drumhierny Wood pNHA*	c. 2.7km north of the study area
Lough Rinn pNHA [001417]	Calcareous lake and associated shoreline and wetland habitats, including semi-natural and wet woodland. Important wintering bird site supporting Greenland white-fronted geese and whooper swan NPWS (2009) *Site Synopsis Lough Rinn pNHA*	c. 4.7km east of the study area
Sheemore Wood pNHA [001421]	Semi-natural deciduous woodland NPWS (2009) *Site Synopsis Sheemore Wood pNHA*	c. 3.2km northeast of the study area
Annaghmore Lough (Roscommon) pNHA [001626]	[Site synopsis not available] See also Annaghmore Lough (Roscommon) SAC above.	c. 11.4km southwest of the study area

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
Drum Bridge (Lough Key) pNHA [001631]	Marsh habitat associated with Lough Key NPWS (2009) *Site Synopsis Drum Bridge (Lough Key) pNHA*	c. 7.2km northwest of the study area
Drumman's Island (Lough Key) pNHA [001633]	Semi-natural ash and oak woodland NPWS (2009) *Site Synopsis Drumman's Island (Lough Key) pNHA*	c. 6km northwest of the study area
Fin Lough (Roscommon) pNHA [001636]	Lake and associated shoreline and wetland habitats, including fens NPWS (2009) *Site Synopsis Fin Lough (Roscommon) pNHA*	c. 3.4km northwest of the study area
Hog's Island (Lough Key) pNHA [001638]	Wooded island habitat on Lough Key NPWS (2009) *Site Synopsis Hog's Island (Lough Key) pNHA*	c. 7.4km northwest of the study area
Lough Boderg and Lough Bofin pNHA [001642]	Lake and associated shoreline and wetland habitats, including semi-natural and wet woodlands, and bog habitats. Important wintering bird site supporting Greenland white-fronted geese NPWS (2009) *Site Synopsis Lough Boderg and Lough Bofin pNHA*	Within and downstream of the study area
Lough Eidin pNHA [001643]	Lake, lakeshore habitat and extensive areas of seasonally flooded wet grassland (callows). Important wintering bird site supporting Greenland white-fronted geese NPWS (2009) *Site Synopsis Lough Eidin pNHA*	Within and downstream of the study area
Tawnytaskin Wood (Lough Key) pNHA [001651]	Deciduous woodland NPWS (2009) *Site Synopsis Tawnytaskin Wood (Lough Key) pNHA*	c. 7.6km northwest of the study area
Bricklieve Mountains & Keishcorran pNHA [001656]	[Site synopsis not available] See also Bricklieve Mountains and Keishcorran SAC above	c. 14km northwest of the study area
Lough Arrow pNHA [001673]	[Site synopsis not available] See also Lough Arrow SAC and SPA above	c. 11.3km northwest of the study area
Lough Errew pNHA [001807]	Lake and associated shoreline and wetland habitats, including wet woodland NPWS (2009) *Site Synopsis Lough Errew pNHA*	c. 5.6km east of the study area
Lough Sallagh pNHA [001808]	Lake and associated shoreline and wetland habitats NPWS (2009) *Site Synopsis Lough Sallagh pNHA*	c. 6.5km east of the study area
Lough Forbes Complex pNHA [001818]	[Site synopsis not available] See also Lough Forbes Complex SAC and Ballykenny-Fisherstown Bog SPA above	c. 9.3km south, and c.10km downstream of, the study area
Carrickaport Lough pNHA [001920]	Calcareous lake and associated shoreline and wetland habitats NPWS (2009) *Site Synopsis Carrickaport Lough pNHA*	c. 7.6km northeast of the study area

Site Name [Code]	Ecological Features for which the Sites are Designated (* = priority Annex I habitat)	Location
Natural Heritage Areas (NHAs)		
Aghnamona Bog NHA [000422]	Peatland habitats, including raised bog. Site also used by Greenland white-fronted geese NPWS (2002) *Site Synopsis Aghnamona Bog NHA*	c. 3.5km southeast of the study area
Bella Bridge Bog NHA [000591]	Peatland habitats, including raised bog NPWS (2002) *Site Synopsis Bella Bridge Bog NHA*	c. 13.4km west of the study area
Cornaveagh Bog NHA [000603]	Peatland habitats, including raised bog NPWS (2002) *Site Synopsis Cornaveagh Bog NHA*	c. 13.6km west of the study area
Kilronan Mountain Bog NHA [000617]	Peatland habitats, including upland blanket bog NPWS (2002) *Site Synopsis Kilronan Mountain Bog NHA*	c. 10.8km north of the study area
Rinn River NHA [000691]	Peatland habitats, including raised bog. Site also used by Greenland white-fronted geese and whooper swans NPWS (2002) *Site Synopsis Rinn River NHA*	c. 5.6km southeast of the study area
Cashel Bog (Leitrim) NHA [001405]	Peatland habitats, including raised bog. Site also used by Greenland white-fronted geese NPWS (2002) *Site Synopsis Cashel Bog (Leitrim) NHA*	c. 3.3km southeast of the study area
Corracramph Bog NHA [001420]	Peatland habitats, including raised bog. Site also used by Greenland white-fronted geese NPWS (2002) *Site Synopsis Corracramph Bog NHA*	c. 1.9km southeast of the study area
Cloonageeher Bog NHA [001423]	Peatland habitats, including raised bog NPWS (2002) *Site Synopsis Cloonageeher Bog NHA.*	c. 7.4km southeast of the study area
Tullaghan Bog (Roscommon) NHA [001652]	Peatland habitats, including raised bog NPWS (2002) *Site Synopsis Tullaghan Bog (Roscommon) NHA*	c. 11km west of the study area

Habitats

Non-designated Areas of Annex I Habitat

Based on a review of available desktop data, specifically Article 17 reporting data regarding the national distribution of Annex I habitats, the following non-designated Annex I habitats occur within the study area:

- *Molinia* meadows on calcareous, peaty or clayey-silt laden soils (Molinion caeruleae) [6410]
- * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [*91E0]

Annex I habitats are of national importance from a biodiversity perspective, whilst priority Annex I habitats are regarded as being of international importance.

In addition, *ex-situ* Annex I habitats may act as supporting features to habitats contained within Designated Sites (e.g. by acting as ecological stepping stones or corridors, providing connectivity for protected species, ensuring viable commuting

and foraging routes, and providing habitats for supporting populations). Areas of non-designated Annex I habitat within the study area are shown on Figures 4.12.2.0 to 4.12.2.5.

It should be noted that these known locations of Annex I habitats are based on desktop records, and it is possible that other areas of Annex I habitats, not currently recorded or mapped, may be present within the study area.

Non-Annex I Woodland Habitats

A review of databases available from the NPWS, specifically data relating to the Ancient and Long-Established Woodland[130] survey and the National Survey of Native Woodlands 2003 - 2008[131], confirmed that areas of the following woodland habitat types are present within, or close to, the study area:

- Bog woodland* (WN7) at Danesfort – included within ecological site EC23. Described as corresponding with the *Betula pubescens - Molinia caerulea* woodland group and of a *Rubus fruticosus - Dryopteris dilatata* vegetation type.
- A possible ancient woodland site at Drumharlow (c.150m from the study area and within Lough Eidin pNHA) comprised of oak-ash-hazel woodland (WN2). Described as corresponding with the *Fraxinus excelsior - Hedera helix* woodland group and of a *Quercus robur - Rubus fruticosus* vegetation type.

Other areas of woodland exist within the study area and, excluding areas of conifer plantation, these have been captured within the ecological sites listed earlier.

Woodlands are of ecological value, due to the relative scarcity of woodland in Ireland, and the high degree of biodiversity they can support. In addition, woodlands provide habitats and foraging resources for a range of protected fauna species e.g. badger, red squirrel, pine marten, birds and bats. Woodlands can also provide ecological connectivity across the wider landscape and environment, including in some cases providing habitat links between Designated Sites.

In general, the ecological value of areas of non-Annex I woodland habitats ranges from local to national importance, depending on their vegetative composition, extent and age.

Records of Protected, Rare and Other Notable Species

Flora

Desktop records of protected, rare or other notable plant species are listed in Table 4.12.2. Flora that were identified as part of the field surveys are detailed in Section 4.12.3.2.

Table 4.12.2 Records of Protected, Rare or Notable Flora Recorded from the Desk Study within the Study Area

Common name / scientific name	Legal status[146]	Red list status[147]	Source	Known locations / habitat preferences
Irish fleabane *Inula salicina*	FPO	Endangered	NPWS Online Map Viewer 10km M89 1967	Typically found along stone, limestone shores and islands of Lough Derg, Counties Galway and Tipperary, unknown elsewhere[148]
Cladonia portentosa	HD V	Not Evaluated	NBDC online database G80	Found on heaths, peaty moorland and dunes[149]
Clustered earth-moss *Ephemerum cohaerens*	FPO	Vulnerable	NPWS Online Map Viewer	Jamestown, Co. Leitrim Grid coordinates M978978. Found on drying sediments in the periodically inundated zones beside lowland lakes, turloughs and the River Shannon Absent from the site during recent survey in 2016.[150]
Constricted feather-moss *Amblystegium humile*	N/A	Endangered	NBDC online database G80	Grows in marshes and muddy places, especially by pools, occurring on soil and tree bases, but it appears to be uncommon. It also occurs on stones and silty banks by streams
Large hook-moss *Pseudocalliergon lycopodioides*	N/A	Vulnerable	NBDC online database G80	Typically found in seasonal pools and turloughs (overlying limestone) with low fertility levels and only slightly fluctuating water levels
Twisting thread-moss *Bryum torquescens*	N/A	Vulnerable	NBDC online database G80	Typically grows on calcareous soil in open sunny places, especially on free-draining substrates on banks, in open patches in grassland, on roadsides, about old quarries, and on thin soil overlying rocks, especially limestone but also hard metamorphic rocks and concrete

[146] HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora (Protection) Order, 2015; WA = Wildlife Acts

[147] Vascular Flora listed in threatened categories from the Irish Red List No. 10 Vascular Plants (Wyse-Jackson *et al*., 2016); Bryophytes from the Irish Red List No. 8 Bryophytes- Mosses, Liverworts & Hornworts (Lockhart *et al.,* 2012).

[148] Parnell, J. & Curtis, T., 2012. Webb's An Irish Flora. Eighth Edition.

[149] Irish Lichens Website. Available at: http://www.irishlichens.ie/pages-lichen/l-74.html

[150] https://www.npws.ie/sites/default/files/fpo/taxon/Ephemerum_cohaerens_07_Jamestown.pdf

To note, the species listed in Table 4.12.2 includes all records of protected flora species within the 10km grid references G80, G90, H00, M89, M99 and N09. Given the habitats present a number of the above species are likely to occur within the study area.

Fauna

There are several European and nationally protected mammal, bird, fish, amphibian, reptile and invertebrate species which have been recorded within the study area. These are summarised in Table 4.12.3.

In the case of bird species, only those species listed in Annex I of the Birds Directive or on the Birds of Conservation Concern in Ireland (BoCCI) Red List are included in the table below.

Greenland white-fronted geese *Anser albifrons*, whooper swan *Cygnus cygnus* and hen harrier *Circus cyaneus* are known from the study area. The dedicated wintering bird surveys carried out to inform a previous road scheme through the study area in the early 2010s recorded Greenland white-fronted geese within the Rinn River and Lough Allen corridor. However, the report also noted that the usage of former local territory by Greenland white fronted geese had declined in recent years.

Whooper swans were observed at numerous locations across the study area during the dedicated wintering bird surveys for the 2011 N4 Carrick-on-Shannon to Dromod Road Project EIS. Flocks of whooper swan were noted around Lough Corry, Eidin Lough, Hartley Bog (to north-east of Eidin Lough) and to the west of the Carrick-on-Shannon golf club.

Evidence of hen harrier was also recorded at numerous sites throughout the study area including at Annaghgerry and Rooksy Lough. Additionally, during a 2008 winter bird survey to inform the N4 Carrick-on-Shannon to Dromod Road Project EIS, Hartley Bog was confirmed as a winter roost site for this species, with several sightings of a single male and one sighting of a pair.

There are also anecdotal records of kingfisher nesting approximately 400-500m north of the Drumsna Bridge over the River Shannon.

With regards to bat species, the following habitat features/areas, present within the study area, are likely to be important for local populations; areas of woodland, river corridors, agricultural lands with well-developed hedgerow/treeline network, old buildings, bridges and underground structures (e.g. icehouses, souterrains etc). Bats, and their breeding and resting places, are protected under the Wildlife Acts. All bat species are also listed on Annex IV of the EU Habitats Directive (whilst the lesser horseshoe bat is also listed as Annex II species) and are afforded strict protection under the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations, 2011. The NBDC database returned records of the following bat species within the vicinity of the proposed development: Daubenton's bat *Myotis daubentonii*, Leisler's bat *Nyctalus leisleri*, brown long-eared bat *Plecotus auritus*, Natterer's bat *Myotis nattereri,* soprano pipistrelle bat *Pipistrellus pygmaeus*, common pipistrelle bat *Pipistrellus pipistrellus,* Nathusius pipistrelle bat

Pipistrellus nathusii, whiskered bat *Myotis mystacinus* and lesser horseshoe bat *Rhinolophus hipposideros*[151].

Additionally, a search of the Bat Conservation Ireland database returned records of four known roosts from within the study area. Three of these roosts, located within the townlands of Drumsna, Lisgarney and Tullyleague belong to brown long-eared bat while one, located within the townland of Cloongownagh, belongs to Natterer's bat.

There are records for the Annex II Marsh fritillary butterfly from within the study area, in the townland of Gortinty, and to the northwest of the study area along the west bank of the River Shannon in the townlands of Cleaheen and Annaghbeg. Devil's-bit scabious, *Succisa pratensis*, the main food plant and an essential component of suitable marsh fritillary butterfly habitat, was recorded within the townland of Kildorragh (ecological site EC78), directly adjacent to the existing N4 roadway.

Table 4.12.3 Records of Protected, Rare or Notable Fauna within the Study Area

Common Name / Scientific Name	Legal Status[152]	Red List Status[153]	Source
Amphibians			
Common frog *Rana temporaria*	HD V; WA	Least Concern	NBDC online database G80, G90, M89, M99, N09
Smooth newt *Lissotriton vulgaris*	WA	Least Concern	NBDC online database G80, G90, H00, M99
Reptiles			
Common lizard *Zootoca vivipara*	WA	Least Concern	NBDC online database G80
Invertebrates			
Freshwater white-clawed crayfish *Austropotamobius pallipes*	HD II, V; WA	Not Evaluated	NBDC online database G90, M89, M99, N09

[151] Only one record of lesser horseshoe bat was returned from the desk study search, which was located at the far western portion of the search area. The study area falls outside of the natural range of this species

[152] HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora (Protection) Order, 2015; WA = Wildlife Acts; BD I/II/III= Birds Directive Annexes I/II/III

[153] Fauna species listed in threatened Red List categories: from Butterflies from the Irish Red List No. 4 Butterflies (Regan *et al.*, 2010); Amphibians, Reptiles & Fish from the Irish Red List No. 5 Amphibians, Reptiles & Freshwater Fish (King *et al*., 2011); Terrestrial Mammals from the Irish Red List No.3 Terrestrial Mammals (Marnell *et al*., 2009; Cartilaginous Fish from the Irish Red List no. 11 Cartilaginous Fish (Sharks, Skates, Rays & Chimaeras) (Clarke *et al*., 2016); Birds from Birds of Conservation Concern in Ireland 2014-2019 (Colhoun & Cummins, 2013); Non-Marine Molluscs from Irish Red List No. 2 Non-Marine Molluscs (Byrne *et al.*, 2009); Water Beetles from Irish Red List No. 1 Water Beetles (Foster *et al.*, 2009); Mayflies from Irish Red List No.7 Mayflies (Ephemeroptera) (Kelly-Quinn & Regan, 2012); Bees from Regional Red List of Irish Bees (Fitzpatrick *et al.*, 2006)

Common Name / Scientific Name	Legal Status[152]	Red List Status[153]	Source
Marsh fritillary *Euphydryas aurinia*	HD II	Vulnerable	NBDC online database G90, H00, M89, N09
Large heath *Coenonympha tullia*	N/A	Vulnerable	NBDC online database H00
The hairy reed beetle *Donacia cinerea*	N/A	Vulnerable	NBDC online database N09
The variegated crawler water beetle *Haliplus variegatus*	N/A	Vulnerable	NBDC online database G90
Irish damselfly *Coenagrion lunulatum*	N/A	Vulnerable	NBDC online database G90, H00, N09
Scarce blue-tailed damselfly *Ischnura pumilio*	N/A	Vulnerable	NPWS Data Request N09
Great yellow bumble bee *Bombus distinguendus*	N/A	Endangered	NBDC online database G80
Desmoulin's whorl snail *Vertigo moulinsiana*	HD II; WA	Endangered	NBDC online database G90
Lilljeborg's whorl snail *Vertigo lilljeborgi*	N/A	Vulnerable	NBDC online database G90
Marsh whorl snail *Vertigo antivertigo*	N/A	Vulnerable	NBDC online database G80, G90, M89, M99, N09
Geyer's whorl snail *Vertigo geyeri*	HD II; WA	Vulnerable	NPWS Article 17 Shapefile M9387
Geyer's whorl snail V*ertigo angustior*	HD II; WA	Vulnerable	NPWS Article 17 Shapefile M9387
Duck mussel *Anodonta anatina*	N/A	Vulnerable	NBDC online database G80, M99, N09
English chrysalis snail *Leiostyla anglica*	N/A	Vulnerable	NBDC online database G80, M89, N09
Glutinous snail *Myxas glutinosa*	N/A	Endangered	NBDC online database G80
Heath snail *Helicella itala*	N/A	Vulnerable	NBDC online database M99
Lake orb mussel *Musculium lacustre*	N/A	Vulnerable	NBDC online database G90
Lilljeborg's pea mussel *Pisidium lilljeborgii*	N/A	Endangered	NBDC online database G80
Iridescent pea mussel *Pisidium pulchellum*	N/A	Endangered	NBDC online database G90, N09
Plated snail *Spermodea lamellata*	N/A	Endangered	NBDC online database G80, N09

Common Name / Scientific Name	Legal Status[152]	Red List Status[153]	Source
Point snail *Acicula fusca*	N/A	Vulnerable	NBDC online database M99
Smooth grass snail *Vallonia pulchella*	N/A	Vulnerable	NBDC online database G90, M99
Smooth ramshorn *Gyraulus laevis*	N/A	Endangered	NBDC online database N09
Swan mussel *Anodonta cygnea*	N/A	Vulnerable	NBDC online database N09 Historic record
Tree snail *Balea perversa*	N/A	Vulnerable	NBDC online database G80, G90, N09
Whirlpool ramshorn *Anisus vortex*	N/A	Vulnerable	NBDC online database M89, M99, N09
Fish			
Brook lamprey *Lampetra planeri*	HD II	Least Concern	NBDC online database G80
Atlantic salmon *Salmo salar*	OSPAR Convention; HD II, V	Vulnerable	NPWS Article 17 shapefile H00, G80
European eel *Anguilla anguilla*	OSPAR Convention	Critically Endangered	NBDC online database G80, G90, H00, M89, M99, N09
Terrestrial Mammals			
Eurasian badger *Meles meles*	WA	Least Concern	NBDC online database G80, G90, H00, M89, M99, N09
Eurasian pygmy shrew *Sorex minutus*	WA	Least Concern	NBDC online database G80, G90, M89, N09
Eurasian red squirrel *Sciurus vulgaris*	WA	Near Threatened	NBDC online database G80, G90, H00, M89, M99, N09; NPWS Online Map Viewer G80
European otter *Lutra lutra*	HD II, IV; WA	least concern in Ireland as per the referenced red list. Near threatened across Europe separately.	NBDC online database G80, G90, H00, M89, M99, N09
Red deer *Cervus elaphus*	WA	Least Concern	NBDC online database G90
Fallow deer *Dama dama*	WA	Least Concern	NBDC online database G80, H00,

Common Name / Scientific Name	Legal Status[152]	Red List Status[153]	Source
			M89; NPWS Online Map Viewer G9000
West european hedgehog *Erinaceus europaeus*	WA	Least Concern	NBDC online database G90, H00, M89, M99, N09
Pine marten *Martes martes*	HD V; WA	Least Concern	NBDC online database G80, G90, H00, M89, M99, N09; NPWS Online Map Viewer G80
Irish hare *Lepus timidus subsp. hibernicus*	WA	Least Concern	NPWS Article 17 Shapefile G80, G90, M99, N09
Irish stoat *Mustela erminea subsp. hibernica*	WA	Least Concern	NPWS Online Map Viewer N0090, G8000, M89
Brown long-eared bat *Plecotus auritus*	HD IV; WA	Least Concern	NBDC online database G80, M89, M99, N09
Daubenton's bat *Myotis daubentonii*	HD IV; WA	Least Concern	NBDC online database G80, G90, H00, M89, M99, N09
Leisler's bat *Nyctalus leisleri*	HD IV; WA	Near Threatened	NBDC online database G80, H00, M89, M99, N09
Lesser horseshoe bat *Rhinolophus hipposideros*	HD II, IV; WA	Least Concern	NBDC online database G80
Nathusius's pipistrelle *Pipistrellus nathusii*	HD IV; WA	Least Concern	NPWS Article 17 Shapefile N09
Natterer's bat *Myotis nattereri*	HD IV; WA	Least Concern	NBDC online database G80, G90, M99, N09
Common pipistrelle *Pipistrellus pipistrellus*	HD IV; WA	Least Concern	NBDC online database M89, M99, N09
Soprano pipistrelle *Pipistrellus pygmaeus*	HD IV; WA	Least Concern	NBDC online database G80, M89, N09
Whiskered bat *Myotis mystacinus*	HD IV; WA	Least Concern	NBDC online database N09
Birds			
Black-headed gull *Chroicocephalus ridibundus*	WA	Red List	NPWS Data Request G90, N09
Common coot *Fulica atra*	BD I, II; WA	Amber List	NBDC online database G80, G90, H00, M89, M99, N09

Common Name / Scientific Name	Legal Status[152]	Red List Status[153]	Source
Common goldeneye *Bucephala clangula*	BD II; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
Common kingfisher *Alcedo atthis*	BD I; WA	Amber List	NBDC online database G80, G90, M89, M99, N09 [EIS]
Common pochard *Aythya ferina*	BD II, III; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
Common tern *Sterna hirundo*	BD I; WA	Amber List	NBDC online database G80, G90, H00, M89, M99, N09
Corn crake *Crex crex*	BD I; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09 (recorded pre-2000)
Eurasian curlew *Numenius arquata*	BD II; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
Eurasian wigeon *Anas penelope*	BD II, III; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
Eurasian woodcock *Scolopax rusticola*	BD II, III; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
European golden plover *Pluvialis apricaria*	BD I, II, III; WA	Red List	NBDC online database N09
Greater white-fronted Goose *Answer albifrons*	BD I, II, III; WA	Amber List	NPWS Data Request G90
Grey partridge *Perdix perdix*	BD II, III; WA	Red List	NBDC online database G80, G90, N09 (recorded pre-1980)
Grey wagtail *Motacilla cinerea*	WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
Hen harrier *Circus cyaneus*	BD I; WA	Amber List	NBDC online database G80, G90, M89, M99, N09
Little egret *Egretta garzetta*	BD I; WA	Green List	NBDC online database N09
Meadow pipit *Anthus pratensis*	WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09

Common Name / Scientific Name	Legal Status[152]	Red List Status[153]	Source
Merlin *Falco columbarius*	BD I; WA	Amber List	NBDC online database G90, H00, M89, M99, N09
Northern lapwing *Vanellus vanellus*	BD II; WA	Red List	NBDC online database G80, G90, H00, M89, M99, N09
Northern pintail *Anas acuta*	BD II, III; WA	Red List	NBDC online database G90, N09 (recorded pre-1990)
Northern shoveler *Anas clypeata*	BD II, III; WA	Red List	NBDC online database G90, M99, N09
Peregrine falcon *Falco peregrinus*	BD I; WA	Green List	NBDC online database G80 (recorded pre-1990)
Red grouse *Lagopus lagopus*	BD II, III; WA	Red List	NBDC online database N90
Short-eared owl *Asio flammeus*	BD I; WA	Amber List	NBDC online database G80 (recorded pre-2000)
Tufted duck *Aythya fuligula*	BD II, III; WA	Red List	NBDC online database G80, G90, H00, M89, N09
Whooper swan *Cygnus cygnus*	BD I; WA	Amber List	NBDC online database G80, G90, H00, M89, M99, N09

Rivers, Fisheries and the Aquatic Environment

According to the EPA data[154], several rivers, and their associated tributaries, are located within the study area. The main rivers and their associated sub-catchments are displayed in Table 4.12.4 below.

A consultation letter was sent to IFI on the 11 September 2020 requesting desktop information regarding the watercourses which lie within the study area, including any records of rare/protected species and any data regarding the fishery potential of relevant watercourses. A response was received on 21 December 2020, which outlined the following sensitive species as being present within the adjacent watercourses and the downstream receiving environment within the River Shannon: Atlantic salmon, brown trout and lamprey.

In addition to supporting rare/protected aquatic species these river systems are likely to also support terrestrial mammals such as otter (*Lutra lutra*), bat and bird species (e.g. kingfisher *Alcedo atthis*) which use aquatic systems for foraging and

[154] Environmental Protection Agency (EPA), 2020. Data available for download at http://gis.epa.ie/GetData/Download

commuting purposes. An old kingfisher nesting location is known from approximately 400-500m north of the bridge at Drumsna.

Table 4.12.4 Main Watercourses and their Associated Sub-catchments Located in the Study Area

Sub-catchment	River / Stream name
Eslin_SC_010 Sub-catchment	Eslin Antfield Unnamed stream - border of Cloonturk and Drumod Beg Fearnaght Fedaro
Boyle_SC_030 Sub-catchment	Ardglass Stream Clogher [Roscommon] Clooneigh 26 Cloonybrien Lismulkeare Tumna Woodbrook House Stream
Shannon[Upper]_SC_020 Sub-catchment	Unnamed Stream - Kilmaddoroe Lough to Bran Lough to Carrickevy Lough to the River Shannon
Shannon[Upper]_SC_040 Sub-catchment	Aghintass Annaduff Ardanaffrin Derryoughter 26 Drumcleavry Drumcree 26 Drumgilra Drumkeeran Drumsna Fargrim Finnalaghta Foxborough Gortconnellan Gortinty Kildorragh 26 Killasanowl Jamestown Canal Kiltycarney Lismoyle 26 Mountcampbell Moyglass; Unnamed stream – border of Annaduff Glebe and Gortinity Unnamed stream – Gortinity to Annaduff Glebe Unnamed stream – border of Annaduff and Gortinty Unnamed stream – border of Annaduff and Derryoughter Tooloscan

Sub-catchment	River / Stream name
	Unnamed stream - Muclaghan Lough to Drumcree Stream
Shannon[Upper]_SC_030 Sub-catchment	Aghameeny Aghancarra Attifinlay Attirory Cloonfad_beg Cornaslieve 26 Danesfort Drumercool Garvlough Greagh 26 Killukin Kilmaddaroe Knockananima Knockadalteen 26 Lisnagat Lisseeghan Unnamed stream – annaghbeg Unnamed stream – border of Annaghbeg and Cloonfad Unnamed stream – border of cornacorroo and coraughrim Pollnagappul Rock 26 Sallaghan 26 Shannon [Upper] Shanballybaun Tonnagh 26 Tonrevagh Unnamed stream - from the shannon at annaghbeg to drumlumman Unnamed stream flowing into corry lough

These watercourses and associated riparian habitats are of high ecological value due to the connectivity they can provide to other sites of ecological importance, and that they can also support a range of rare and protected aquatic species.

The watercourses contained within the study area are deemed to range in ecological value from local to national importance, owing to their nature conservation designations and the fact that they may support rare/protected species of conservation value and provide ecological connectivity across the study area.

Ecological Sites

Following a review of orthophotography and collation of available existing habitat information, 113 ecological sites were identified. A ground truthing exercise was subsequently undertaken to verify the orthophotography interpretation and refine the boundaries of the ecological sites, where they were in close proximity to, or overlapped with, an option corridor. The description and evaluation of the ecological sites are presented in the Ecological Sites section below and Table

4.12.5, with the locations of the ecological sites shown on Figures 4.12.1.0 to 4.12.1.5.

4.12.3.2 Field Surveys

This section details the results of field surveys undertaken to date to inform the constraints study and subsequent options selection process. All elements of the habitat map of relevance to identifying constraints (i.e. Annex I habitats) have been incorporated into the constraints GIS datasets and/or the ecological sites. Detailed studies of habitats at the southern and northern crossing points of the River Shannon were undertaken to help inform the constraints study given the likely impacts associated with these locations. However, as per NRA guidance, surveys at the constraints stage are typically walkover surveys and not detailed habitat surveys of individual ecological sites.

Terrestrial Habitats

Habitat Survey in the Townlands of Corryolus and Cloonman (which includes part of Lough Eidin pNHA)

The Corryolus area, which lies to the east of the River Shannon and north of Carrick-on-Shannon, is largely dominated by wet grassland (GS4) vegetation, with prominent soft rush *Juncus effusus*, which has developed on the poorly-drained, mineral soils. This vegetation dominates a wide ridge which runs in an east to west direction. Along the wide floodplain banks of the River Shannon, there is a wide band of tall freshwater marsh (GM1) vegetation, and these areas are generally subject to flooding for a significant proportion of the year. In places this zone of marsh vegetation can be around 200 metres wide. From a botanical perspective the marsh vegetation is relatively species-rich and undisturbed and is considered to be of high ecological value. Other habitats which occur include hedgerows (WL1), scrub (WS1) and wet grassland dominated by purple moor-grass (GS4) however the areas of these habitats are limited in extent.

The Cloonmaan area, which lies to the west of the River Shannon and northwest of Carrick-on-Shannon, is generally dominated by a mixture of wet grassland (GS1) which is often semi-improved throughout as a result of agricultural management. Smaller areas of improved agricultural areas also occur however it is possible that many of these areas would revert to wet grassland if agricultural practices such as grazing and silage cutting were abandoned. Along the banks of the River Shannon, a well-developed band of freshwater marsh (GM1) vegetation occurs in areas prone to flooding. This vegetation includes a small population of marsh pea *Lathyrus palustris* which has a restricted distribution in Ireland. This record would appear to be the first post-1930 record of the species from the Carrick-on-Shannon area[155]. Two small blocks of riparian woodland (WN5) dominated by grey willow (*Salix cinerea oleifolia*) occur along the banks of the River Shannon in this area.

Habitat Survey in the Townlands of Cortober, Cordrehid, Attirory, Rinnacurreen and Drumkeeran.

[155] Botanical Society of Britain & Ireland (BSBI), 2022. Online maps. Available at: https://bsbi.org/maps

The Attirory area which lies to the east of the River Shannon is generally dominated by tall freshwater marsh (GM1) with smaller areas of wet grassland (GS2) and wet willow-alder-ash woodland (WN6) (with allegiances to priority Annex I Alluvial woodland habitat) also occurring throughout. In the middle of the area there is a large field of wet grassland which is regularly cut for silage. A prominent feature of marsh vegetation close to the River Shannon is the abundance of low (2 to 5 metres tall) willow *Salix cinerea oleifolia* and alder *Alnus glutinosa* bushes. These low shrubs have not generally formed closed canopy woodland at present however it is likely that this area will become progressively dominated by wet woodland in the near future. Other habitats which occur include improved agricultural grassland (GA1) and a small area of transition mire (PF3). The site supports relatively large areas of marsh and wet woodland habitat.

Most of the Cordrehid/Cortober area is dominated by wet grassland (GS4) with smaller areas of improved agricultural grassland occurring on the better-drained soils. A wide zone (c. 100m) of marsh (GM1) vegetation occurs along the western banks of the River Shannon. This area regularly floods during the winter/spring months. In the middle of the area there is a meandering river/stream, the Killukin River, which flows towards the River Shannon in a northeasterly direction. This slow-moving stream is generally between 5 and 7 metres wide and supports a narrow zone of marginal reed swamp vegetation in places. Areas adjoining this stream support a wide marshy floodplain dominated by soft rush with conspicuous wild angelica *Angelica sylvestris* and meadowsweet *Filipendula ulmaria*.

Most of the land to the west of the Killukin River comprises steeply sloping ground with a mineral soil dominated by wet grassland vegetation which is semi-improved in places. Other habitats which occur in this general area include hedgerows (WL1) and small areas of riparian woodland (WN5) and conifer plantation (WD4).

Walkover Surveys of Ecological Sites

The results of the walkover surveys of ecological sites have been incorporated into the descriptions provided in Table 4.12.5.

Ecological sites

Ecological sites are sites of ecological value: i.e. those likely or determined to be at least of a local importance (higher value) (refer to National Roads Authority, Guidelines for Assessment of Ecological Impacts of National Road Schemes 2009 for more detail). These are primarily defined based on the habitat types present or likely to be present but may also include important flora and fauna sites or populations.

The boundaries of the ecological sites have been defined based on the results of the desk study and interpretation of orthophotography. Refinement of these boundaries was completed following a ground truthing exercise at ecological sites identified within the option corridors to verify the types of habitats present.

Ecological sites identified in the study area are presented in Table 4.12.5 and displayed on Figure 4.12.1.0 to 4.12.1.5.

Table 4.12.5 Ecological Sites Identified in the Study Area

Ecological Site Number	Location	Description	Ecological Valuation
EC01	Usna Woodlands	Broadleaved woodland	Not surveyed
EC02	Drumharlow	Broadleaved woodland	Local Importance (Higher Value)
EC03	Woodbrook	Broadleaved woodland	Local Importance (Higher Value)
EC04	Woodbrook	Broadleaved woodland (including some recently planted) and scrub	Not surveyed
EC05	Drumharlow	Broadleaved woodland and scrub	International Importance
EC06	Woodbrook / Cloongownagh	Broadleaved woodland	International Importance
EC07	Clooneigh	Broadleaved / wet woodland and wet grassland. Potential for *91E0 habitat	Not surveyed
EC08	Cloongownagh	Broadleaved woodland	Not surveyed
EC09	Cloongownagh	Broadleaved woodland	Not surveyed
EC10	Cloongownagh	Broadleaved woodland and conifer plantation	Not surveyed
EC11	Dorrary	Broadleaved woodland	Not surveyed
EC12	Cuiltyconeen	Broadleaved woodland (including some recently planted)	Local Importance (Higher Value)
EC13	Knockananima	Broadleaved woodland, scrub and wet grassland.	Not surveyed
EC14	Tumna	Broadleaved / wet woodland / scrub on shore of Eidin Lough. Potential for *91E0 habitat	Not surveyed
EC15	Scregg	Broadleaved woodland, scrub and conifer plantation	Not surveyed
EC16	Cloonman	Broadleaved / wet woodland / scrub, marsh and wet grassland on bank of River Shannon. Areas of confirmed and potential *91E0 habitat	International Importance
EC17	Cloonskeeveen	Broadleaved / wet woodland / scrub and wet grassland on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC18	Danesfort	Broadleaved woodland	Not surveyed
EC19	Deerpark	Broadleaved / wet woodland / scrub on bank of Killukin River. Potential for *91E0 habitat	Not surveyed

Ecological Site Number	Location	Description	Ecological Valuation
EC20	Danesfort	Broadleaved / wet woodland / scrub associated with Killukin River. Potential for *91E0 habitat	Not surveyed
EC21	Danesfort	Broadleaved woodland	Not surveyed
EC22	Danesfort	Broadleaved woodland	Not surveyed
EC23	Danesfort / Cartron	Broadleaved / wet woodland and bog woodland. Potential for 91D0 and *91E0 (due to hydrological connection to River Shannon floodplain)	Not surveyed
EC24	Cartron	Broadleaved / wet woodland. Potential for *91E0 (due to hydrological connection to River Shannon floodplain)	Not surveyed
EC25	Corry	Broadleaved woodland	Not surveyed
EC26	Corry	Broadleaved woodland	Not surveyed
EC27	Portaneoght	Broadleaved / wet woodland and scrub	Local Importance (Higher Value)
EC28	Portaneoght	Broadleaved / wet woodland and scrub. Possible *91E0	Local Importance (Higher Value)
EC29	Hartley	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC30	Hartley	Broadleaved / wet woodland / scrub in River Shannon floodplain. Hydrologically connected to the river. Potential for 91E0 habitat	International Importance
EC31	Hartley	Broadleaved / wet woodland / scrub and wet grassland in River Shannon floodplain. Hydrologically connected to the river. Potential for 91E0 habitat	International Importance
EC32	Hartley	Broadleaved / wet woodland / scrub and wet grassland in River Shannon floodplain. Hydrologically connected to the river. Potential for 91E0 habitat	International Importance
EC33	Townparks	Broadleaved / wet woodland / scrub and wetland habitat on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC34	Townparks	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC35	Cordrehid	Broadleaved / wet woodland / scrub and wet grassland / marsh habitat on bank of River Shannon. Potential for *91E0 habitat	Local Importance (Higher Value)

Ecological Site Number	Location	Description	Ecological Valuation
EC36	Cordrehid	Broadleaved / wet woodland / scrub on bank of River Shannon. Contains *91E0 habitat	Not surveyed
EC37	Cordrehid	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC38	Island on Corry Lough	Riparian woodland / scrub in River Shannon island. Potential for *91E0	Not surveyed
EC39	Danesfort	Broadleaved / wet woodland/scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC40	Danesfort / Cartron	Broadleaved / wet woodland and wet grassland. Potential for *91E0 (due to hydrological connection to River Shannon floodplain)	Not surveyed
EC41	Cartron	Broadleaved / wet woodland. Potential for *91E0 (due to hydrological connection to River Shannon floodplain)	Not surveyed
EC42	Cartron / Corry	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat.	Not surveyed
EC43	Corry	Broadleaved / wet woodland. Potential for *91E0 (due to hydrological connection to River Shannon floodplain)	Not surveyed
EC44	Corry	Wet woodland and wet grassland	Not surveyed
EC45	Corry	Broadleaved woodland	Not surveyed
EC46	Corry	Wet grassland and scrub	Not surveyed
EC47	Ballynamoney / Cornamucklagh / Kilboderry	Broadleaved woodland and scrub	Local Importance (Higher Value)
EC48	Aghancarra / Drumlumman	Broadleaved woodland / wet woodland	International Importance
EC49	River Shannon Island at Cordrehid / Attirory	Riparian woodland / scrub in River Shannon island. Potential for *91E0	Local Importance (Higher Value)
EC50	Attirory	Marsh, wet woodland, wet grassland and scrub. Contains areas of priority Annex I alluvial woodland habitat [*91E0] and an area of Annex I transition mires habitat [7140]. Potential for scrub to develop into *91E0 habitat in the short to medium term	National Importance
EC51	Attiror y / Rinacurreen / Drumkeeran	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats. *91E0 present	International Importance

Ecological Site Number	Location	Description	Ecological Valuation
EC52	Attirory / Drumkeeran / Lisseeghan	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats. *91E0 present	International Importance
EC53	Rinacurreen Lough	Lake and associated wetland, broadleaved / wet woodland and scrub habitats. Potential for peatland habitats and *91E0	Not surveyed
EC54	Ballynacleigh	Broadleaved woodland	Not surveyed
EC55	Island on Corry Lough	Riparian woodland / scrub in River Shannon island. Potential for *91E0	Not surveyed
EC56	Cornacorroo	Broadleaved / wet woodland on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC57	Corry / Cloonfad Beg	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC58	Ballagh Lough	Lake and associated wetland habitats	Not surveyed
EC59	Dromore / Clogher	Broadleaved woodland and mixed conifer / broadleaf woodland	Not surveyed
EC60	Clogher	Broadleaved woodland	Not surveyed
EC61	Greagh	Broadleaved woodland (including some recently planted)	Not surveyed
EC62	Kiltycarney	Artificial lake, semi-natural grassland and scrub	Local Importance (Higher Value)
EC63	Corbally / Lisgarney	Broadleaved / wet woodland and wet grassland	Local Importance (Higher Value)
EC64	Cloonfeacle / Drummaunroe/Gort	Broadleaved / wet woodland, scrub and wet grassland	Not surveyed
EC65	Cornacorroo / Coraughrim	Broadleaved / wet woodland, scrub and wet grassland along the River Shannon. Potential for peatland habitats and *91E0	Not surveyed
EC66	Corraughrim	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC67	Corgullion	Wet grassland and scrub	Not surveyed
EC68	Corraughrim/Gort	Broadleaved / wet woodland/scrub on bank of River Shannon. Potential for *91E0 habitat. Annex I hay meadow [6510] habitat previously record for this site	Not surveyed
EC69	River Shannon Island at Gort / Cuiltyconway	Riparian woodland / scrub in River Shannon island. Potential for *91E0	Not surveyed

Ecological Site Number	Location	Description	Ecological Valuation
EC70	Cuiltyconway	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC71	Cuiltyconway	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC72	Jamestown	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC73	Jamestown	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC74	Jamestown	Broadleaved / wet woodland / scrub on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC75	Corralara	Wet woodland, scrub, wet grassland and peatland habitats. Likely to support Annex I peatland and potentially Annex I woodland habitats (e.g. 91D0 and *91E0)	Not surveyed
EC76	Dangan	Wet woodland, scrub, wet grassland and peatland habitats. Likely to support Annex I peatland and potentially Annex I woodland habitats (e.g. 91D0 and *91E0)	Not surveyed
EC77	Aughriman South	Broadleaved woodland, scrub, semi-natural grassland wet grassland. Potential for peatland habitats	International Importance
EC78	Minkill / Kildorragh	Broadleaved woodland and wet grassland. Wet grassland with *Succisa pratensis* and potential for marsh fritillary butterfly	Local Importance (Higher Value)
EC79	River Shannon Island at Tully / Charlestown	Riparian woodland / scrub in River Shannon island. Potential for *91E0	Not surveyed
EC80	Charlestown / Cloonavery	Broadleaved and conifer woodland along the River Shannon. Potential for *91E0	Local Importance (Higher Value)
EC81	Cloonavery	Broadleaved woodland	Not surveyed
EC82	Ardanafrin / Lackagh	Broadleaved woodland and scrub	Not surveyed
EC83	Johnstown Canal	Canal and associated treelines and riparian / wet woodland. Potential for *91E0	Not surveyed
EC84	Ardanaffrin	Broadleaved woodland	Not surveyed
EC85	Cuiltyconway / Corralara	Broadleaved woodland	Not surveyed
EC86	Dangan	Wet grassland	Not surveyed

Ecological Site Number	Location	Description	Ecological Valuation
EC87	Mountcampbell	Broadleaved woodland and mixed conifer / broadleaf woodland	Local Importance (Higher Value)
EC88	Mountcampbell / Crickeen	Broadleaved and conifer woodland along the River Shannon. Potential for *91E0	Local Importance (Higher Value)
EC89	River Shannon Island at Mountcampbell / Charlestown	Riparian woodland / scrub in River Shannon island. Potential for *91E0	Not surveyed
EC90	Drumcleavry	Broadleaved / wet woodland on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC91	Cloonteem	Wet grassland	Not surveyed
EC92	Corry	Broadleaved / wet woodland. Hydrologically connected to the River Shannon. Potential for *91E0 habitat	Not surveyed
EC93	Cartron Lough	Lake and associated wetland habitats	Not surveyed
EC94	Lowfield Lough	Lake and associated wetland, broadleaved / wet woodland and scrub habitats. Potential for *91E0	Not surveyed
EC95	Foxborough	Broadleaved woodland (including some recently planted)	Not surveyed
EC96	Foxborough / Lavagh	Planted broadleaved woodland, wet grassland and scrub	Not surveyed
EC97	Gortconnellan Lough / Spa Lough	Lake and associated wetland habitats	County Importance
EC98	Annaduff / Glebe	Broadleaved woodland	Not surveyed
EC99	Derryoughter	Broadleaved / wet woodland, scrub and wet grassland on bank of River Shannon. Potential for *91E0 habitat	International Importance
EC100	Cloonteem	Broadleaved / wet woodland on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC101	Moyglass	Broadleaved/wet woodland and conifer plantation on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC102	Moyglass / Tooloscan / Skeagh	Broadleaved / wet woodland, scrub and wet grassland on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC103	Annaduff	Broadleaved woodland	Not surveyed
EC104	Gortinty	Broadleaved woodland	Not surveyed
EC105	Drumgilra Lough / Gortinty Lough	Lake and associated wetland, broadleaved / wet woodland and scrub habitats. Potential for *91E0	International Importance

Ecological Site Number	Location	Description	Ecological Valuation
EC106	Derrylaur / Derrybrack / Mullagh	Broadleaved / wet woodland, scrub and wet grassland on bank of River Shannon. Potential for *91E0 habitat	Not surveyed
EC107	Derrybrack	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats and 91D0	Not surveyed
EC108	Aghamore	Broadleaved woodland	Not surveyed
EC109	Mullagh	Broadleaved / wet woodland	Not surveyed
EC110	Finnalaghta	Quarry pond, semi-natural grassland and scrub	Not surveyed
EC111	Fearnaght / Drumlon	Broadleaved woodland and planted mixed conifer / broadleaf woodland	Not surveyed
EC112	Fearnaght	Broadleaved woodland and scrub	Local Importance (Higher Value)
EC113	Bog Lough	Lake and associated wetland, peatland and woodland habitats. Likely to support Annex I peatland and potentially Annex I woodland habitats (e.g. 91D0 and *91E0)	International Importance

Rare and/or Protected Plant Species

No rare or protected plant species noted to date from the field surveys.

None of the species returned from the desk study and listed in Table 4.12.3 were recorded. No other rare or protected flora was recorded during the constraints walkover survey.

Non-Native Invasive Species

Planting, dispersing, or allowing/causing the dispersal, spread or growth of certain non-native plant species is controlled under Article 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended); and refers to plant or animal species listed on the Third Schedule of those regulations. The accidental spread of non-native invasive plant species as a result of construction works has the potential to impact upon terrestrial habitats within and immediately adjacent to potential Alternatives and Options; potentially affecting plant species composition, diversity and abundance over the long-term. The effects of introducing such non-native invasive plant species to highly sensitive and ecologically-important habitat areas (e.g. designated area for nature conservation or areas of Annex I habitat) have the potential to result in a likely significant negative effect, at geographic scales ranging from local to international.

There are several non-native invasive plant species which have been recorded within the study area. These are summarised in Table 4.12.6.

Table 4.12.6 Non-native Invasive Species Identified in the Study Area

Common Name / Scientific Name	Townland
Japanese knotweed *Reynoutria japonica*	Fearnaght
Japanese knotweed *Reynoutria japonica*	Lisseeghan
Japanese knotweed *Reynoutria japonica*	Fearnaght
Japanese knotweed *Reynoutria japonica*	Fearnaght
Japanese knotweed *Reynoutria japonica*	Faulties
Japanese knotweed *Reynoutria japonica*	Faulties / Fearnaught townland border
Japanese knotweed *Reynoutria japonica*	Faulties
Japanese knotweed *Reynoutria japonica*	Fearnaght

4.12.4 Summary

As outlined above, 113 ecological sites were identified within the study area based on an examination of aerial photography, information gathered during the desktop study and a ground truthing exercise carried out during a site survey. The Zone of Influence (ZoI) of the constraints study largely focusses on the study area, with consideration of various impacts that might affect identified/confirmed biodiversity features. These ecological sites comprise a variety of habitat types of varying ecological value including areas of mixed broadleaf woodland, areas of riparian woodland, scrub, wet grassland, marsh, areas of broadleaf/conifer plantations, quarries and lakes with associated surrounding wetland habitat. Although surveys associated with the constraints study focused on the study area, ecological receptors in the wider landscape were also considered and included features such as hydrologically or hydrogeologically connected habitats and/or species, particularly in respect to mobile species that are associated with nearby designated sites (European, National etc.). Thus, in addition to the 113 ecological sites identified, the following features were also noted as constraints:

- Designated sites in the vicinity of the study area and within the downstream receiving environment (including SACs, SPAs, NHAs and pNHAs)
- Designated Habitats (Annex I and priority Annex I habitats)
- Rare, protected and notable flora
- Invasive non-native flora species
- Rare, protected and notable fauna
- Waterbodies (including rivers, streams and lakes)
- Policies and objectives outlined within the relevant local area plans (i.e. Carrick-on-Shannon LAP) as well as higher level land and strategic plans

4.13 Hydrology

4.13.1 Introduction

This section describes the hydrological constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with the constraint's figures, Figures 4.13.1.0 to 4.13.4.5.

Section 4.13.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.13.3 describes the hydrological constraints within the N4 Project study area. A summary is presented in Section 4.13.4.

4.13.2 Methodology

This assessment was prepared taking cognisance of the requirements of the NRA guidance for the preparation of route selection reports for geology, hydrology and hydrogeology (NRA 2009) [156].

The guidelines provide useful criteria for ranking the importance of the identified hydrological and hydrogeological constraints. These criteria are presented in Table 4.13.1.

This desk study collated and reviewed the following sources of information to identify hydrological constrains within the study area:

- Current and historical Ordnance Survey maps available for the study area (1:2,500 and 1:10,560 scales)
- Aerial Photography
- OPW Arterial and Drainage District Mapping
- CFRAM Mapping and CFRAM Hydrology, Hydraulics and Flood Relief Options Reports for the Carrick-on-Shannon Study Area
- OPW Hydrometric Data for River and Lake Gauges
- EPA Environmental Mapping and GIS Layers
- EPA Water Quality Status Data
- EPA Water Framework Directive data
- Shannon River Basin Reports
- Roscommon County Development Plan (2021-2027)[157]
- Leitrim County Development Plan (2015-2021)[13]

[156] NRA, 2009. Environmental Impact Assessment of National Road developments – Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Developments. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

[157] Roscommon County Council, 2021. Draft Roscommon County Development Plan. Available at: https://www.rosdevplan.ie/

- Leitrim County Development Plan (2022-2028)[17]
- Carrick-on-Shannon Local Area Plan (2010)**Error! Bookmark not defined.**
- Geological Survey of Ireland Groundwater Database including
- Aquifer mapping, Bedrock Mapping, Karst Features, Aquifer Vulnerability, Groundwater Recharge mapping, Quaternary Mapping including soils and sub-soils and groundwater flood mapping

Table 4.13.1 Criteria for Rating the Importance of Identified Features (Based on NRA Guidelines (2009); Box 4.2: Criteria for Rating Site Attributes – Hydrology)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Floodplain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery. Locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Floodplain protecting between 5 and 50 residential or commercial properties from flooding. Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes. Quality Class C (Biotic Index Q3, Q2- 3). Floodplain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying

4.13.3 Existing Environment

4.13.3.1 Introduction

The constraints study area extends northwest to southeast with an area of 78.2km^2 and is 18.3km long and 7.7km wide at its widest point. The entire constraints study area is located within the Upper River Shannon catchment, hydrological Area No. 26. The River Shannon runs almost longitudinally through the study area which extends from just south of Eidin Lake in the townland of Drumharlow to just east of Lough Boderg and north of Lough Scannal in the townland of Faulties in the southeast.

The surface hydrology constraints will be presented under the following sub-headings:

- Watercourse features
- Drainage
- Hydro-ecological features
- Flood Risk
- Surface Abstractions
- Surface discharges

4.13.3.2 Watercourses

Upper River Shannon

The River Shannon is the main river system within the study area, with all watercourses within the constraints study area out falling within a relatively short distance of the mainline River Shannon. The catchment area of the River Shannon which extends to just downstream of Eidin Lake (i.e. approximately 2km upstream of Carrick-on-Shannon Bridge) is 1283km^2; to Carrick-on-Shannon Bridge it is 1,294km^2; and at the inlet to Lough Boderg towards the downstream end of the study area it is 1427km^2. These catchment areas represent a reasonably large sized river catchment system through the study area.

The upstream end of the study area (northwest), the River Shannon catchment, can be split in two sub-catchments: (1) Boyle River catchment and (2) the Upper River Shannon catchment which includes Lough Allen. The Boyle River which discharges into Eidin Lake has a total catchment area of 635km^2 to its outlet from Eidin Lake. The Boyle River catchment is sluggish and has many upstream lakes and wetlands including Oakpart Lough, Lough Key and Lough Gara as well as Eidin Lake. These lakes and floodplain areas produce a sizable natural flood attenuation effect. The Upper Shannon sub-catchment which includes the Lough Allen and the Leitrim River is in general a steeper catchment than the Boyle River catchment. The Upper Shannon catchment extends northwards close to the Border between Leitrim and Fermanagh and has a total area to its confluence with the Boyle River of 610km^2.

Lough Allen represents a major lake of some 33.5km^2 in surface area and its outflow is strictly controlled by the ESB at Bellantra Sluices. Lough Allen is used by the ESB to provide strategic storage for the Lower Shannon Hydroelectric (Ardnacrusha) Scheme and therefore its outflow is controlled. Similarly, the downstream Lough Ree lake is also controlled by the ESB at Athlone for a similar purpose. The water level on Lough Allen and the outflow discharges are controlled by lifting sluice gates at the Bellantra Sluices and is used like Lough Ree to provide compensation flow to the Lower Shannon for low flow periods to maintain consistent hydropower generation at Ardnacrusha throughout the year.

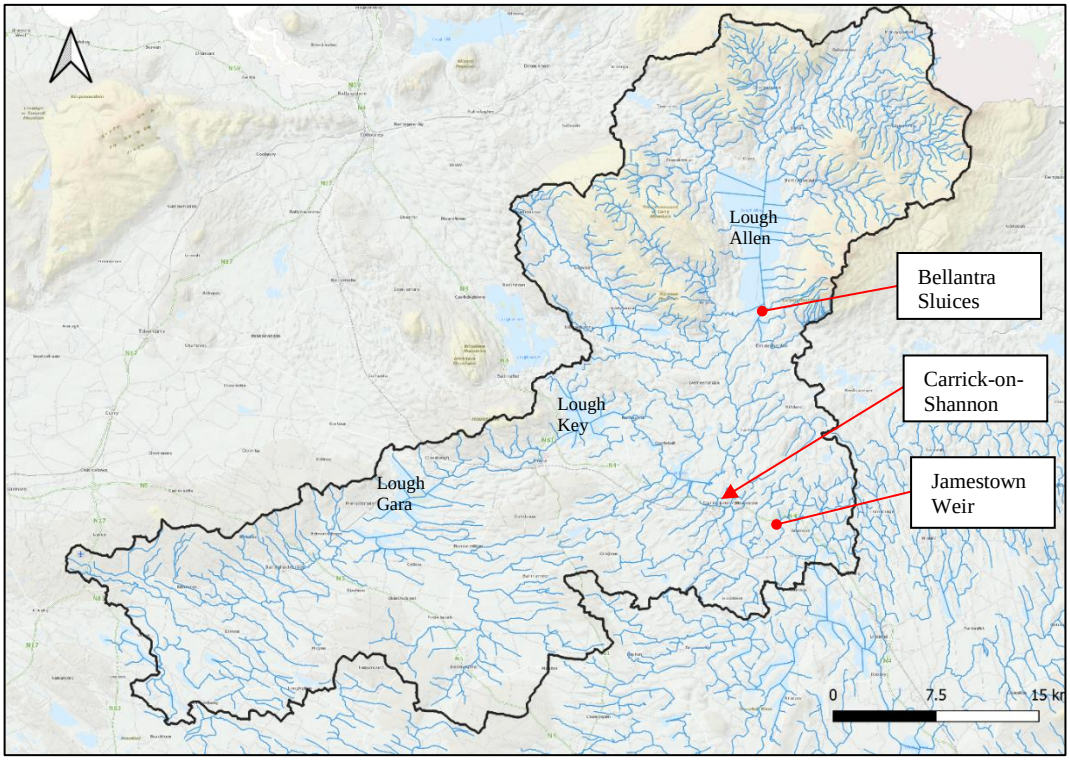

Plate 4.13.1 Upper Shannon Catchment Map to Jamestown Weir

A short distance downstream of Carrick-on-Shannon, the River Shannon flows through a large, elongated lake basin called Lough Corry. It has a relatively wide floodplain area as far as Jamestown Bridge. From Jamestown Bridge to Drumsna Village, the river floodplain is generally constrained by a narrow valley with steep sides on both banks of the river channel confining the river to an almost channelised reach section. This section of the river has a considerably higher gradient than the sluggish and wide lake like conditions that exist in the River Shannon upstream of Jamestown Bridge to Carrick-on-Shannon and upstream to Eidin Lake. A sluiced weir operated by Waterways Ireland, referred to as the Jamestown Weir, see Plate 4.13.3 is located 850m downstream of Jamestown Bridge which provides water level control for upstream navigation and the inflow to the Jamestown Canal. This is achieved through a broad crested weir section and gated section at the Jamestown Weir where sluices are manually lifted. In winter/autumn flood periods Waterways Ireland generally raise up all gates so as to avoid any potential significant effect on upstream flooding at Carrick-on-Shannon and surrounding callows.

Plate 4.13.2 Lough Allen Controlled Outflow at Bellantra Sluices

Plate 4.13.3 View from Jamestown Weir (taken 27 February 2020) (note all flow at that time within channel and discharging over the Permanent Weir Section also)

Plate 4.13.4 Summer Operation at Jamestown Weir with Levels Low and Not Discharging over the Permanent Weir Section

The catchment areas of the River Shannon to Jamestown Quay and to Drumsna Quay are 1374 km^2 and 1385km^2 respectively, ref Plate 4.13.8. The river channel section between Jamestown and Drumsna is not navigable, particularly in the low flow periods. A lock gated navigation canal (the Jamestown Canal) upstream of Jamestown at Ardanaffrin townland on the left bank (southeast) c. 650m upstream of Jamestown Bridge connects via a constructed canal of almost 2.8km in length to Lough Nanoge on the River Shannon which avoids the unnavigable reach section between Jamestown and Drumsna Villages. The entire section of the River Shannon channel within the study area would be considered to be an important amenity and fishery river. However, the Upper Shannon River has not been designated as Salmonid water body.

ESB Control

As part of the Shannon hydroelectric scheme, the ESB control water levels in the Shannon Lakes through their control of Lough Allen at the Bellantra sluices, Lough Ree at Athlone weir and Lough Derg at Parteen weir. The control of lake levels enables ESB to ensure sufficient river flow throughout the year for Ardnacrusha whilst meeting lake and river level obligations in terms of navigation and low flows. Lough Allen, which controls the flow rate from c. a 442km^2 catchment area, is approximately 35km^2 in surface area and therefore a rise of 1m in lake level represents 35million cubic metres of lake storage. Such storage represents an effective rainfall depth of 80mm over the contributing catchment area. There is almost 80 years of recorded lake levels for Lough Allen and from the outflow channel downstream of Bellantra sluices. These levels are used with the ESB Rating Equation to estimate daily outflow based on daily water level readings taken at

9:00am. The ESB operation of the Bellantra sluices sets the outflow from Lough Allen which is circa 37% of the catchment area to Carrick-on-Shannon.

The control of Lough Allen and the released outflows to the Shannon are set out in the ESB Regulation and Guidelines for the Control of the River Shannon (Nov 2003). The regulation dictates the sluice gate opening settings, height and the speed of gate opening, the maximum permissible lake level and the minimum permissible lake outflow. In respect to normal operations, the regulations set out that the water level in the channel downstream of the Bellantra sluices should not drop below 46.40m OD, which approximates a discharge of $5m^3/s$. It recognises that it may not be possible to maintain this level during drought periods even when the sluices are fully open. Optimisation of storage from Lough Allen is no longer an important factor to the ESB in generation of power at Ardnacrusha with control primarily for navigation and flood requirements. However, storage which has built up in Lough Allen over the winter period may be released during the summer.

The ESB endeavour to maintain the level of Lough Allen above 48.16m OD Poolbeg during mid-March and the end of October (this is considered to represent the minimum navigation level for Lough Allen)[158]. In order to achieve this, it is considered desirable that the level of the lake is above 48.6m OD Poolbeg during May and early June in order to achieve the minimum lake level and a $5m^3/s$ discharge. Throughout the remainder of the year, a discharge from Lough Allen of 20 to $25m^3/s$ is generally sufficient to keep the lake level at or above 49.68m OD Poolbeg (maximum normal operating level). At 49.68m OD Poolbeg with the Bellantra Sluice gate opening set to 400mm the discharge from Lough Allen is circa $30m^3/s$. The dam crest level at which a spill will occur for Lough Allen is 52.12m OD Poolbeg and the exceptional Reservoir Level is 51.12m OD (i.e. an allowance of 1m is made for wave surcharge on the earthen embankments).

The outflow relationship for the Bellantra Sluices set at flood control levels where the twin 6m wide gates are set with a bottom leaf of each gate set at an opening height of 400mm and the top of the upper leaf set at 49.68m OD.

Table 4.13.2 ESB Bellantra Sluice Flow Relationship for Lough Allen Outflow

Upstream Water Level Hydrometric Gauge 26073 mOD Poolbeg	**Downstream Water Level Hydrometric Gauge 26030 mOD Poolbeg**	**Lough Allen Discharge Q (m^3/s)**
49.68	47.5	29.5
49.83	47.56	31.3
49.98	47.65	34
50.13	47.75	37.2
50.28	47.86	40.7
50.43	47.98	44.8

[158] Jacobs, 2004. Understanding Water Levels on the River Shannon; Shannon Catchment-based Flood Risk Assessment and Management (CFRAM) Study. OPW. Available at: http://shannoncframstudy.jacobs.com/docs/Understanding%20water%20levels%20of%20the%20River%20Shannon_120814.pdf

Upstream Water Level Hydrometric Gauge 26073 mOD Poolbeg	Downstream Water Level Hydrometric Gauge 26030 mOD Poolbeg	Lough Allen Discharge Q (m^3/s)
50.58	48.11	49.4
50.73	48.25	54.5
50.88	48.38	59.4
51.03	48.52	64.9
51.18	48.67	71
51.33	48.83	77.8

The desirable minimum outflow during summer period is $5m^3/s$.

The estimated 150year flood level by the ESB for Lough Allen is 51.25m OD which represents a controlled discharge of 74.1cumec.

Waterways Ireland Control

Waterways Ireland operate the Jamestown Weir such that they can maintain summer minimum upstream levels for navigation purposes. Jamestown Weir has a 17.2m long broad crested weir section for higher flood flows at a crest level of 42.9m OD Poolbeg, a gated sluice section with 12 No. 2.05m wide by 1.9m high openings at an invert of 40.9m OD Poolbeg. The structure has a 1.7m wide spill units for fish passage having a crest elevation of 41.88m OD Poolbeg. A second spillway on towards the right side of the channel and structure is 6.94m wide at an elevation of 42.62m OD Poolbeg.

The control imposed by Waterways Ireland is for navigation purposes only and is set to maintain summer levels for navigation throughout the Upper River Shannon channel which extends northwards into the Lough Allen navigation Canal. The gates are closed as necessary to achieve and maintain a normal summer operating level upstream at Jamestown of 42.98mOD. The 95-percentile water level recorded at Jamestown Hydrometric Gauge 26085 is 42.865m OD Poolbeg and median water level is 43.11m OD Poolbeg.

Based on the hydrometric record for hydrological years 2005 to 2019 (16 years of daily gauging record) the minimum recorded water level at Jamestown Hydrometric Gauge is 42.73m OD Poolbeg and the 99 and 95-percentile levels (exceeded 99 and 95% of the time) are 42.83m OD and 42.92m OD Poolbeg. In the autumn and winter periods when river is in flood all of the gates are opened.

In the 16 year period the typical range of water levels at Jamestown (difference between 1 and 99-percentile levels) is 1.48m.

Hydrometric Gauges

The River Shannon is hydrometrically gauged at a number of locations within and proximate to the study area. These river gauges include Lough Allen (26073 ESB), Bellantra Sluices tailwater channel (26030 EPA), Boyle River at Boyle Abbey (26108 OPW), River Shannon at COS Bridge (26324, EPA), River Shannon at

Jamestown Bridge (26085, OPW) and River Shannon at Drumsna Quay (26089, OPW).

Table 4.13.3 Hydrometric Gauging on the Upper River

Site	Gauge Ref No.	Hydrometric data	Area km^2
Boyle Abbey Bridge	26108	Flow and water level estimates	528
Bellantra Sluices	26030/26073	Flow and water level	417
Lough Allen	26073	Lake water level only	417
Carrick-on-Shannon Br.	26324	Water level only	1290
Jamestown	26085	Water level only	1374
Drumsna	26089	Water level only	1385
Athlone	26027	Flow and Water Level	4601

Additional recorders are being installed in the summer 2021 by the OPW as part of the COS Flood Relief Scheme Study being carried out by Leitrim Co. Co. in conjunction with the OPW at the Jamestown Weir facility

Bridge Structures on the River Shannon

The River Shannon has three existing bridge crossings within the study area. These are located at the narrower channel sections of the river at Drumsna, Jamestown and Carrick-on-Shannon. These structures are shown below and are similar, having 5 no. wide arches.

Plate 4.13.5 Carrick-on-Shannon Bridge Crossing

Plate 4.13.6 Jamestown Bridge Crossing

Plate 4.13.7 Drumsna Bridge Crossing

Tributaries

The main tributary streams and rivers within the constraints study area are presented in Table 4.13.4. All of these tributaries discharge to the River Shannon within a relatively short geometric distance from their catchment centroid. In terms of categorisation of drain, stream and river the catchment area is used as follows:

- small drainage channel < 0.25km^2
- small stream 0.25 to 5km^2
- medium stream 5 to 10km^2
- large stream 10 to 20 km^2
- small river 20 to 100km^2
- medium river 100 to 500km^2
- Large river > 500km^2

It is assumed that all streams and rivers should be considered to be potentially fishery watercourses with spawning potential. The largest local tributary discharging into the River Shannon within the study area is the Killukin River located in Co. Roscommon and discharges in the Cortober area, downstream of Carrick-on-Shannon River Bridge on the southern side of the river. Based on this classification the watercourses within the study area are 3 no. small rivers, 2 no. large streams, 4 no. medium streams and 20 no. small streams.

Table 4.13.4 Details of Watercourses within the Study Area

Study ref	EPA Name	EPA Code	Catchment Area	Downstream receiving Watercourse
1	Clogher	26C18	28.6	Eidin Lake Boyle River
2	Ardglass Stream	26A12	2.9	Eidin Lake Boyle River
3	Woodbrook house Stream	26W01	2.5	Eidin Lake Boyle River
4	Clooneigh26	26C55	3.0	Eidin Lake Boyle River
5	Tumma	26T07	1.3	Eidin Lake Boyle River
6	Caldragh	N/A	1.65	Shannon upper 26S02
7	Kilmaddaroe Stream	N/A	5.79	Bran Lough and Mackan26
8	Knockadalteen26	26K30	3.5	Knockananima Stream
9	Knockananima Stream	26K25	7.6	Shannon upper 26S02 at COS
10	Lisnagat	26L18	1.9	Shannon upper 26S02 at COS
11	Attifinlay	26A18	1.1	Shannon upper 26S02 at COS
12	Drumercool	26D31	1.43	Killukin River
13	Killukin River	26D31	33.9	Shannon upper 26S02 at COS
14	Danesfort	26D49	0.2	Lough Corry
15	Tonrevagh R	26T97	21	Lough Corry
16	Rock26	26R17	2.4	Tonrevagh R
17	Attirory Stream	26A26	1.4	Lough Corry
18	Kilmaddaroe Stream	26K24	8.3	Lough Corry
19	Pollnagappul	26P05	0.9	Lough Corry
20	Sallaghan26	26S24	0.2	Shannon upper 26S02
21	Kiltycarney	26K39	0.5	Shannon upper 26S02
22	Lismoyle26	26L41	0.7	Shannon upper 26S02
23	Killasanowl	26K38	3.9	Shannon upper 26S02
24	KilDorragh26	26K41	0.6	Shannon upper 26S02
25	Drumsna R	26D53	17.2	Shannon upper 26S02
26	Gortinty Stream	26G35	8.5	Shannon upper 26S02
27	Drumcleavry R	26D57	13.4	Shannon upper 26S02
28	Ardanaffrin	26A40	0.5	Drumcleavry R
29	Antfield	26A30	1.5	Eislin River 26E01

There are many small local drains particularly within or close to the floodplain area not included in this list.

The additional catchment area from Eidin Lake which is part of the Boyle River System and the Upper Shannon confluence downstream to Carrick-on-Shannon Bridge is 12km^2 and is associated with small tributaries draining to the relatively short 2.5km reach between Eidin Lake and Carrick-on-Shannon Bridge. These tributaries are the Knockananima River (6.6km^2) which joins the River Shannon on the southside and the Lisnagat Stream (1.8km^2), which joins on the northside. The remainder is the River Shannon floodplain drainage area of c. 2km^2.

Downstream of Carrick-on-Shannon Bridge, the Killukin River drains to the River Shannon at Cortober on its southern side having a catchment area of 32km^2. Small, urbanised tributaries on the north side drain to the River Shannon downstream of the river bridge. These are the Attifinlay, Aghancarra and Attirory streams. Combined, all of the identified tributaries discharging to the River Shannon from downstream of Eidin Lake to Lough Tap has a total catchment area of 110km^2 representing 7.7% of the total river catchment area of the River Shannon. The River Shannon catchment to Carrick-on-Shannon is substantially rural with an urbanisation factor of just 0.3%.

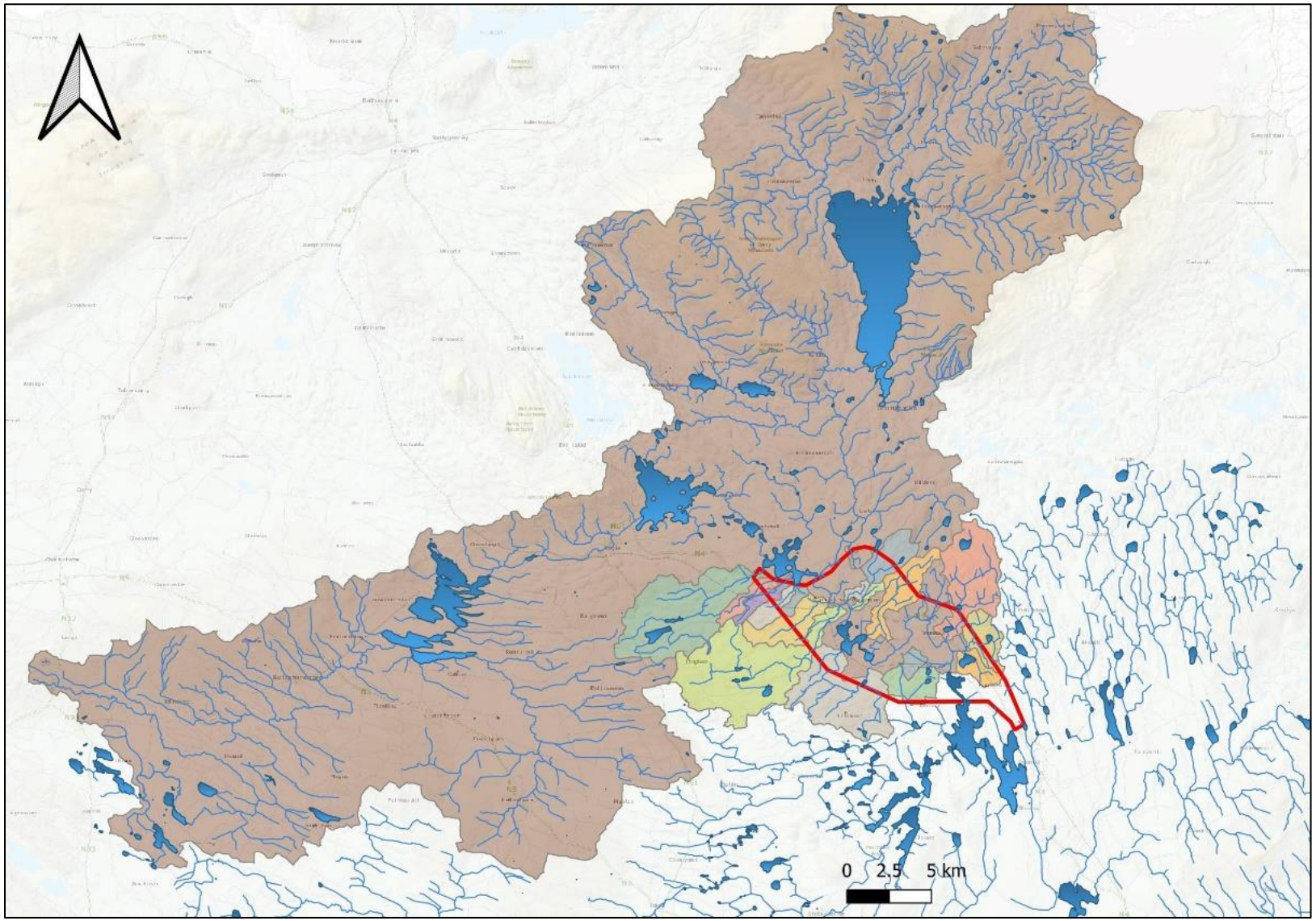

Plate 4.13.8 Context of Catchments Contributing to Watercourses within the Study Area

4.13.3.3 Lakes and Standing Waters

Within the study area and immediately upstream and downstream (see Figures 4.13.1.0 to 4.13.1.5) there are numerous large lakes and standing water features present on the Shannon System. The water lake features are summarised as follows:

Table 4.13.5 Lakes within and in proximity to the Study Area

Lake Name	Area ha
Eidin Lake	269.5
Lough Bran	12.5
Lough Corry	154
Ballagh Lough	5
Cartron Lough	8.5
Lowfield Lough	7
Gortconnellan / SPA Lough	13.5
Drumgilra / Gortinty Lough	42
Tap Lough	75
Bog Lough	7
Lough Boderg Lough Scannel Bofin Lough	966

Many of these lakes have relatively low residence times in summer period and have the potential to be prone to pollution. The WFD status of many of these lakes within the study area are under review by the EPA. Avoidance of direct encroachment into these lakes is important as they represent a county status, and for the bigger lakes a regional status.

4.13.3.4 Water Quality

The river waterbody WFD ecological status provided by the EPA is based on a five year monitoring period with the latest published cycle period available on the EPA Waters web site for the period 2016 – 2021. It shows that all water courses including the upper River Shannon_060 itself and its tributaries within the constraints study area are classified as at moderate status. The watercourses including the River Shannon below Jamestown (Shannon(upper)_070) are also assigned a moderate status. The lakes of Lough Eidin upstream of Carrick-on-Shannon and Lough Corry downstream are assigned poor status. The downstream Lakes of Tap North, Lough Boderg and Lough Bofin are assigned moderate ecological status.

All of river waterbodies have been identified to be at risk from catchment pressures and requiring action under the WFD river basin management plan. The risk status for the lakes within the study area are under review for Lough Eidin, Lough Corry and Lough Tap and at Risk for the lower lakes of Boderg and Bofin.

All of the watercourses discharging to the River Shannon from Leitrim Village downstream to Jamestown are designated as a protected drinking water body under Article 7 abstraction for Drinking Water which is associated with the large regional drinking water abstraction from the Shannon to the north of Carrick-on-Shannon. It is noted that Eidin Lake and the Boyle River and tributaries are not included in the protected drinking water body.

4.13.3.5 Flooding and Flood Risk

The River Shannon upstream of Jamestown Bridge has a very wide and extensive floodplain area. The Shannon Catchment Flood Risk Assessment and Management (CFRAM) study was one of seven River Basin District studies carried out across the Republic of Ireland from 2011 to 2016. The Carrick-on-Shannon area was included in the CFRAM assessment under Unit of Management (UoM) 25/26 (Shannon Upper and Lower, Hydrometric Areas 25 and 26). The CFRAM study included detailed hydrological and hydraulic modelling assessments to quantify the flood risk from fluvial and coastal sources and to identify management measures to protect vulnerable receptors.

Based on the Shannon CFRAM (Catchment Flood Risk Assessment and Management) study the 10-year, 100-year and 1000-year flood extents for the Shannon have been estimated and mapped. See Figures 4.13.1.0 to 4.13.1.5.

Table 4.13.6 Flood Levels for 10, 100 and 1000 Year Return Periods

Return Period	**10yr**	**100yr**	**1000yr**
Annual Exceedance Rate	0.1%	0.01%	0.001%
Flood Level H (m OD) Malin	41.74	42.31	42.86

The November 2009 flood event was historically the most significant flood at Carrick-on-Shannon Hydrometric Gauge and the Boyle Abbey Hydrometric Gauge and downstream Jamestown and Drumsna Hydrometric Gauges.

This event produced a recorded peak flood level of 42.672mOD Malin at Carrick-on-Shannon River Bridge Hydrometric Gauge 26324. The estimated peak flow at Boyle Abbey Bridge Hydrometric Gauge is 79m^3/s and the corresponding peak outflow from Lough Allen is estimated based on ESB hydrometric data to have been 54m^3/s. Taking account of the additional catchment area downstream of Boyle and Lough Allen (c. 326km^2) to Carrick-on-Shannon, the peak flow in the Shannon through Carrick-on-Shannon is unlikely to have exceeded 190 m^3/s for the November 2009 flood event.

Table 4.13.7 Flood Magnitudes and Estimated Return Period at Relevant Gauges for the Two Largest Flood Events Recorded

	Boyle River		Lough Allen Outflow		River Shannon Jamestown	
Flood Event	**Peak Flow (m^3/s)**	**Return Period (yrs)**	**Peak Flow (m^3/s)**	**Return Period (yrs)**	**Peak Flow (m^3/s)**	**Return Period (yrs)**
2009	79.0	96	55.27	46	184.2	283
2015	72.5	57	53.04	37	160.6	80

The Carrick-on-Shannon Urban Area surrounding the River Shannon banks is highly sensitive to flood risk with extensive flooding occurring during the November 2009 flood event, but also regular flooding of some properties occurs each year. As a consequence, flood risk represents a significant hydrological constraint for the option selection process and particularly in light of the requirement by the flood risk management planning guidelines and amendments (2009, 2012) concerning avoidance of flood zones and passing a justification test with the requirement for minimising flood impact. In particular this applies to any potential new crossing of the River Shannon given its very extensive floodplain areas both upstream and downstream of Carrick-on-Shannon. See Figures 4.13.1.0 to 4.13.1.5.

4.13.3.6 Surface Water Abstraction

A large surface water abstraction from the River Shannon as part of the South Leitrim Regional Supply Scheme is located circa 1km upstream of Carrick-on-Shannon Bridge near the Town Parks area on the northern riverbank. The abstracted water is treated at the Carrick-on-Shannon water treatment plant to achieve drinking water standards and supplies the Carrick-on-Shannon and environs area. This abstraction would be considered a strategic asset and of regional importance and sensitive to hydrological regime change, particularly pollution and water quality effects. No other significant surface water abstractions were identified within the constraints study area.

4.13.3.7 Surface Discharges

There are a number of discharges identified and licensed by the EPA within the study area, including the Carrick-on-Shannon Waste Water Treatment Plant (WWTP) outfall discharge, and a number of commercial discharges and storm discharges. All of these are located downstream of the public water abstraction. There is a potential for combined impact with any potential development on the water quality of the receiving watercourses both during the construction phase activities and from the routine road drainage discharges. The presence of these outfalls would not be considered a significant constraint on a potential road development, but combined impacts would need to be determined.

4.13.3.8 Water Dependent Habitats

Water dependant habitats, generally associated with soft sediments, may be impacted by any potential development through accidental contamination, localised flooding through storm drainage or the alteration of that natural base-flow supplies to fens and marshlands. This could cause a change to the hydrological regime resulting in a drying out of such areas. Soft sediments are indicative of wet grasslands, peatland (wet heath, blanket bog cut over bid etc.) and alluvial woodland type habitats.

For the areas of soft sediments and peaty soils indicative of wet grassland and bog land areas, that are potentially sensitive to the hydrological regime and particularly to the road drainage, refer to Figures 4.13.4.0 to 4.13.4.5. These areas have a strong correlation with the mapped floodplain areas which is conducive to the presence of water dependant habitats. Along the riverbank of the River Shannon through the study there is potential for the presence of alluvial woodland, which is a priority Annex I habitat.

4.13.4 Summary

The important hydrological features that will influence the option selection are the river channel and floodplains of the larger streams and rivers and particularly the River Shannon floodplain area. All tributary streams and small rivers are classified as having local higher value. These watercourses will all discharge within a relatively short distance into the River Shannon and its associated lakes. The closest European Sites on the River Shannon are Clooneen Bog and Lough Forbes Complex at 8km and 10km downstream of the study area. These sites which have a high attribute value could potentially be indirectly impacted by the proposed road development through pollutant discharges both during construction and operation. Such water quality impacts are unlikely to be significant given the available high dilution in the River Shannon and its lakes. The large regional drinking water abstraction point 1km upstream of the River Shannon Bridge in Carrick-on-Shannon is a regionally important attribute and potentially sensitive to pollution from a proposed road development.

4.14 Hydrogeology

4.14.1 Introduction

This section describes the hydrogeological constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with Figures 4.14.1.0 to 4.14.3.5.

Section 4.14.2 describes the methodology and sources of information that were used to carry out the study. Section 4.14.3 describes the hydrogeological constraints within the study area. A summary is presented in Section 4.14.4

4.14.2 Methodology and Sources of Information

4.14.2.1 Methodology

This assessment was prepared in accordance with the requirements of the Transport Infrastructure Ireland (TII), formerly National Roads Authority (NRA), Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes[159]. This desktop study includes a review of the information listed in Section 4.14.2.2, to identify the constraints associated with hydrogeology within the study area.

The NRA guidelines[159] provide criteria for ranking the importance of the hydrogeological constraints identified, and these criteria are presented in Table 4.14.1.

The desk study includes a hydrogeological assessment of the following criteria:

- Karst features
- Aquifer type and classification
- Groundwater vulnerability
- Groundwater resources
- Hydro-ecology

[159] NRA, 2009. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

Table 4.14.1 Criteria for Rating the Importance of Identified Features (based on NRA Guidelines (2009) Box 4.3: Criteria for Rating Site Attributes) [159]

Importance	Criteria	Typical example
Extremely High	Attribute has a high quality or value on an international scale.	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. NHA status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

4.14.2.2 Sources of Information

The following list of data sources were the main information sources consulted to identify hydrogeological constraints:

- Ordnance Survey Discovery Series mapping (1:50,000)[160]
- Bing Maps (2019) base mapping[55]
- Google Maps (2020)[33]

[160] Ordnance Survey Ireland (OSi) (Discovery Series) OSi Licence number 2021/OSI_NMA_139 & OSi Licence number 2021/18/CCMA

- Bedrock Geology Map (1:100,000)[161]
- Groundwater Resources (Aquifers)[161]
- Groundwater Vulnerability[161]
- Groundwater Rock Unit[161]
- GSI Groundwater Bodies[162]
- Groundwater Source Protection Areas[161]
- Groundwater Wells and Springs[161]
- Groundwater Flooding Areas [163]
- Karst Features and Tracer Test Database[161]
- Discharges and emissions [164]
- Designated ecological areas[165]
- Water Quality Monitoring Database and Reports[164]

4.14.3 Existing Environment

This section describes the hydrogeological constraints identified within the study area. Constraints associated with aquifer type, groundwater vulnerability, groundwater resources and water dependant terrestrial ecosystems within the study area are described herein.

4.14.3.1 Karst Features

Karstic areas are those where the rock present is readily dissolved by water (relative to other rock types). Distinctive karstic features are formed along preferential groundwater flow paths such as fractures, fissures or joints. Karstic aquifers are the most common source of bedrock groundwater in Ireland. In these, groundwater

[161] Geological Survey Ireland (GSI). Webviewer including: Bedrock Geology 1:100,000, Groundwater Rock Units, Groundwater Aquifers, Groundwater Vulnerability, Groundwater Wells and Springs, Karst Features and Tracer Test. Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=3400f393afa844538e5b81679552205d [Accessed: 13/08/2020]
[162] Geological Survey of Ireland, Groundwater Bodies:
Geological Survey Ireland, Carrick on Shannon GWB: Summary of Initial Characterisation
Geological Survey Ireland, Kilglass Dromod GWB: Summary of Initial Characterisation
Geological Survey Ireland, Scramoge North GWB: Summary of Initial Characterisation
Available form: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx [Accessed: 13/08/2020]
[163] Groundwater Flood Data. https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [Accessed: 13/08/2020]
[164] Environmental Protection Agency (EPA). Discharges and Emissions. Available at: https://gis.epa.ie/EPAMaps/
[Accessed: 13/08/2020]
[165] National Parks & Wildlife Service (NPWS) Webviewer https://www.npws.ie/maps-and-data

flow is dominated by fissure flow, leading to potentially high yields and the aquifers can extend over large areas.

A single karst feature, as mapped by the GSI, is present within the boundary of the study area. A spring, namely Toberconellan, (GSI reference No. 1729SEK002) is situated approximately 1.5km south of the railway station at Carrick-on-Shannon.

It is expected that there are unmapped karst features within the study area as the GSI karst database is not comprehensive. A review of historical mapping by OSI[160] indicate there are numerous springs mapped in the region which are not in the GSI karst database.

A hydrogeological site survey was completed in October 2020 which included a review of potential karst features. The survey did not identify any clear karst features and the surveyed areas were not indicative of highly karstified terrain. Some karst spring type features were identified during the site walkover, however these were relatively minor drainage features and as such are not assigned a feature importance. While the underlying limestone aquifer has karst potential it may be the case that karst features are either buried under glacial till or manifest as deeper conduit flow systems discharging to the River Shannon. The field survey confirmed the presence of shallow groundwater in areas of soft ground some of which are associated with ecological sites.

The underlying aquifer is a regionally important aquifer and therefore all the springs are classified as high importance. The spring locations are shown in Figures 4.14.2.0 to 4.14.2.5.

4.14.3.2 Aquifer Classification and Groundwater Bodies

The Geological Survey Ireland (GSI) have classified geological strata for hydrogeological purposes based on the value of the groundwater resources and the hydrogeological characteristics. There are three principal categories of aquifer, corresponding to whether they are major, minor or unproductive resources whereby:

- Regionally Important Aquifers are capable of supplying regionally important abstractions (e.g. large public water supplies), or excellent yields (>400 m^3/d)
- Locally Important Aquifers are capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or good yields (100-400 m^3/d)
- Poor Aquifers are capable of supplying small abstractions (e.g. domestic supplies), or moderate to low yields (<100 m^3)

The three principal aquifer categories are further subdivided into 10 aquifer sub-categories[161] in Table 4.14.2.

Table 4.14.2 Aquifer Category[161]

Aquifer category	Sub-category description	Code
Regionally Important (R)	Karstified Bedrock dominated by diffuse flow	(Rkd)
	Karstified Bedrock dominated by conduit flow	(Rkc)
	Fissured bedrock	(Rf)
	Extensive sand & gravel	(Rg)
Locally Important (L)	Sand & gravel	(Lg)
	Bedrock which is Generally Moderately Productive	(Lm)
	Bedrock which is karstified to a limited degree or limited area	(Lk)
	Bedrock which is Moderately Productive only in Local zones	(Ll)
Poor (P)	Bedrock which is Generally Unproductive except for Local zones	(Pl)
	Bedrock which is Generally Unproductive	(Pu)

Examples of significant impacts to aquifers due to construction works and operation of transport infrastructure are as follows:

- The disruption of groundwater flow paths during earthworks
- Reduced yield and groundwater levels in groundwater supplies adjacent to earthworks or cuttings
- Disruption of baseflow to groundwater fed rivers or fens
- Contamination of the aquifer through accidental spillage

The aquifer classification and groundwater bodies within the study area are summarised in Table 4.14.3. Four aquifer classifications are present in the study area as shown in Figures 4.14.2.0 to 4.14.2.5. These are also listed in Table 4.14.3.

There are five types of groundwater rock units present within the study area:

- The Dinantian Pure Bedded Limestones are mapped across the majority of the study area and are classified as a Regionally Important Aquifer (Rkc)
- The Dinantian Sandstones are located in the southwestern part of the study area and are classified as a Locally Important Aquifer (Lm)
- The Mudbank Limestone is located in a small section to the south of the site and is classified as a Locally Important Aquifer (Ll)
- To the southwest of the study area, Ordovician Volcanics and Ordovician Metasediments are present which are classified as a Poor Aquifer (Pl)

There are no gravel aquifers mapped by the GSI within the study area.

Table 4.14.3 Aquifer Classification and Groundwater Bodies within the Study Area[161] and NRA Importance Ranking[159]

Aquifer classification	Bedrock formation (1:100,000 GSI Bedrock Map)	Groundwater rock unit	Groundwater body[162]	Constraint importance ranking (NRA)
Rkc	Croghan Limestone Formation & Bricklieve Limestone Formation & Ballymore Limestone Formation & Oakport Limestone Formation	Dinantian Pure Bedded Limestones	Carrick-on-Shannon	Very High
Lm	Fearnaght Formation	Dinantian Sandstones	Scramoge North	Medium
Ll	Mudbank limestone	Dinantian Pure Unbedded Limestones	Carrick-on-Shannon	Medium
Pl	Aghamore Formation	Ordovician Volcanics	Kilglass Dromod	Low
	Finnalaghta Formation	Ordovician Metasediments	Scramoge North	Low

4.14.3.3 Aquifer Vulnerability

Aquifer vulnerability is the term used to describe the intrinsic geological and hydrogeological characteristics which determine the ease with which a groundwater body may be contaminated by human activities.

Aquifer vulnerability is determined mainly by the permeability and thickness of the subsoils that underlie the topsoil. For example, bedrock with a thick, low permeability overburden is less vulnerable than bedrock with a thin, high permeability, gravel overburden. This is due to the ability of potential contaminants to reach the aquifer in a relatively short period and with little or no contaminant attenuation due to the thin or absent overburden.

Aquifer vulnerability classification guidelines, as published by the GSI[161], are given in Table 4.14.4.

Table 4.14.4 GSI Vulnerability Rating Matrix[161]

Vulnerability rating	Hydrogeological conditions				
	Subsoil permeability (type) and thickness			Unsaturated zone	Karst features
	High permeability (sand / gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	Sand / gravel (aquifers only)	(<30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable
(2) Precise permeability values cannot be given at present
(3) Release point of contaminants is assumed to be 1-2 meters below ground surface

Groundwater vulnerability within the study area ranges from 'Extreme' where bedrock is close or at the surface to 'Low' vulnerability in areas where thick subsoil deposit is present, refer to Figures 4.14.1.0 to 4.14.1.5.

4.14.3.4 Groundwater Sources

Groundwater sources include springs, wells or boreholes which are used for groundwater abstraction by domestic, agricultural, commercial, industrial, local authority or group water scheme users. Groundwater sources can be impacted by lowering of the water-table which may reduce available supply and by accidental spillages or releases of contaminants which may impact the water quality.

Source Protection Zone (SPZ) reports have been produced by the GSI and the EPA. The reports aim to guide development planning and regulation to provide protection to groundwater sources. To date, there are no SPZ reports produced for any location within the study area. In addition, there are no groundwater Group Water Scheme abstraction points located in the study area.

A preliminary Domestic Well Audit was not carried out at this stage of the study, but a comprehensive audit will be carried out as part of Phase 3, Design and Environmental Evaluation, after selection of the preferred option. 69 features from the GSI Wells and Spring database are located within the study area, however, the records do not state which wells are currently used for abstraction. Note, 50 of the 69 features are listed as geotechnical boreholes, installed as part of previous ground investigations in the area. It is expected that the 19 remaining features are potable water sources supplying less than 50 homes, which is considered to be of low importance as a constraint (based on NRA Guidelines (2009) Box 4.3: Criteria for Rating Site Attributes)[159].

In terms of feature location accuracy (which refers to the location of a well or spring within a defined radius, the exact location is not known), there are 62 features within

10m, 20m and 50m accuracy, one within 200m, one within 500m and five within an accuracy of 1km.

The wells and springs are identified in Figures 4.14.3.0 to 4.14.3.5

4.14.3.5 Groundwater Contamination

The EPA Map Viewer[164] was consulted for their records of discharges and emissions which may affect groundwater quality within the study area. The discharge licences and emissions considered relevant are listed in Table 4.14.5 and identified in Figures 4.14.3.0 to 4.14.3.5.

Table 4.14.5 Discharge and Emissions Licenses within the Study Area

Licence No. / Reference number	Discharge / Emission
WPL/11/02	Rosderra Meat, Jamestown, Co. Leitrim – Wastewater Discharge Point
P0021-02	Masonite Ireland – Integrated Pollution Control (IPC) Site Emission Licence
W0064-01	Carrick-on-Shannon – Landfill Site

Sites containing potentially contaminated land are detailed in Section 4.15 (Soils and Geology). Some of these sites such as landfills and those associated with historical land use contamination may contain contaminated groundwater. These sites are listed under the following headings in Section 4.15.3:

- Landfills (licensed and historical)
    - Landfill locations identified have the potential to be associated with groundwater contamination. The landfills identified include licensed sites as well as areas where material of unknown nature has been disposed
- Pits, quarries and mines (active and historical)
    - Within the study area there are two historic iron mines south of Aghamore and the Kiltycarney Quarry
- Industrial facilities (licensed and historical)
    - Discharge and emission licenses relevant to groundwater are presented in Table 4.14.5
- Historical land use contamination
    - Historical industrial land uses within the study area include gas works, a power station, corn and flour mills, railway stations, corn stores and kilns, water pumps, water works and a pumping station. Contamination from historical land use is likely to be localised and therefore the impact on the groundwater is considered to be insignificant

4.14.3.6 Groundwater Flooding

The GSI Groundwater Flood Data Maps[163] were consulted and two small areas of historic groundwater flooding are recorded within the study area. The Kiltycarney Quarry is a former flooded quarry (GSI reference GW3236) and is located around 3km southeast of Carrick-on-Shannon within the townland of Kiltycarney. The area of groundwater flooding recorded was 1.2ha. The second historic groundwater flooding location (GSI reference GW3277) is located approximately 0.5km west of Cartron Lough, with a groundwater flooding area of 0.4ha recorded.

The two areas of historic groundwater flooding within the study area are identified in in Figures 4.14.3.0 to 4.14.3.5.

4.14.3.7 Hydro-ecology

Groundwater dependant habitats are hydrogeological constraints as they have the potential to be impacted as a result of changes in groundwater levels, flows or quality through, for instance, accidental spillages and dewatering causing deterioration in the flow and or quality of the baseflow to the habitat.

A conservative approach is taken regarding groundwater dependent habitats. All water dependant habitats are included as hydrogeological constraints until it is established, during the assessment of the preferred transport solution, if they are dependent on groundwater and/or surface water.

There are no European sites i.e. Special Protection Areas (SPA) designated under the Birds Directive or Special Areas of Conservation (SAC) designated under the Habitats Directive, within the study area or in immediate proximity to it.

There are no Natural Heritage Areas (NHA) located within the study area, however, two proposed Natural Heritage Areas (pNHA) are identified. Lough Eidin pNHA to the immediate northwest of Carrick-on-Shannon and Lough Boderg/Lough Bofin pNHA to the south of Drumsna. Both pNHAs are located partially within the study area. These habitats are listed in Table 4.14.6 and presented in Figures 4.14.3.0 to Figure 4.14.3.5. Further discussion of these habitats is provided in Section 4.12 Biodiversity.

The constraint importance ranking shown in Table 4.14.6 is only related to the hydrogeological importance ranking due to the site being a water dependant habitat.

Table 4.14.6 Water Dependant Habitats and NRA Importance Ranking

Site name	Site code	Designation	Characteristics	Constraint importance ranking (NRA)
Lough Boderg and Lough Bofin	001643	pNHA	Lake and associated wetlands	Very High
Lough Eidin	001643	pNHA	Lake, wetlands, overwintering birds	Very High

Non-designated Areas of Annex I Habitat

The biodiversity constraints study detailed in Section 4.12 has preliminarily identified, via desk study, interpretation of orthophotography and a site visit, habitat types present or likely to be present within the study area that may also include important flora and fauna sites and populations.

The following Annex I groundwater dependent habitats have been identified within the study area but outside a European site (*indicates priority habitat):

- *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [*91E0]
- Transition mires and quaking bogs [7140]
- *Bog woodland [*91D0]

Annex I habitats are of national importance, therefore are considered of 'Extremely High' importance by the NRA constraint ranking. These habitats are presented in Figure 4.12.1.0 to Figure 4.12.1.5. Summary of Hydrogeological Constraints.

The hydrogeological features that represent constraints within the study area include the following:

- Aquifers: the majority of the area is underlain by a regionally important karst aquifer with a conduit flow system (Rkc). This aquifer type can support regional groundwater supplies, large springs and regional groundwater flow. The aquifer is susceptible to karstification. There are smaller areas of locally important and poor aquifers in the southeast of the study area. There are no gravel aquifers mapped in the study area
- Aquifer Vulnerability: the aquifer vulnerability ranges from low, where there are thick low permeability subsoils, to extreme, where bedrock is close to surface
- Karst: the limestone underlying the majority of the catchment is classified as a karst aquifer, however only one karst feature is mapped in the study area. A karst site survey was completed to inform this stage of the assessment and did not identify any additional karst features. Further detailed karst feature mapping will be completed when the preferred transport solution is defined to identify any unmapped karst features
- Groundwater resources: there are no groundwater public, private or group water schemes identified within the study area and there are no groundwater source protection areas mapped within the study area
- Potential contamination: there are some potential areas of groundwater contamination associated with landfills and historical land contamination
- Groundwater flooding: two small areas of potential groundwater flooding have been identified by GSI which are included as constraints. The hydrogeological field mapping highlighted significant areas of shallow groundwater in soft soils adjacent the River Shannon corridor
- Hydro-ecology: two pNHA sites are identified within the study area which contain potential groundwater dependant terrestrial ecosystems. Additional

areas of alluvial woodlands, transition mires and quaking bogs and bog woodlands have been identified

4.14.4 Summary

Table 4.14.7 Summary of Hydrogeology Constraints

Category	Name	Relevant Characteristics	Constraint importance ranking (NRA)
Karst Features	Toberconnellan Spring	Drainage, dewatering and contamination of aquifers from construction works. Areas of extreme groundwater vulnerability	High Importance
	Historic Springs (1930s Mapping, numerous)		Unrecorded – importance yet to be defined
	Unrecorded Karst Features		
Aquifer	Regionally Important Bedrock Aquifer – Karstified	Associated with the Ballymore, Croghan and Bricklieve Limestone Formations. Extreme to low vulnerability	High Importance
	Locally Important Bedrock Aquifer	Associated with the Fearnaght and Mudbank Limestone Formations. Extreme to moderate vulnerability	Medium Importance
	Poor Bedrock Aquifer	Associated with the Aghamore and Finnalaghta Formations. Extreme to low vulnerability	Low Importance
Groundwater Resources	Groundwater wells / springs (GSI record) No group water schemes or public supply source protection areas.	Drainage, dewatering and contamination of aquifers from construction works	Low Importance
Groundwater Discharge Licences & Emissions	Wastewater Discharge Points & Section 4s (WPL/11/02 Rosderra Meats)	Potential contamination	
	IPC Site Emissions (Masonite Ireland P0021)	Potential contamination	
	Landfill Sites (Carrick-on-Shannon Landfill W0064) (See Figure 14.5.4.0)	Potential contamination	

Category	Name	Relevant Characteristics	Constraint importance ranking (NRA)
	Historical landfill sites, pits, quarries and mines	Potential contamination	
Groundwater Flooding	GW3236 and GW3277	Two small areas of historic groundwater flooding recorded by the GSI	Low Importance
Hydro Ecology	Lough Boderg and Lough Bofin – pNHA	Includes groundwater dependent habitat – lake & wetlands.	Very High Importance
	Lough Eidin – pNHA	Includes groundwater dependent habitat – lake, wetlands & overwintering birds	Very High Importance
	Non-designated areas of Annex I habitat	Alluvial forests [*91E0] transition mires and quaking bogs [7140] and bog woodland [*91D0]– attribute has a high quality of international importance	Extremely High Importance

4.15 Soils and Geology

4.15.1 Introduction

This section describes the soils and geological constraints identified within the study area for the N4 Carrick-on-Shannon to Dromod Project and should be read in conjunction with Figures 4.15.1.0 to 4.15.4.5.

Section 4.15.2 describes the methodologies and sources of information that were used to carry out the study. Section 4.15.3 describes the soils and geology constraints within the study area. A summary is presented in Section 4.15.4 and references are listed in Section 4.15.4.

4.15.2 Methodology and Sources of Information

4.15.2.1 Methodology

The study has been carried out in accordance with the National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes[166] and in accordance with the Environmental Impact Assessment Directive (2014/52/EU)[167]. The NRA is now known as Transport Infrastructure Ireland (TII), however for the purpose of this report the guidelines mentioned above are referred to as the NRA guidelines[166].

The assessment is based on the results of a Preliminarily Sources Study Report (PSSR) [168] and historical publicly available ground investigation results. The PSSR[168] includes a review of the information sources listed in Section 4.15.2.2 to identify the constraints associated with soils and geology within the study area and is included in Appendix A.4.15.1 of this Option Selection Report.

The NRA guidelines[166] provide useful criteria for ranking the importance of the identified soils and geological constraints which are presented in Table 4.15.1. This assessment is generally consistent with the approach presented in the NRA guidelines and is undertaken using the criteria for rating the importance of identified features. Using this, it will allow the screening of potential alternatives and options for the project with respect to potentially contaminated soils and geological constraints.

[166] National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, Ireland: Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

[167] European Union, 2014. Directive 2014/52/EU of the European Parliament and of the Council. Official Journal of the European Union.

[168] Arup, 2021. N4 Carrick-on-Shannon to Dromod Preliminary Sources Study Report: 274219-ARUP-02-OS-RP-CG-000001

Table 4.15.1 Criteria for Rating the Importance of Identified Features (based on NRA Guidelines; Box 4.1 entitled 'Criteria for Rating Site Attributes - Estimation of Importance of Soil and Geology Attributes')[166]

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and / or soft organic soil underlying route is significant on a national or regional scale. *	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and / or soft organic soil underlying route is significant on a local scale. *	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and / or high fertility soils. Moderately sized existing quarry or pit.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and / or soft organic soil underlying route is moderate on a local scale. *	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and / or moderate fertility soils. Small existing quarry or pit.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and / or soft organic soil underlying route is small on a local scale. *	Large historical and / or recent site for construction and demolition wastes. Small historical and / or recent landfill site for construction and demolition wastes. Poorly drained and / or low fertility soils. Uneconomically extractable mineral resource.

** relative to the total volume of inert soil disposed of and/or recovered*

4.15.2.2 Sources of Information

This constraints study was undertaken as a desktop exercise. The following sources were studied in order to identify soils and geological constraints.

Topographical and Geographic Maps and Datasets

The following mapping and geographical datasets were reviewed as part of this study:

- Environmental Protection Agency (EPA) Contours[169]
- Google Maps (2020)[33]
- Bing Maps (2020) base mapping[55]
- OSI Rivers and Lakes[170]
- Corine Landcover [171]
- OSI Historic Map 6 Inch 1837 – 1842[172]
- OSI Historic Map 25 Inch 1888 – 1913[172]
- OSI 6 Inch Cassini 1930's[172]
- 1995, 2000, 2005 OSI Aerial Photography[172]
- Ordnance Survey Discovery series mapping[173]

Publications

The following publications were referenced and reviewed as part of this study:

- National Roads Authority. (2008). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*. Ireland[166]
- National Roads Authority. (2009) *Environmental Impact Assessment of National Road Schemes – A Practical Guide*. Revision 1[174]
- Environmental Protection Agency. (2017) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*. Draft[21]
- Matthew Parkes, R.M & S.P (2012). The Geological Heritage of Roscommon. An audit of County Geological Sites in Roscommon. Geological Survey Ireland[175]

[169] Environmental Protection Agency, 2022. EPA Contours. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=088740d9f8ad466788fc25e268394656 .
[170] Ordnance Survey Ireland, 2022. OSI Rivers and Lakes. Available at: https://gis.epa.ie/GetData/Download
[171] Environmental Protection Agency, 2018. Corine LandcoverAvailable at: https://gis.epa.ie/GetData/Download .
[172] Ordnance Survey Ireland, 2020. GeoHive. [Online] Available at: http://map.geohive.ie/
[173] Ordnance Survey Ireland. Discovery Sheet 1828, 1830, 2028 and 2030, s.l.: s.n.
[174] National Roads Authority, 2009. Environmental Impact Assessment of National Road Schemes – A Practical Guide. Revision 1
[175] Parkes, M., Meehan, R. & Preteseille, S., 2012. The Geological Heritage of Roscommon, An audit of County Geological Sites in Roscommon, s.l.: Geological Survey Ireland.

- TII 'Managing Geotechnical Risk' (2019) *DN-ERW-03083*[176]

Solid Geology

The following digital datasets and maps from the GSI were reviewed as part of this study:

- Bedrock Geology of Ireland (1:100,000 scale)[177]

Drift maps

The following drift maps were reviewed as part of this study:

- EPA National Soils Map (Teagasc Soils)[178]
- Teagasc Soils Map[179]
- Quaternary Geology of Ireland (1:50,000 scale)[180]
- Quaternary Geomorphology (1:50,000 scale)[181]

Geological Survey Ireland datasets (GSI)

The following GSI datasets were consulted:

- GSI karst landform features and traced underground connections[182]
- GSI landslide database[183]
- GSI landslide Susceptibility Classification[184]
- GSI Active Quarries and Pits[185]
- GSI APM Historical Pits and Quarries[186]
- GSI mineral localities[187]

[176] Transport Infrastructure Ireland, 2019. Managing Geotechnical Risk DN-ERW-03083. Available at: https://www.tiipublications.ie/library/DN-ERW-03083-01.pdf
[177] Geological Survey of Ireland, 2020. Bedrock Geology 1:100,000. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a40f6a8ca91f4340a86b12649d831d74 .
[178] Environmental Protection Agency. National Soils Map. [Online] Available at: https://gis.epa.ie/GetData/Download
[179] Geological Survey of Ireland, 2020. Teagasc Soils. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=82f09cca5c2c4221aa983d1a6d610c78
[180] Geological Survey of Ireland, 2020. Quaternary Sediments. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=1bbf22e9391c484db4b84e4150313bae
[181] Geological Survey of Ireland, 2019. Quaternary Geomorphology. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=6ed00a12b7de4a3eb5535bc0875191ee
[182] Geological Survey of Ireland, 2020. Groundwater Karst Data. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=aaa493208ff04f059ce5107e96089a71
[183] Geological Survey of Ireland, 2020. National Database of past landslide events in Ireland. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=cc35e0d1462d45698dda2a14d609c4db
[184] Geological Survey of Ireland, 2020. Landslide Susceptibility Classification. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=1101f04b18e84ed790fa6e17021f57d8
[185] Geological Survey of Ireland, 2020. Active Quarries and Pits Ireland. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=de18ea08ecd344b88c52b65b55fd9abb
[186] Geological Survey of Ireland, 2019. APM Pits and Quarries. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a205a046a2474e82944f9823b6568ea0
[187] Geological Survey of Ireland, 2020. Mineral Localities. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=43d66cb2f2f24d81b7e03b8acda00c6a

- GSI aggregate potential mapping final scores for granular and rock deposits[188] [189]
- GSI geological heritage sites[190] [191]
- GSI Geotechnical Boreholes Submitted by Industry[192]
- GSI Verified Boreholes[193]
- GSI Geotechnical Sites Submitted by Industry[194]
- GSI Unverified Boreholes[195]
- GSI Groundwater Vulnerability[196]

Other Datasets

The following datasets were also consulted:

- EPA Licenced Waste Facilities[197] [198]
- Water Framework Directive (WFD): Article 5 Landfill[199]
- EPA Extractive Industries[200] [199]
- EPA Local Authority Waste Facility Register[201]
- EPA Historic Landfill Register[202]

[188] Geological Survey of Ireland, 2019. APM Granular Aggregate Final Scores. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=8306d891261e44928b240f18edaeb4cc
[189] Geological Survey of Ireland, 2019. APM Crushed Rock Aggregate Final Scores. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=647d87bb85c64c2691f0c1f21cfea273
[190] Geological Survey of Ireland, 2020. Geological Heritage Audited Sites. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=35bb2b4ba2ca479ab7db513b445be7dc
[191] Geological Survey of Ireland, 2020. Geological Heritage Unaudited Sites. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=5203261e602d477da69ef0171f6f403b
[192] Geological Survey of Ireland, 2020. Geotechnical boreholes submitted by industry to GSI. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a78d571ab90442e2a7ebc6d7d36c9a43
[193] Geological Survey of Ireland, 2020. Boreholes verified by the Geological Survey Ireland. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=4737fa3211c54464b0a1d871f2093121
[194] Geological Survey of Ireland, 2020. Geotechnical Site Investigations with Links to Reports. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=f2ecd636745d4f50b78f9469750d6d8c
[195] Geological Survey of Ireland, 2020. GSI Bedrock Borehole Locations (Unverified). [Online] https://dcenr.maps.arcgis.com/home/item.html?id=28a500216eba49ce8a32910d2c799620
[196] Geological Survey of Ireland, 2020. Groundwater Vulnerability. [Online] Available at: https://dcenr.maps.arcgis.com/home/item.html?id=0a4dfd3097c64aada6eea057b33ba65f
[197] Environmental Protection Agency, 2020. Licenced Waste Facilities. [Online] Available at: https://gis.epa.ie/GetData/Download
[198] Environmental Protection Agency, 2020. Waste Licence Search. [Online] Available at: http://www.epa.ie/terminalfour/waste/index.jsp?disclaimer=yes&Submit=Continue
[199] Environmental Protection Agency. WFD Article 5 Point Pressures. [Online] Available at: https://gis.epa.ie/GetData/Download
[200] Environmental Protection Agency, 2015. Extractive Industries Register. [Online] Available at: http://www.epa.ie/ei/#/register
[201] Environmental Protection Agency. Local Authority Waste Facility Register. [Online] Available at: http://facilityregister.nwcpo.ie/
[202] Environmental Protection Agency. Historic Landfill Application or Certificate of Authorisation. [Online] Available at: http://www.epa.ie/terminalfour/HLF/index.jsp?disclaimer=yes&Submit=Continue

- EPA IE and IPC Sites[203] [204]
- Urban Wastewater Treatment (UWWT) Plants[205] [206]
- WFD: Article 5 Mine[199]
- WFD: Article 5 Wastewater Treatment Plants (WWTP)[199]
- WFD: Article 5 Water Treatment Plants (WTP)[199]
- WFD: Article 5 Section 4 Discharge Points[199]
- WFD Section 4 Discharge Points[207]
- OPALS Viewer – Mineral Exploration and Mining[208]
- List and locations of licenced landfills, waste permitted sites, historic and active pits and quarries from Leitrim and Roscommon County Councils
- EPA Historic Mine Locations[209]
- WFD Article 5: Quarry[199]

Other Sources of Information

- N4 Carrick-on-Shannon to Dromod PSSR, written by Arup[168]
- Information provided by Leitrim County Council on surveys to inform a previous road scheme through the study area in the early 2010s

Historical Ground Investigation Reports

- Carrick-on-Shannon Bypass Ground Investigation Report No. 7435, IGSL 2001[210]
- N4 Carrick-on-Shannon Bypass Geotechnical Ground Investigation Factual Report No. PC6044, Priority Geotechnical Limited 2006[211]
- N4: Carrick-on-Shannon to Dromod Preliminary Ground Investigation – Contract 1 Factual Report No. PC9081 Priority Geotechnical Limited 2010[212]

[203] Environmental Protection Agency, 2020. Industrial Emissions (IE) and Integrated Pollution Control (IPC) Facilities. [Online] Available at: https://gis.epa.ie/GetData/Download
[204] Environmental Protection Agency. IE / IPC Register. [Online] Available at http://www.epa.ie/terminalfour/ippc/index.jsp?disclaimer=yes&Submit=Continue
[205] Environmental Protection Agency. EPA Licensed UWWT Plants and 2018 Status. [Online] Available at: https://gis.epa.ie/GetData/Download
[206] Environmental Protection Agency. Waste Water Discharge Authorisation Search. [Online] Available at: http://www.epa.ie/terminalfour/wwda/wwda-search.jsp?countyName=Leitrim&Submit=Search+by+County
[207] Environmental Protection Agency, 2016. WFD Section 4 Discharges. [Online] Available at: https://gis.epa.ie/GetData/Download
[208] Department of the Environment, Climate and Communications, 2021. OPALS Viewer. [Online] Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=212642ca425f4739a36e247c64032b73
[209] Environmental Protection Agency. Historic Mines Project – Site Location. [Online] Available at: https://gis.epa.ie/GetData/Download [Accessed 01 August 2020]
[210] IGSL, 2001. Carrick-on-Shannon By Pass Ground Investigation Report No. 7435
[211] Priority Geotechnical Limited, 2006. N4 Carrick-on-Shannon Bypass Geotechnical Ground Investigation Factual Report No. PC6044
[212] Priority Geotechnical Limited, 2010. N4: Carrick-on-Shannon to Dromod Preliminary Ground Investigation – Contract 1 Factual Report No. PC9081

4.15.3 Existing Environment

This section describes the soils and geology constraints identified within the study area.

Constraints associated with geomorphology, soils and subsoil deposits, solid geology, landslide susceptibility, contaminated land, historic waste permit sites and existing licensed facilities, economic geology and geological heritage within the study area are described herein.

4.15.3.1 Overview

The study area is generally bounded by agricultural areas to the north, south, west and east. Kilronan Mountain and Slieve Anierin are located north of the study area near Lough Allen, the Curlew Mountains are located northwest of the study area near the town of Boyle and Slieve Bawn is located south of the study area. The River Shannon runs through the study area from the northwest corner to the southeast corner. There are many tributaries located both east and west that feed into the River Shannon. Along the rivers alignment there are numerous lakes, for example Eidin Lake which sits to the northwest of the study area on the river, Lough Corry to the south of Carrick-on-Shannon, Lough Tap and Drumgilra Lough which are located south of Drunsna. Lough Boderg, Lough Scannal and Lough Bofin are located along the river to the southeast of the study area.

The Jamestown Canal runs from east to west, just south of Jamestown.

The current alignment of the N4 runs west to east in the northwest of the study area, crosses the River Shannon west of Carrick-on-Shannon and then veers south, to the southeast of Carrick-on-Shannon. The Jamestown - Drumsna Bypass undertaken in 1996 and located to the southeast of Carrick-on-Shannon is a single lane carriageway located to the north of Jamestown and Drumsna. Further south, the Dromod-Roosky Bypass Scheme constructed in 2007 comprises a Type 2 Dual carriageway.

The main Dublin to Sligo railway line for the most part occupies the western side of the study area south of the River Shannon, crossing the Killukin River in the northwest and the Shannon west of Drumgilra Lough.

The primary land use within the study area is agricultural, with a number of areas of private managed forestry plantations. There are settlements within the study area, such as Carrick-on-Shannon, Cortober, Drumsna, Jamestown and Aghamore.

4.15.3.2 Topography

The regional topography and the surrounding landscape is dominated by mountains to the north of the study area surrounding Lough Allen with peaks greater than 580mOD. The Curlew Mountains (250mOD) are located west of the study area near Boyle and the Slieve Bawn mountain range (260mOD) is located south of the study area. On the lowlands, the topography is dominated by an undulating landscape with elevations ranging from 40mOD (along the River Shannon) to 90mOD (at the peaks of drumlins)[169]. There are extensive areas of flood plain along the banks of

the River Shannon which are relatively flat lying at less than 40mOD. The landscape of the study area predominately comprises a hummocky landscape with peaks of 90mOD and hollows between the peaks of less than 50mOD.

The alignment of the existing N4 passes through elevations ranging from 40mOD to 70mOD.[169]

4.15.3.3 Geomorphology

Geomorphology is the study of the landforms which comprise the earth's surface, the processes which have modified and shaped it in the past and which continue to modify and shape it at the present time.

Ireland has been most influenced by two epochs of glaciation, the Munsterian and Midlandian. The geomorphology presented within the study area is from the younger Midlandian glaciation. As the glaciers were retreating, they left behind glacial landforms and deposits known as Drumlins and Ribbed Moraines which occur frequently across the study area and are responsible for the undulating landscape. The swarm of Drumlins to the south of the River Shannon within the study area is known as the Irish southwestern most extreme of the 'Drumlin Belt'[175]. A more detailed description of glacial processes and landforms that are found within the study area is presented in the PSSR[168] in Appendix A.4.15.1.

4.15.3.4 Soil Deposits

The soil deposits are predominately a function of the underlying parent material subsoils as detailed in Table 4.15.2. The soil types are shown on Figures 4.15.1.0 to 4.15.1.5.

Areas of made ground are extensive around Carrick-on-Shannon and extend westward out along the R368 and R370 for approximately 1km and eastwards along the N4 for approximately 0.6km. These are shown on Figure 4.15.4.0 to 4.15.4.5 in addition to other areas of made ground which include:

- An area associated with a licensed landfill (Active licence number W0064-01) just north of Carrick-on-Shannon at Ballynamoney. This location was used for the disposal of domestic, commercial and industrial waste in addition to sewerage sludge between 1965 and 2005
- Near the intersection of the N4 and L3656 north of Jamestown, an area associated with a disused quarry (Kiltycarney Quarry), the nature of the material at this location is unknown
- At the location of the Rosderra Meats industrial facility near Jamestown, the nature of the material at this location is unknown
- At the intersection of the N4 and R299 near Drumsna, the nature of the material at this location is unknown
- At Drumsna, the nature of the material at this location is unknown

Typically Made Ground is comprised of variable materials of varying strengths and depths with a potential for contamination.

Large areas of alluvium deposits are recorded along the banks of the River Shannon and its associated tributaries. A large area of alluvium is also recorded intersecting the Dublin to Sligo railway line and the R370 approximately 1.5km west of the Carrick-on-Shannon Railway Station.[178]

Isolated pockets of lacustrine deposits exist throughout the study area adjacent to the tributaries of the River Shannon at the following locations:[178]

- Approximately 2.0km southwest of Carrick-on-Shannon
- Adjacent to Drumgilra Lough
- Adjacent to Lough Tap
- Approximately 1.7km north of Faulties

Two areas of blanket peat are recorded at the eastern end of the site, approximately 1.3km north of Faulties.[178]

Large areas of cutover/cutaway peat deposits exist throughout the study area, mainly in the hollows between the drumlin peaks.[178]

Three areas of fen peat are shown throughout the study area at the following locations:[178]

- Northwest of Carrick-on-Shannon
- Along the most easterly banks of Lough Corry
- Along the easterly bank of a smaller lough just south of Lough Corry

Though there are a large number of soil types throughout the study area, these can be summarised as follows:

- Made ground considered low importance for agriculture
- Well drained soils considered high importance for agriculture
- Poorly drained soils considered low importance for agriculture
- Alluvium considered medium importance for agriculture
- Peaty soils considered low importance for agriculture

Soils are also major components of ecosystems and a non-renewable resource. In accordance with the Environmental Impact Assessment Directive (2014/52/EU)[167], threats to soil functions such as organic matter, erosion, compaction and sealing from increased landtake needs to be limited and considered in the assessment of infrastructural projects.

The ranking of soils for agricultural purposes in this section is not the ranking system used for Material Assets – Agriculture.

Table 4.15.2 Summary of Soils within the Study Area (Teagasc Classification)[178] [179]

Soil Type	Teagasc Description[179]	EPA National Soils Description[178]
Made	Made ground	Made
AlluvMIN	Alluvial (mineral)	Mineral alluvium
Lac	Lacustrine type soils	Lacustrine
BktPt	Blanket peat	Blanket peat
Cut	Cutover / cutaway peat	Raised Bog cutaway / cutover
FenPt	Fen peat	Fen peat
AminDW	Deep well drained mineral (Mainly acidic)	Acid Brown Earths / Brown Podzolics
AminPD	Mineral poorly drained (Mainly acidic)	Surface water Gleys / Ground water Gleys Acidic
AminPDPT	Peaty poorly drained mineral (Mainly acidic)	Peaty Gleys Acidic
AminSP	Shallow poorly drained mineral (Mainly acidic)	Surface water Gleys / Ground water Gleys Shallow
AminSRPT	Shallow, rocky, peaty / non-peaty mineral complexes (Mainly acidic)	Podzols Peaty
BminDW	Deep well drained mineral (Mainly basic)	Grey-Brown Podzolics / Brown Earths Basic
BminPD	Mineral poorly drained (Mainly basic)	Surface water Gleys / Ground water Gleys Basic
BminPDPT	Peaty poorly drained mineral (Mainly basic)	Peaty Gleys Basic Parent Materials Basic
BminSP	Shallow poorly drained mineral (Mainly basic)	Surface water Gleys / Ground water Gleys Shallow
BminSRPT	Shallow, rocky, peaty / non-peaty mineral complexes (Mainly basic)	Lithosols Peats
BminSW	Shallow well drained mineral (Mainly Basic)	Renzinas / Lithosols

4.15.3.5 Subsoil Deposits

Subsoil deposits comprise the unconsolidated geological deposits which cover the solid geology and are shown on Figures 4.15.2.0 to 4.15.2.5. They are generally not considered an environmental constraint with the exception of soft ground and made ground due to the possible excavated material produced during road construction.

The subsoils mapping of the region indicate that the study area is dominated by glacial till derived from limestones. There are large areas of cutover raised peat and areas of alluvium. These are located along the alignment of the River Shannon and in the hollows between drumlin peaks. The remainder of the study area consists of made ground, blanket peat, fen peat, lacustrine sediments, till derived from Namurian sandstones and shales, bedrock outcrop or subcrops. The subsoil types

as classified by the GSI Quaternary mapping within the study area are listed in Table 4.15.3 below. Detail descriptions of the subsoil deposits are presented in the PSSR[168] in Appendix A.4.15.1.

The thickness of subsoil deposits is variable throughout the study area, with thinner subsoils in areas of shallow bedrock, including towards the northwest and southeast of the study area. Karstified bedrock outcrops are present at the western end and north of Carrick-on-Shannon.[180]

Large areas of alluvium deposits are evident in many areas surrounding the River Shannon, with isolated pockets associated with the tributary streams such as the Killukin and Knockananima Rivers along the alignment of the Jamestown Canal, particularly south of Carrick-on-Shannon.[180]

A large number of extensive peat deposits (blanket peat and cutover raised peat) are located across the study area, along the alignment of the River Shannon and in the hollows between the drumlin peaks.[180]

Three fen peat deposit areas are present within the study area, the first is just northwest of Carrick-on-Shannon, one located on the most easterly banks of Lough Corry, and one located on the banks of a smaller lough just south of Lough Corry.[180] A fen is a wetland system with a high water level at, or just below, its surface. They are characterised by their distinct water chemistry which is mineral rich and differs from bogs which are acidic and low in minerals. Fens developed after the last glaciation in depressions occupied by shallow lakes. The soils in fens comprise normally consolidated highly organic soils that are extremely compressible.

Four areas are shown as comprising lacustrine sediments, the first two are on the southern bank of Drumgilra Lough, one on the eastern bank of Lough Tap and the fourth approximately 1.7km north of Faulties. A number of areas comprising lacustrine sediments are also shown to be sitting just outside of the study area to the west and east.[180]

One small area of made ground is shown within the Drumgilra Lough.[180]

Typically, made ground is comprised of variable materials of varying strengths and depths. It has the potential also to be contaminated.

Table 4.15.3 Summary of Subsoils (GSI Quaternary) within the Study Area[180]

Soil Type	Description
Fill	Made Ground
A	Alluvium
L	Lacustrine sediments
BktPt	Blanket peat
Cut	Cut over raised peat
FenPt	Fen peat
TLs	Till derived from limestones
TNSSs	Till derived from Namurian sandstones and shales
KaRck	Karstified bedrock outcrop or subcrop

Soil Type	Description
Rck	Bedrock outcrop or subcrop

4.15.3.6 Bedrock Geology

The rock formations encountered in the study area are detailed in Table 4.15.4 and shown on Figures 4.15.3.0 to 4.15.3.5.

The bedrock geology of the study area is dominated by 330 million years old Lower Carboniferous Limestones of the Oakport, Croghan, Ballymore, Bricklieve Formations. Much older Ordovician rocks from the Finnalaghta and Aghamore formations are exposed at the surface in the Slieve Bawn mountains to the south of the study area. These are remnants of a former ocean floor that have been lifted up on the east side of the Strokestown Fault that trends northeast to southwest through the study area.[177]

There are other faults also trending northeast to southwest within the study area, one separating the Oakport and Ballymore Formation in the northwest and another separating the Bricklieve and Croghan Formations. There is a parallel northeast to southwest fault to the east of the Strokestown Fault. There are two northwest to southeast trending faults to the north and south of the Aghamore Formation across the eastern end of the study area.[177]

Detail descriptions of bedrock lithologies are presented in the PSSR[168] in Appendix A.4.15.1.

The older Ordovician meta sediments and volcanistic breccias to the southeastern end of the study area are possibly a harder rock type than the adjacent limestones mostly due to how they were formed. The chemical make-up of these formations increases the acid sulphate rock potential which could be significant if reusing this material as engineering fill.

Table 4.15.4 Summary of Bedrock Geology within the Study Area [177]

Geological Period	Formation	Description
Carboniferous	Mudbank Limestone	Mudbank Limestone.
Carboniferous	Bricklieve Limestone Formation	Lithological Summary: Bioclastic cherty limestone. The formation comprises 6 informal groups, which consist of medium to thickly bedded grey bioclastic limestones, generally wackestones and packstones devoid of internal bedding features. The groups are separated by lithostrotionid-rich intervals.

Geological Period	Formation	Description
Carboniferous	Ballymore Limestone Formation	Lithological Summary: Black calcarenites and shales. A basal unit of medium bedded crinoidal calcarenites, followed by a middle unit 40m thick of thin bedded dark nodular limestones with thick interbeds of calcareous shale. A small carbonate mudbank occurs within the middle unit.
Carboniferous	Croghan Limestone Formation	Lithological Summary: Muddy limestone and calcarenites. The lowest member comprises 40m of thin-bedded brown-weathering muddy limestone with irregular development of shale partings. The middle member is a distinctive 15m massive even-bedded crinoidal, occasionally oolitic, calcarenite.
Carboniferous	Oakport Limestone Formation	Lithological Summary: Dark crinoidal calcarenites and shales. A basal member, 27m thick, of clean fine calcarenite contains occasional coarse crinoidal beds and argillaceous wackestones. It is overlain by a distinctive unit dominated by fine peloidal calcilutites and laminated calcilutites.
Carboniferous	Fearnaght Formation	Lithological Summary: Cream conglomerate and red sandstone. It is composed of cream coloured quartz-pebble conglomerate with a sandy matrix, subarkose and red and purple micaceus flaggy sandstones and purple and brown quartzites.
Ordovician	Aghamore Formation	Lithological Summary: Lava and volcaniclastic breccia. Principally spilitic lavas and volcaniclastic conglomerate, with only relatively minor amounts of interflow sediments. These include greywacke, and chert and shale, which are most abundant in the southern parts.

Geological Period	Formation	Description
Ordovician	Finnalaghta Formation	Lithological Summary: Blue-grey greywackle & black argillite. Almost entirely consists of bluish-grey, non-calcareous greywacke, which is composed of quartz, felisic igneous and micaschist detritus. Black argillites, 1m to 15m thick, also occur.

A review of the GSI Bedrock Outcrop, GSI Quaternary map and GSI Groundwater Vulnerability map was completed, locations of bedrock outcrops and subcrops provide an indication of areas with a greater potential of shallow bedrock.[177] [181] [196]

The following areas have been identified as having a greater potential to shallow bedrock:

- Across the western end of the study area
- South of Carrick-on-Shannon
- North of Carrick-on-Shannon
- North of Jamestown
- South of Jamestown and the River Shannon
- Large areas across the eastern portion of the study area east of Drumgilra Lough

4.15.3.7 Karst Features

The GSI Karst database was consulted to determine if the Carboniferous limestone formations within the study area are karstic and contain karst solution features. There is one recorded feature within the study area in the Croghan Limestone formation; the Toberconellan spring located approximately 2.0km south of Carrick-on-Shannon, south of the railway station.

There are a significant number of karst features (including springs, enclosed depressions, turloughs and swallow holes) surrounding the study area (some of these features are approximately 500m offset from the study area boundary) recorded to the south and west of Carrick-on-Shannon within the Oakport Limestone, Ballymore Limestone and Croghan Limestone formations.[182]

This indicates that these lithologies could be susceptible to karstification and karst features could exist within the study area. The karst features have either not been mapped or the limestone is locally less susceptible to karstification. This could be due to a lower calcium carbonate content, or it is overlain by subsoils which impede karstification or have infilled karst features. It is also notable that there is a relatively high density of small streams, tributaries to the River Shannon, in the study area which in places flow through areas mapped where rock is close to surface. This relatively high drainage density (length of river channels per unit area)

is not expected in karst aquifers where drainage is predominately underground and again may suggest that the bedrock is less susceptible to karstification in the study area. Further detail on the karst features is presented in Section 4.14 Hydrogeology.

4.15.3.8 Landslide Susceptibility

The GSI has developed a landslide susceptibility map for the entire area of the Republic of Ireland.[184]

Generally, landslide susceptibility is correlated to the topography, so the areas with higher landslide susceptibility are in the higher, steeper elevations, coastal cliffs and valley sides. The majority of the study area has a low landslide susceptibility with localised areas having a moderately low to moderately high susceptibility. These locations are recorded mainly in areas of peat and along the banks of the River Shannon. One significant area with a moderately high susceptibility rating is located along the R368 south of Carrick-on-Shannon in the town land of Killukin. This appears to be located on the eastern side of a drumlin in glacial till and shallow bedrock. There are no recorded landslides by the GSI within the study area.[183]

4.15.3.9 Soft Ground and Compressible Soils

The extent of soft soil deposits is a key constraint within the study area, soft ground areas recorded on the GSI Quaternary map are shown on Figures 4.15.4.0 to 4.15.4.5. The deposits are so widespread that any potential option will impact these deposits. Typically, these subsoils will be excavated and replaced with suitable engineering fill or undergo ground improvement. The excavated soft soils may require a repository within the study area. In areas of cut, landtake in soft soils could be significant. It should be noted that the organic content of the peat deposits will significantly impact the CO_2 rating for potential options in the study area. Refer to Section 4.15.3.5 for further details on locations of the soft soil deposits across the study area.

A request has been made to Leitrim and Roscommon County Councils for details and locations of any engineering problems and instabilities associated with soft ground throughout the study area. The following have been reported:

- **Embankment Failure at Corbally:** a localised section of the Jamestown Drumsna Bypass embankment failed near the townland of Corbally. The cause was deemed to be failure of the soft soils (approximately 3.0m deep) under the existing embankment during remedial works to widen the road.

The following significant area of soft ground has been reported:

- **N4 Piled Embankment:** Piled embankment constructed in 2001/2002 as part of the Jamestown to Drumsna Bypass, north of Drumgilra Lough across a 300m long section of soft ground, soft ground depths up to 8mbgl.

Soft organic soils such as peat and alluvium are highly compressible and subject to instability and significant long-term settlement if not engineered properly.

4.15.3.10 Contaminated Sites and Unsuitable Material

Potential sources of contamination within the study area have been investigated and identified into the following four categories as described in the following sections:

- Landfills (licensed and historical)
- Pits, quarries and mines (historical)
- Industrial facilities (licensed and historical)
- Historical land use contamination

Publicly available records from both online and within Leitrim and Roscommon County Councils have been consulted to determine the type and location of sites that are possibly contaminated or possibly store unsuitable material. It is possible there are such facilities that are not officially recorded and therefore these are not shown on Figures 4.15.4.0 to 4.15.4.5.

4.15.3.11 Landfills

In 1996 the EPA began licensing certain activities in the waste sector. These include landfills, transfer stations, hazardous waste disposal and other significant waste disposal and recovery activities. These are potential geological constraints as they may act as areas of contamination.

There is one EPA licensed waste facility[197] [198] (and Water Framework Directive Article 5 Landfill[199]) recorded within the study area as shown on Figures 4.15.4.0 to 4.15.4.5, this facility has the following details:

- Carrick-on-Shannon Landfill, Ballynamoney – Active Licence Number W0064, operations ceased in 2005. Operated as a waste disposal facility for domestic, commercial and industrial waste in addition to sewerage sludge between 1965 and 2005.

According to the EPA there is no known historical (or 'legacy') landfills within the study area.[202]

According to the EPA there are no Waste Facility Permits or Certificates of Registration within the study area.[201]

Leitrim and Roscommon County Councils have been consulted for their records of landfills and waste related sites. The following areas of potential fill have been identified from information provided by Leitrim County Council on surveys undertaken to inform a previous road scheme through the study area in the early 2010s and are shown on Figures 4.15.4.0 to 4.15.4.5:

1. To the south of the Ballynamoney Landfill is an area of made ground or fill material. This site was identified as three old waste permit facilities which have since been filled in. These sites have been reported in earlier reports as comprising a mixture of clay, gravel and peat.
2. A waste permit site is located near the R280, north of Carrick-on-Shannon. This site is surrounded by heavily developed residential areas while this site remains undeveloped. The nature of the material at this site is unknown.

3. Close to Carrick-on-Shannon, west of the R280 is an old waste permit site, this site is situated to the rear of some older houses with large gardens and therefore remains somewhat undeveloped. The nature of the material at this site is unknown.
4. St. Mary's GAA sports grounds were once registered as an old permit site and therefore as an alternative land use this site has been developed as a sports facility. The nature of the material at this site is unknown.
5. A waste permit site just west of Carrick-on-Shannon in the Drishoge Townland, operator unknown. The nature of the material at this site is unknown.
6. Three old permit sites were identified in the Roscommon area in the Cloongownagh Townland along the existing N4, approximately 2.5km west of Carrick-on-Shannon. These are thought to have been used for the recovery and disposal of material as part of the N4 realignment.
7. Three sites south of Carrick-on-Shannon station which has been reported as being used for the importing of natural subsoil to raise the level of the agricultural land.
8. A large waste site is located close to Finnalaghta with an area of 26,690m^2; this site is located parallel to the existing N4. The nature of the material at this site is unknown.
9. Jon's Civil Engineering Company who was the main Contractor on the Dromod-Roosky Bypass which was constructed in 2006/2007 has two registered waste sites in this area, a small site close to the road and a larger site near Fearnaght with an area of 15,421m^2. It is possible that these areas were used as borrow pits for earthworks on the Dromod-Roosky Bypass and subsequently for disposal of unsuitable soft soils that were excavated and replaced along this section of new road. The 2009 ground investigation completed by Priority Geotechnical Ltd reported a mixture of peat, clay, silt, sand and sandstone, siltstone and limestone gravel.

4.15.3.12 Historical Pits, Quarries and Mines

Historical pits and quarries are potential sources of ground contamination or unsuitable material as the nature of backfill material is generally highly variable and unregulated. According to the GSI records there are 39 historical pits and quarries within the study area.[186]

The Department of the Environment, Climate and Communications show no historic mines within the study area.[208]

The EPA records show there are no known WFD Article 5 Mines within the study area.[199]

According to the EPA there are no historic mines within the study area.[199] [209]

From the review of the OSI 6 Inch 1837 to 1843 historic mapping there are two iron mines shown south of Aghamore at the eastern end of the study area, these two sites are not shown the OSI 25 Inch 1888 to 1913 historic mapping.[172] The location of

these two sites are currently listed as mineral locations (Mineral Location Reference 1736 and 1737) within the GSI Mineral Localities dataset.[187]

Leitrim and Roscommon County Councils have been consulted for their records of historic pits, quarries and mines within the study area. The following site has been reported within the study area:

- Kiltycarney Quarry (Quarry currently not endorsed by the local County Council), was authorised for activity during the construction of the Jamestown – Drumsna Bypass. A condition of the permission given was that the quarry is rehabilitated within six months of completion of the scheme. This did not occur and therefore this quarry is unauthorised and at present it is not active.

The known historic quarries, pits and mines to the Local Authorities, the GSI and the EPA records are shown on Figures 4.15.4.0 to 4.15.4.5.

4.15.3.13 Industrial Facilities

Existing and historic industrial sites may potentially be a source of local contamination and/or restrictions due to site activities or licence controls. However, these sites operate within the EPA Industrial Emissions (IE) and Integrated Pollution Control (IPC) licence framework and due to the regulated nature of their activities, the risk of contamination is low. A request has been made to Leitrim and Roscommon County Councils for information pertaining to industrial facilities within the study area. The IE/IPC licenced sites listed in Table 4.15.5 and shown on Figures 4.15.4.0 to 4.15.4.5 have been reported within the study area.[203] [204]

Table 4.15.5 IE/IPC Licenced Industrial Facilities [203] [204]

RegCD	Name	Licence Status	Licence Type	Address
P0641-01	Irish Rubber Components Limited	Surrendered	IE	Tullyleague, Carrick-on-Shannon Roscommon
P0021-02	Masonite Ireland	Licenced	IPC	Derryoughter, Drumsna, Carrick-on-Shannon, Leitrim

Similarly, sites which have been granted a wastewater discharge licence may be a source of contamination or developmental restrictions. There are a number of wastewater discharge sites listed by Irish Water and the EPA within the study area, summarised in Table 4.15.6.

Table 4.15.6 Urban Wastewater Treatment Plant locations (UWWTP) with a Wastewater Discharge Licence Recorded by Irish Water and the EPA within the Study Area [205] [206]

Irish Water Reg No.	Name	Authorisation Type	Agglomeration Name	Licence Status
D0154-01	Irish Water	Licence	Carrick-on-Shannon	Licenced
A0465-01	Irish Water	Certificate	Jamestown	Certified
A0467-01	Irish Water	Certificate	Drumsna	Certified

There are two WFD Section 4 discharge points within the study area, these are summarised in Table 4.15.7.

Table 4.15.7 WFD Section 4 Discharge Points within the Study Area [207] [199]

Registration Number	Status	Name	Location
WP 1-11A	Unknown	Jones Oil Ltd	Carrick-on-Shannon
WPL/11/02	Unknown	Rosderra Meats	Leitrim

4.15.3.14 Historic land use contamination

Land contamination is related to site history and previous land use which can leave contaminants in the ground depending on historic site activities. The extent of soil contamination from historic land uses are typically localised. The NRA guidelines[166] do not define specifically what is a heavy or light industry. The following categories are recommended.

Heavy Industries include

Medium to large scale industries, such as power stations, gas works, wastewater treatment plants, other municipal facilities, etc.

According to the review of the OSI 1830's and 1890's historic mapping and the EPA records, the following medium to large-scale industries are located within the study area and presented on Figures 4.15.4.1 to 4.15.4.5:[172]

- One historic gas works site located on the western side of Carrick-on-Shannon near the Carrick-on-Shannon railway station (E:593042, N: 798676)
- One historic power station labelled as "Electric Light Works & Pumping Station" on the 25 Inch 1888-1913 historic map, located within Carrick-on-Shannon (E:593734, N: 800030)

Industries that involve significant amounts of harmful chemicals or metals such as dry cleaning, soap works, smithy, foundry, lime kilns etc.

According to the review of the OSI 1830's and 1890's historic mapping the following are located within the study area and are presented on Figures 4.15.4.0 to 4.15.4.5:[172]

- Three historic corn mills; one south of Carrick-on-Shannon (E:592907, N:797726), one north of Carrick-on-Shannon and the other east of the River Shannon adjacent to the R201 (E: 602404, N:796798)
- Two historic rail station sites; one on the western side of Carrick-on-Shannon called Carrick-on-Shannon Station (E:592993, N: 798776); and the other south of Jamestown called Drumsna Station (E: 598800, N: 795684)

Light Industries include

According to the OSI 1830's, 1890's and Cassini historic mapping the following light industries exist across the study area but are not included on Figures 4.15.4.0 to 4.15.4.5[172]:

- One historic Flour Mill in the town of Jamestown
- One historic corn store in the town of Drumsna
- Two historic corn kilns:
  - One in the townland of Corry
  - One on the western side of Lough Tap
- Four Historic water pumps:
  - Two in Carrick-on-Shannon
  - One in Jamestown
  - One approximately 600m east of Drumgilra Lough
- The Carrick-on-Shannon Water Works site located next to St Patricks Community Hospital in Carrick-on-Shannon
- One Historic pumping station adjacent to the South Leitrim Regional Water Treatment Plant in Carrick-on-Shannon

4.15.3.15 Economic Geology

The economic geological features within the study area have been subdivided into the following categories:

- Crushed rock aggregate potential
- Granular aggregate potential
- Active pits, mines and quarries
- Mineral resource locations
- Areas containing deep, well drained soils suitable for agriculture as detailed in Section 4.15.3.4

4.15.3.16 Crushed Rock Aggregate Potential

GSI carried out national crushed rock aggregate potential mapping between 2007 and 2013.[189] The maps are compiled based on the lithology, as well as existing and historic quarry activity. The final scores have five bands ranging from very low potential (blue) to very high potential (red) and have been applied to the entire area

of the Republic of Ireland. The portion of the study area north and east of the River Shannon ranges between moderately to very high potential with some pockets of low potential. The portion of the study area south of the River Shannon typically has a low potential with some large areas of moderately to high potential.

4.15.3.17 Granular Aggregate Potential

The GSI Granular Aggregate Potential Mapping categorises granular deposits in terms of aggregate resource into five levels, from very high potential to very low potential.[188] The study area has portions with very low to high potential. There are several zones of granular aggregate potential within the study area. The moderate to high potential granular aggregate deposits are located in the alluvial deposits along the alignment of the River Shannon and its tributaries as shown on Figures 4.15.4.0 to 4.15.4.5.

4.15.3.18 Active Pits, Mines and Quarries

The GSI 2014 Quarry Directory was consulted.[185] There are no recorded active pits, mines or quarries within the study area.

The Department of the Environment, Climate and Communications show no active mines within the study area.[208]

Leitrim and Roscommon County Councils have been consulted for their records of active pits, quarries and mines within the study area. The following areas of potential active pits, quarries and mines have been reported as being within the study area:

- Finnalaghta Quarry (not endorsed by the local County Council) situated to the east of the River Shannon, according to the GSI database, this was once a disused sandstone quarry. Presently it is a registered quarry, register number QS0226, EPA register details are presented in Table 4.15.8.

The EPA Extractive Industries Register (2015) was consulted.[200] There is one recorded active quarry within the study area, details are provided in Table 4.15.8. The EPA Extractive Industries Register did not distinguish what the quarry is used for, i.e. sand/gravel or rock.

Table 4.15.8 EPA 2015 Registered Quarry Locations within the study area [200]

Register Number	Name	Site Address
QS0226	Ballyfeeney Rock Ltd.	Aghamore, Carrick-on-Shannon, Co. Leitrim

The active and inactive pits and quarries known to the Local Authorities and according to the GSI and EPA records are shown on Figures 4.15.4.0 to 4.15.4.5.

4.15.3.19 Mineral Resource Locations

The location of mineral resources is shown on Figures 4.15.4.0 to 4.15.4.5. There are ten licences held for prospecting within the study area.[208]

Six of these are 'Open – Exploration Incentives' as follows:

- Prospecting Licence 2769
- Prospecting Licence 2766
- Prospecting Licence 4462
- Prospecting Licence 4463
- Prospecting Licence 1668
- Prospecting Licence 2705

Four are 'Open' as follows:

- Prospecting Licence 3585
- Prospecting Licence 3888
- Prospecting Licence 3889
- Prospecting Licence 3686

There are a number of mineral resource locations within the study area according to the GSI Mineral Localities database[187], these are summarised in Table 4.15.9 below.

Table 4.15.9 Summary of Mineral Localities (GSI) within the Study Area [187]

Mineral location reference	Key mineral	Townland
5054	Limestone	Hughestown
2589	Ironstone	Dergvone
4821	Fluorspar and pyrite	Tully
4822	Fluorspar and pyrite	Tully
4820	Fluorspar	Carrick
1736	Haematite	Gortinee
1737	Haematite	Gortinee
1734	Greywacke	Finnalaghta
1735	Sandstone	Fearnaghta

4.15.3.20 Geological Heritage

A database of geological heritage sites is maintained by the GSI in partnership with the National Parks and Wildlife Service (NPWS).[190] [191] There are no geological sites of national importance within the study area.

There is one County Geological Site (CGS) and two unaudited sites within the study area. The GSI was consulted on whether there are any imminent changes to the geological heritage sites database for County Leitrim and County Roscommon. There are no imminent changes for County Roscommon. It was noted by the GSI that County Leitrim is an 'unaudited' county and is currently being audited with

more information becoming available over the coming months. The three sites are detailed in Table 4.15.10 and are shown on Figures 4.15.4.0 to 4.15.4.5.

CGS do not receive statutory protection like Natural Heritage Areas (NHA) but receive an effective protection from their consideration in the planning system. However, GSI consider many of the County Geological Sites to be of national importance as they are the best representative example of particular geological formations or features. They will be formally proposed by the GSI, for designation as NHAs by the National Parks and Wildlife Service after due survey and consultation with landowners.

Table 4.15.10 Geological Heritage Sites [190] [191]

Site name	Site code	Designation	Characteristics
Mid Roscommon Ribbed Moraines	RO022	CGS	This field of ribbed moraine forms part of a small, discrete field northwest of Slieve Bawn.
Gortinee	-	CGS (Unaudited)	Iron ore in tholeiitic volcanics, Mined as early as the 16thC; smelted at Dromod and Arigna.
Finnalaghta Quarry	-	CGS (Unaudited), may be recommended for NHA	Lower Palaezoic D1 structure, termed “transected monocline”.

4.15.4 Summary

4.15.4.1 Geological Constraints

The soils and geological features that represent constraints within the study area have been identified in this constraints study and are summarised in Table 4.15.11.

Table 4.15.11 Summary of Geological Constraints and Importance

Category	Name	Relevant Characteristics / Key Constraints	Importance
Geomorphology	Drumlins	Glacial till / sands and gravel, possible shallow bedrock (roche moutonnée) potential for variable reusability. Irregular topography.	High
	Ribbed Moraine	Glacial till / sands and gravel, potential for variable reusability. Irregular topography.	High
	The River Shannon, lakes and other surface water features	Associated soft ground, possible requirements to excavate. Need to locate a suitable repository within the study area.	High
Soils	Well Drained Soils	Importance for agriculture.	High
	Alluvium	Importance for agriculture.	Medium
	Lacustrine Deposits	Importance for agriculture.	Medium
	All	Limiting impact on soil ecosystem in accordance with EIA Directive (2014/52/EU).	High
Subsoils	Alluvium, Blanket Peat, Fen Raised Peat, Lacustrine Deposits	Soft compressible ground, possible requirements to excavate and deposit in a repository within the study area. Land take in areas of cut through soft ground could be significant. The CO2 emissions for any route chosen within the study area with the excavation of organic peat would need to be considered.	High
	Made Ground	Variable ground both consistency and content. This material will possibly need to be excavated and could potentially be contaminated.	High
Bedrock Geology	Limestone Formations	Potential for karst features and associated voids, potential to cause collapse of ground.	Low

Category	Name	Relevant Characteristics / Key Constraints	Importance
		Potential for irregular bedrock topography due to karst weathering and faulting which could adversely affect piled foundations for structures. A number of springs noted outside the study area to the northwest.	
	Volcanic Formations	Acid sulphate rock potential and variable rock strength.	Low to medium
	Bedrock Outcrops	Potential for shallow bedrock.	High
Landslide Susceptibility and Compressible Soil	Recorded Landslides	No recorded landslides in the GSI landslide database. Some localised areas have a moderately low to moderately high susceptibility.	Low
	Compressible Soils associated with River Shannon, lakes and areas of peat	Soft ground susceptible to instability during construction and significant long-term settlement. Embankment failure noted along the Jamestown to Drumsna Bypass at Corbally.	High
Contamination and Unsuitable Material	Landfills	Soft ground, variable material requirement to excavate, potentially contaminated. Important resource for the disposal of material.	High
	Historic Pits and Quarries	Soft ground, variable material requirement to excavate, potentially contaminated.	High
	Industrial Facilities	IPC Licenced Facilities. Potentially contaminated.	Low
	Wastewater Discharge Points	Potentially contaminated.	Low
	Historic Land Use Contamination	Contamination and variable material requirement to excavate from historic gas works, power station, mills, rail tram sites, gravel pit, quarries.	High
Economic Geology	Existing Pits and Quarries	Stability of quarry faces. Potential source of aggregate, licensed facility.	High
	Crushed Rock Aggregate Potential	The portion of the study area east of the River Shannon has a moderately to very high potential for crushed rock. The portion of the study area west of the River Shannon has a low potential with areas of moderately to high potential.	High

Category	Name	Relevant Characteristics / Key Constraints	Importance
	Granular Aggregate Potential	The granular aggregate potential varies from very low to high.	High
	Potential Mineral Resources	A number of prospecting licences are held within the study area with limited associated reports.	High
Geological Heritage	Mid Roscommon Ribbed Moraines	County Geological Site.	High
	Gortinee	IGH 15 Economic Geology.	High
	Finnalaghta Quarry	IGH 4 Cambrian – Silurian. (recommended for NHA status)	High

4.16 External Parameters

4.16.1 Introduction

In addition to the identification of natural and artificial constraints, various external parameters which may impact on the development of feasible alternatives and options must also be considered as part of the Constraints Study. These external parameters are covered in the following sections:

- Section 4.16.2 Funding and Scope
- Section 4.16.3 Construction Phasing
- Section 4.16.4 Key Performance Indicators
- Section 4.16.5 Technical Standards
- Section 4.16.5.5 Access Control
- Section 4.16.6 Policy Documents
- Section 4.16.7 Procedural and Legal Requirements

A summary is presented in Section 4.16.7.

4.16.2 Funding and Scope

Under the Roads Acts 1993 to 2007[213], Transport Infrastructure Ireland (TII) in conjunction with the Local Authorities are responsible for the planning, design and implementation of national roads projects. The N4 at Carrick-on-Shannon has been identified within the National Development Plan (2018 – 2027)[214] as a section of the national road network to be progressed through pre-appraisal and early planning during 2018.

As funding is subject to change, TII continuously monitor their commitments to on-going projects. The decision to proceed with the various phases of a scheme relies on the funding being made available by central government.

Leitrim County Council, on behalf of itself and on behalf Roscommon County Council, under an agreement made pursuant to Section 85 of the Local Government Act 2001, are developing a solution to the existing transportation issues along the N4 corridor between Faulties and Drumharlow. Funding has been provided to take the project through Phases 1 to 4 of the TII Project Management Guidelines (PMG)1. This includes:

- Phase 1 - Scheme Concept and Feasibility

[213] Government of Ireland, Law Reform Commission, 2016. Roads Act 1993 REVISED Updated to 8 March 2016. Available at: https://www.lawreform.ie/_fileupload/RevisedActs/WithAnnotations/HTML/EN_ACT_1993_0014.htm
[214] Government of Ireland, Department of Public Expenditure and Reform, 2018. National Development Plan 2018-2027. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null

- Phase 2 - Option Selection
- Phase 3 - Design and Environmental Evaluation
- Phase 4 - Statutory Processes

4.16.3 Construction Phasing

Construction phasing and sequencing is a key concern with any construction project. Successful site management minimises the length of time for which land disturbing activities are undertaken; essentially one part of the site is graded and completed before construction commences on other parts of the site. As well as planning and scheduling benefits, construction sequencing seeks to minimise the environmental impacts to an area, such as excess sedimentation.

Construction phasing becomes more critical at the interfaces with existing infrastructure (e.g. the railway line) and large natural features (e.g. River Shannon). At these locations, sequencing of work would also seek to minimise delay and impact on existing road users throughout the construction of the project. As the study area contains an urban area (i.e. Carrick-on-Shannon), the potential to affect a significant number of people increases the closer an option is to existing communities. Construction phasing then becomes key in seeking to reduce the amount of delay and nuisance caused to the public and also getting the project completed in a reasonable amount of time.

More precise details of exact construction sequencing will be developed during Phase 3 - Design and Environmental Evaluation of the project. Potential impacts due to any interim construction phasing arrangement will be assessed as part of the Environmental Impact Assessment Report which will be prepared during Phase 3 of the project.

4.16.4 Key Performance Indicators

Traditionally, the Level of Service concept was used to determine the quality of a roads project. Level of service is a quality measure describing operational conditions within a traffic system whereby it aims to understand the actual capacity of a road lane and relates this to a “Level of Service”. However, this measure was developed with the private motor car in mind and with the primary concern of keeping traffic congestion to a minimum.

More recently, the performance of a roads project has evolved to include all road users including pedestrians, cyclists and public transport users. Levels of Service relating to pedestrians and cyclists include wait time at junctions and actual route lengths in comparison to desire lines. The Level of Service of a public transport system includes wait time, frequency of available services, ease of interchange between different modes, access locations and journey comfort. Many of the specific objectives of the project such as reduced delay, improved journey time reliability and a reduction in collision frequency and severity, will ultimately be achieved if existing Levels of Service can be enhanced for all transport users.

In order to determine the Level of Service of the project, Key Performance Indicators (KPI) were identified, and the performance of each alternative and option

will be assessed against these individual KPIs to ensure that the project objectives are delivered.

4.16.5 Technical Standards

4.16.5.1 Roads

Any new national roads, associated link and connector roads and merge/diverge slip roads will be designed in accordance with the with the TII Publications.

Public streets and urban roads will be designed in accordance with the Department of Transport's Design Manual for Urban Roads and Streets (DMURS). Pedestrian facilities also comply with the guidelines outlined in DMURS.

Internal road networks of residential housing estates will be designed in accordance with "Recommendations for Site Development Works for Housing Areas" by the Department of the Environment and Local Government.

4.16.5.2 Cycle and Pedestrian Routes

Cyclist facilities will consider the recommendations outlined in the National Transport Authority, National Cycling Manual 2011, DMURS and the TII standards.

4.16.5.3 Drainage

The following will be designed in accordance with the requirements of the relevant TII publications:

- Runoff generated from any new road development
- Upgrades to the existing infrastructure
- Runoff from catchments which are impacted on by a new road development
- Upgrade to the existing infrastructure

Any public foul sewers impacted on by the works, will be designed in accordance with BS EN 752 "Drain and Sewer Systems Outside Buildings - Sewer System Management" and the Department of the Environment and Local Government "Recommendations for Site Development Works for Housing Areas" and will comply with any particular drainage requirements outlined by the relevant Local Authority as appropriate to the sewer in question.

Public surface water sewers will be designed in accordance with national best practice for drainage Works i.e. Greater Dublin Strategic Drainage Study Regional Drainage Policy Volume 2 – New Development (GDSDS-RDP Volume 2) and will comply with any particular drainage requirements outlined by the relevant Local Authority as appropriate to the sewer in question.

Works involving alteration to significant rivers or streams will be subject to Section 50 approval under the Office of Public Works Arterial Drainage Act 1945.

4.16.5.4 Structures

The design of structures will be carried out in accordance with the TII Publications and the relevant Eurocodes. Loading will be applied in accordance with EN 1991-2: Eurocode 1 - Actions on Structures – Part 2: Traffic loads on bridges and its associated National Annex.

4.16.5.5 Access Control

A controlled access road is a road which has been designed with unrestricted free flow of traffic on the mainline and access only provided at specific junctions. The extent of access control is also dependent on the final cross-section and ultimately could restrict access for learner drivers, vehicles under 50cc, slow moving vehicles (under 50km/h), invalid carriages, pedestrians, pedal cycles, and animals. In such a case, a safe alternative route for these road users must be provided.

While it is not anticipated that a motorway will be provided as part of this project, a road component of the transport solution may be designated as a protected road under the Roads Act 1993. A protected road approved by the Minister may restrict of all means of direct access to the protected road from or to specified lands. It can also restrict specific types and classes of vehicles, similar to those restricted on motorways. Again, a safe alternative route must be provided if a protected road is proposed as part of the Project.

4.16.6 Policy Documents

The national primary route N4, Dublin to Sligo is a strategic corridor from Dublin to the northwest and border counties and is approximately 198km in length. It is recognised as being of particular importance in enhancing accessibility to some of the most peripheral areas in the northwest (including Leitrim/Roscommon/Sligo and Donegal) and west of the River Shannon.

The N4 forms part of the EU TEN-T Comprehensive road network providing a strategic link between Dublin and Sligo, which was designated a regional centre in the 2018 National Development Plan and National Planning Framework. The N4 connects directly with the N5 and N6 national primary routes which also form part of the EU TEN-T Comprehensive road network.

In 2018, the Government published the Ireland National Development Plan 2018 – 2027 (NDP). The NDP sought to progress the strategic outcomes set out in the NPF and recognised the regional centre status of Sligo. In relation to the second National Strategic Outcome - Enhanced Regional Accessibility the NDP states:

"… the objective is to complete those linkages so that every region and all the major urban areas, particularly those in the North-West, which have been comparatively neglected until recently, are linked to Dublin by a high-quality road network.".

This project has been included in the TII National Roads Programme 2018 to 2027. A commitment to progressing the N4 Carrick-on-Shannon to Dromod *"through pre-appraisal and early planning during 2018 to prioritise projects which are*

proceeding to construction in the National Development Plan" is included in the NDP.

4.16.7 Procedural and Legal Requirements

The 2019 TII Project Management Guidelines (PE-PMG-02041)[1] outline a procedural framework for the phased approach to the development, management and delivery of Major National Road Schemes in Ireland. The guidelines set out the Project Phases and describe each of the Processes, Deliverables and Approvals required at each Phase throughout the development of a project so that it is delivered in accordance with the 2015 Roads Act.

Please note, the PMG are only a guide as to how National Road and Public Transport Capital Projects should progress. Deviations from the guide can be discussed and agreed with TII so to enact the most appropriate elements of the PMG for the project in question.

It is required that the detailed design shall comply with all relevant design standards.

It is a legal requirement that detailed design of the preferred transport solution shall be designed for safety in construction in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013.

It is a legal requirement to ensure compliance with the various environmental directives.

4.16.8 Summary

While there are various external parameters which are likely to constrain the project, the most notable are the legal constraints as the project must be deliverable within the bounds of the law.

region to support further economic and social development. Junction frequency reduction will improve safety and road network performance.

- Connectivity to the existing national and regional road network
- Serve existing travel demand which currently comprises both strategic and local
- Promote a mobility that is efficient and safe
- Provide junction layouts which are consistent and intuitive and remove or re-locate non-standard junction types
- Provide junctions which are safe for non-motorised users
- Ensure an overall junction and access provision which achieves the wider objectives of the project, including enhancing regional connectivity

5 Consideration of Alternatives and Options

5.1 Introduction

Multi Criteria Analysis (MCA) is a technique outlined in the Department of Transport, Tourism and Sports Common Appraisal Framework for Transport Projects and Programmes (CAF) as an appraisal tool to evaluate alternatives and options based on identified criteria and ranked on the basis of an aggregation procedure. The basis of the MCA for the N4 Carrick-on-Shannon to Dromod Project is an explicit set of objectives, namely the project objectives. MCA can be expressed in either qualitative or quantitative terms.

Once the problems that the project are seeking to solve have been identified and the project objectives are set, CAF states "*the need for an intervention should then be clearly set out and justified. If an intervention is appropriate, a number of options should be generated with a view to developing a range of alternative measures that look likely to achieve the specific objectives that the project is seeking to address. A Base Case must first be established and then options for investment should be identified and appraised in comparison to this. In line with the Public Spending Code, this requires the analyst to generate a range of realistic options so that benefits and costs can be compared relative to a scenario where very little or no change has taken place. A preliminary assessment of the costs and benefits should be undertaken of the options. The options are then sifted for the better performing options to be taken on to the detailed appraisal stage."*

"A minimum of four options (i.e. Do-Nothing or Do-Minimum and at least 3 Do-Something options) should be subject to appraisal at preliminary appraisal stage. Where fewer than four options have been considered the project appraisal report and Business Case should include a rationale for the approach taken."

The purpose of this chapter is to provide an overview of the methodology for the development and assessment of alternatives and options and to provide the detail of the initial sifting of the long list of alternatives and options to derive a range of alternatives and options that are likely to contribute to achieving the project objectives.

It should be noted that within the context of TII Project Appraisal Guidelines (PAG) Unit 4.0 (*Consideration of Alternatives and Options*)[1], an *alternative* refers to a specific transport mode (road, rail, bus, air etc.) or demand management proposal (fiscal, control, ITS measures etc.) which could address the need for an intervention. An *option* refers to a specific road based measure (road upgrade, new route, junction improvements etc.) that may be developed as part of the road alternative. Hereafter in this report, the term 'alternative' refers to the rail, bus, active travel or demand management proposals, whereas the term 'option' refers to the road based measures.

[1] Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 4.0 – Consideration of Alternatives and Options PE-PAG-02013. Available at: https://www.tiipublications.ie/library/PE-PAG-02013-01.pdf

5.2 Methodology for Alternatives and Options Development

5.2.1 Overview

As outlined in PAG Unit 4.0, the initial step focussed on drafting a long list of potential alternatives and options that may address the need for intervention. The development of potential alternatives and options took cognisance of the mapped key constraints whilst also seeking to optimise the opportunities identified, such as the trip attractors in the study area and the possibility of integrating with or providing for public transport and active modes. Alternatives and options on this initial list were then subjected to a sifting process which comprised a qualitative assessment against the stated project objectives to establish, at a fundamental level, if these would respond, in whole or in part, to the transportation problems identified on the corridor.

The conclusion of the sifting process is to advance a number of reasonable and feasible alternatives and options to the Options Selection Process. The Options Selection process is a three-stage process as outlined within TII PAG Unit: 4.0 namely:

- Stage 1 – Preliminary Options Assessment, develop a number of feasible options and carry out a Multi-Criteria Analysis (MCA) under the assessment criteria of Engineering, Environment and Economy. This will result in a refined number of options (minimum of four, Do-Nothing or Do-Minimum and a least three Do-Something Options).
- Stage 2 – Project Appraisal Matrix, carry out a full Cost Benefit Analysis (CBA) and MCA of the quantifiable and non-quantifiable impacts of these options (under the six CAF Criteria of Economy, Safety, Environment, Accessibility & Social Inclusion, Integration and Physical Activity).
- Stage 3 – Preferred Option after the completion of Stage 2, select a Preferred Option for the Scheme. Following this, prepare a Project Appraisal Balance Sheet (PABS) to summarise the impact of the Preferred Option.

The assessments for each of these three stages are described in detail in subsequent Chapters 6, 7, 8 and 9. The focus of this chapter is to detail the development of the alternatives and options which are subsequently subjected to these assessments.

5.2.2 Sifting Process

5.2.2.1 Alternatives Sifting Methodology

A range of Do-Something Alternatives were developed incrementally in accordance with the intervention hierarchy, as set out in the NIFTI policy, of prioritising active modes ahead of private car. Alternatives were identified and grouped under the headings of active travel, public transport measures and demand management measures. The alternatives generally can deliver on many of the project objectives in respect of climate resilience and sustainable development but may not be capable,

if considered in isolation, of solving the problems identified on the N4 corridor. Therefore, all the potential alternatives which were identified were advanced past this sifting exercise for consideration at Stage 1 Preliminary Assessment so that their merits can be established, and they then can be combined with other options to provide a holistic solution.

5.2.2.2 Options Sifting Methodology

Options which serve key trip attractors such as Carrick-on-Shannon/Cortober at the local level and the Dublin/Sligo strategic route at the national level were identified. These options may also provide opportunity for interchange with other transport modes or active travel modes as part of developing an integrated transport solution which meets the project objectives.

The steps below were followed for the Options Sifting Process:

1. Identify a long list of geometrically feasible options which connected the N4 at the western end of the study area to the N4 at the eastern end of the study area.
2. Assess these options at a high level to screen them depending on their ability to meet the project objectives and the level of potential impacts associated with them.

The road based options which were considered as part of the previous studies on this N4 corridor were included in the long list of geometrically feasible options. However, it should be noted that there have been significant changes to policy and legislation both at a national and European level in the interim since the previous studies, such as the 2016 Catchment Flood Risk Assessment and Management (CFRAM) Programme and associated flood risk mapping, the 2017 EIA Directive, the 2019 National Planning Framework, the 2019 Climate Action Plan (CAP) and 2023 updated CAP and the publication of NIFTI in December 2021 to mention but a few. The Climate Action Plan states *'the accelerating impact of greenhouse gas emissions on climate disruption must be arrested… Decarbonisation is now a must if the world is to contain the damage and build resilience in the face of such a profound challenge'*. Current policies and legalisation were taken into account in the sifting process.

An option was not screened out if it did not deliver on every project objective. However, particular consideration is given to the level of demand on an option as this determines how effective it will be in relieving the traffic congestion in Carrick-on-Shannon/Cortober, whilst also considering constraints of international importance, which include biodiversity and climate change. Options which are not feasible and practical from the perspective of delivering on the over-riding project objectives of solving the problems identified, whilst also adhering to the essential shift towards climate resilient and sustainable development, are removed from further consideration in the sifting process.

An incremental approach should be adopted when considering potential options with options ranging from a Do-Nothing and a Do-Minimum option (i.e. 'Base Case' option) to include a range of Do-Something options. Plate 5.2.1 below sets out the process that will be followed during the option selection process of the

project and how it aligns with the principles of modal hierarchy and intervention hierarchy as set out in NIFTI.

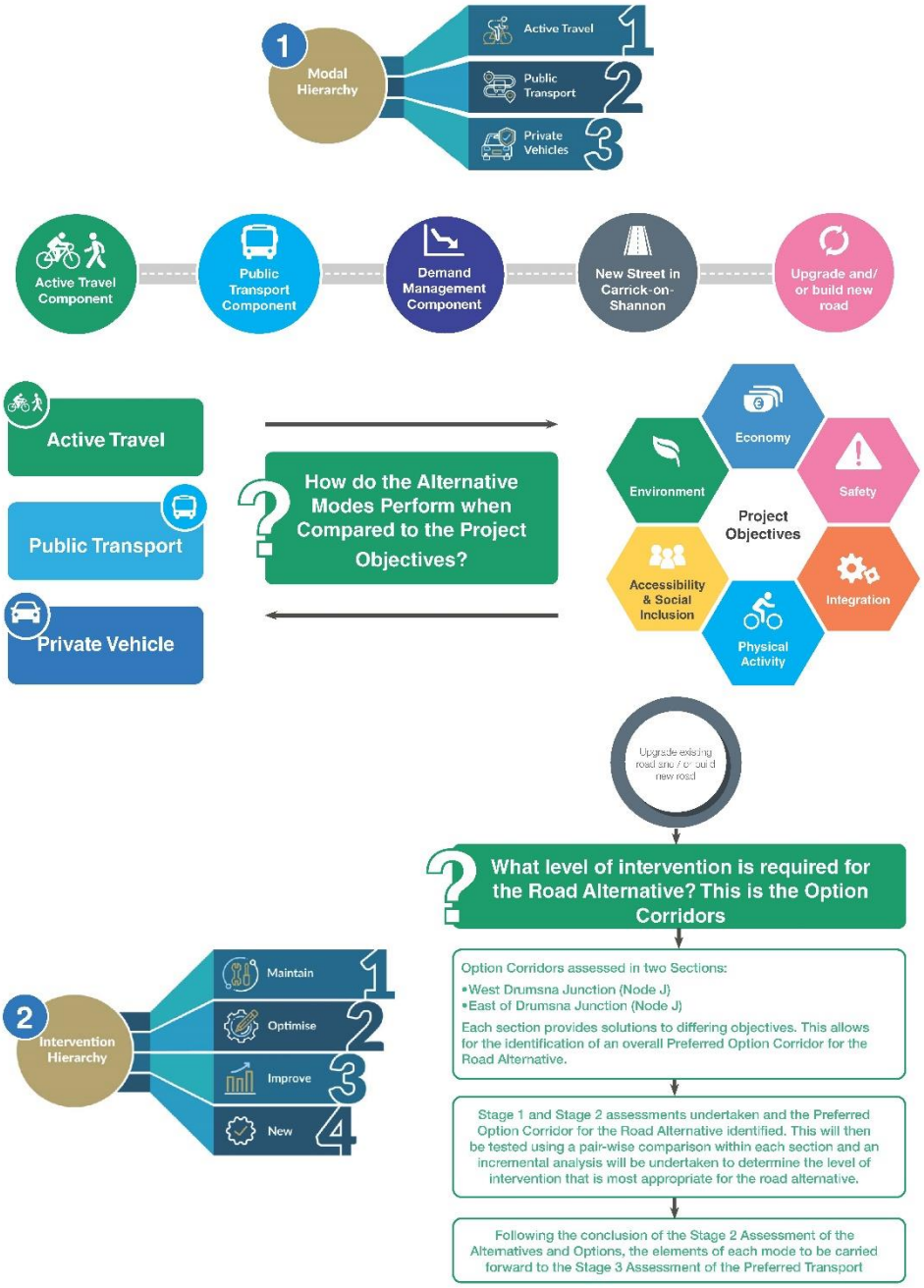

Plate 5.2.1 The Option Selection Process

5.2.2.3 Do-Nothing Option

The Do-Nothing Option is the scenario whereby there is no intervention on the proposed network. This option does not exist in the case of the N4 Carrick-on-

Shannon to Dromod Project as there are already planned and committed projects in the locality. Hence it is not considered further.

5.2.2.4 Do-Minimum Option

The first potential option to be identified is the Do-Minimum Option as it forms the base case against which all other options are assessed. The Do-Minimum Option will include those transportation projects and services that are committed within the appraisal period of the project. This includes road schemes, public transport improvements, smart mobility and demand management measures and the provision of pedestrian and cyclist facilities; but does not include the delivery of the project itself. All elements of the Do-Minimum Option are included as part of each Do-Something option such that the only difference between the two is the project solution being proposed. This approach ensures that the true impact of the project solution can be isolated and objectively assessed.

When deciding the appropriate components of the Do-Minimum Option, there are often two possible definitions of complementary projects that should be considered in the appraisal of the scheme in question, namely:

1. *"Planned"* improvements that are included in the fiscally constrained long-range plan for which the need, commitment, financing and public and political support are identified and may be reasonably expected to be implemented
2. *"Committed"* improvements that have been progressed through the planning and are either under construction or are programmed into the capital expenditure budget

Consultation with the local authorities in the study area identified the various components to be included in the Do-Minimum Option which was based on the degree of certainty that such interventions may occur and the likely impact such interventions may have on future travel demand. The components of the Do-Minimum Option are included in Appendix A.5.2.1.

5.2.2.5 Do-Something Road Based Options

In response to the transportation problems identified in Chapter 2 Identification of Need, a wide array of road improvement measures can be considered as offering potential solutions along the N4 corridor and an incremental approach should be adopted when considering potential road based solutions.

As with all potential transport solutions, road based interventions should not focus solely on addressing existing road capacity shortfall, but rather need to sit in the context of wider transportation policy and mobility within the corridor and study area. For example, the scale of road based intervention necessary is inextricably linked to the concurrent delivery of an improved public transport system, improved active travel measures and additional demand management measures in the study area, as these will encourage modal shift and potentially reduce road demand. It is imperative that road based interventions do not undermine the future need for investment in more sustainable transport solutions.

The first Do-Something road based option is an option which seeks to maximise the use of the existing asset and is referred to as the Management Option. The development of the Management Option included an assessment of the N4 in the context of the following:

i. Sustainable use of infrastructure
ii. Technological innovation
iii. Provision for all modes of transport including non motorised users such as pedestrians and cyclists encouraging more active travel and sustainable trips utilising safer crossing infrastructure
iv. Private access control
v. Proximity of junctions and consistency of junction types
vi. Sections of poor safety using global targets and TII Publications Design Guidelines

Therefore, the existing N4 was assessed and a range of management measures, where feasible, were agglomerated to form the Management Option. Detail of the development of the Management Option and associated figures are provided in Appendix A.5.2.2.

Further Do-Something options were developed incrementally from an option to wholly reuse the existing N4 to an option including small scale improvements to address specific issues on the existing N4 to more significant investments comprising new off-line construction. Options must be significantly different and take account of potential differences in alignment, design standard and junction strategy. Significant differences in the likely costs and benefits of options would require the alignments to be treated as separate options.

5.2.2.6 Output of Sifting Matrix

The initial long list of alternatives and options together with the outcome of their assessment is included in Appendix A.5.2.3. The alternatives and options which were assessed against the project objectives are set out below, noting that those with a strikethrough were sifted out and did not progress to Stage 1 Preliminary Assessment:

~~Do-Nothing~~

Do-Something Alternatives

- Active Travel Initiatives
- Public Transport Alternatives including bus and rail
- Demand Management Alternative

Do-Something Options

- Do-Minimum Option
- Management Option

- Do-Something Road Based Options – West of Drumsna
  - Dark Green Option
  - Purple Option
  - ~~Option 3~~
  - Black Option
  - Orange Option
  - Cyan Option
  - ~~Option 7~~
  - ~~Option 8~~
  - ~~Option 9~~
- Do-Something Road Based Options – East of Drumsna
  - Option 10
  - Purple Option
  - Green Option
  - Yellow Option
  - Option 14

5.3 Consultation

5.3.1 Environmental Workshop No. 2

Environmental Workshop No. 2 took place via Microsoft Teams on 25 February 2021. Each of the environmental specialists provided a summary and description of their key constraints within the project study area based on additional studies and surveys carried out post Environmental Workshop No. 1.

Each of the Stage 1 Alternatives and Options were reviewed in detail and provided an opportunity for all present to recommend modifications in order to minimise impacts on the receiving environment.

5.3.2 Public Consultation

Public consultation on the Stage 1 Alternatives and Options was undertaken from 19 May to 25 June 2021. As part of this consultation, key stakeholders were consulted and invited to make submissions.

During the course of the consultation, additional options were identified by members of the public for consideration. Refer to Appendix A.6.2.1 for further details. These additional options were assessed using the sifting methodology as set out above to determine if such options merit inclusion as a Stage 1 Option.

The additional options identified for sifting are as follows and shown on Plate 5.3.1:

- Do-Something Road Based Option – North of study area crossing of Lough Eidin and River Shannon crossing via new bridge at Hartley Bridge – Option 15

- Do-Something Road Based Option – Extend Black Option Corridor via Keenaghan Industrial Estate and tie back into existing N4 at Lisseeeghan – Option 16
- Do-Something Road Based Option via R368 – R368 via Elphin from Killukin to Strokestown – Option 17
- Do-Something Road Based Option via N5 Longford and N61 to Boyle – Upgrade the existing N5 and tie into and upgrade N61 – Option 18
- Do-Something Road Based Option – Double Railway Crossing south of Cortober – Option 19
- Do-Something Road Based Option – Upgrade to existing L7414 – Option 20
- Do-Something Road Based Option – Southern off-line bypass continuously adjacent to railway line – Option 21
- Do-Something Road Based Option – Northern off-line bypass along the boundary of study area (or beyond) – Option 22
- Do-Something Road Based Option – Introduce a roundabout at Faulties/Fearnaught and run a parallel road up to Aghamore – Option 23
- Do-Something Road Based Option – Upgrade to existing R299 – Option 24
- Do-Something Road Based Option – Add a connection from the R368, Elphin Road, to the southern Option – Option 25. Note also that the Draft Roscommon Development Plan includes an objective to upgrade the Elphin Road from the train station to the town.

The additional options identified by the public for consideration above have been assessed against the project objectives and the outcome of their assessment is included in Appendix A.5.2.3. Two of these additional options namely, Option 23 and Option 25, were retained as modifications and additions to the Phase 2 – Stage 1 Options which were then incorporated into the Stage 2 Options.

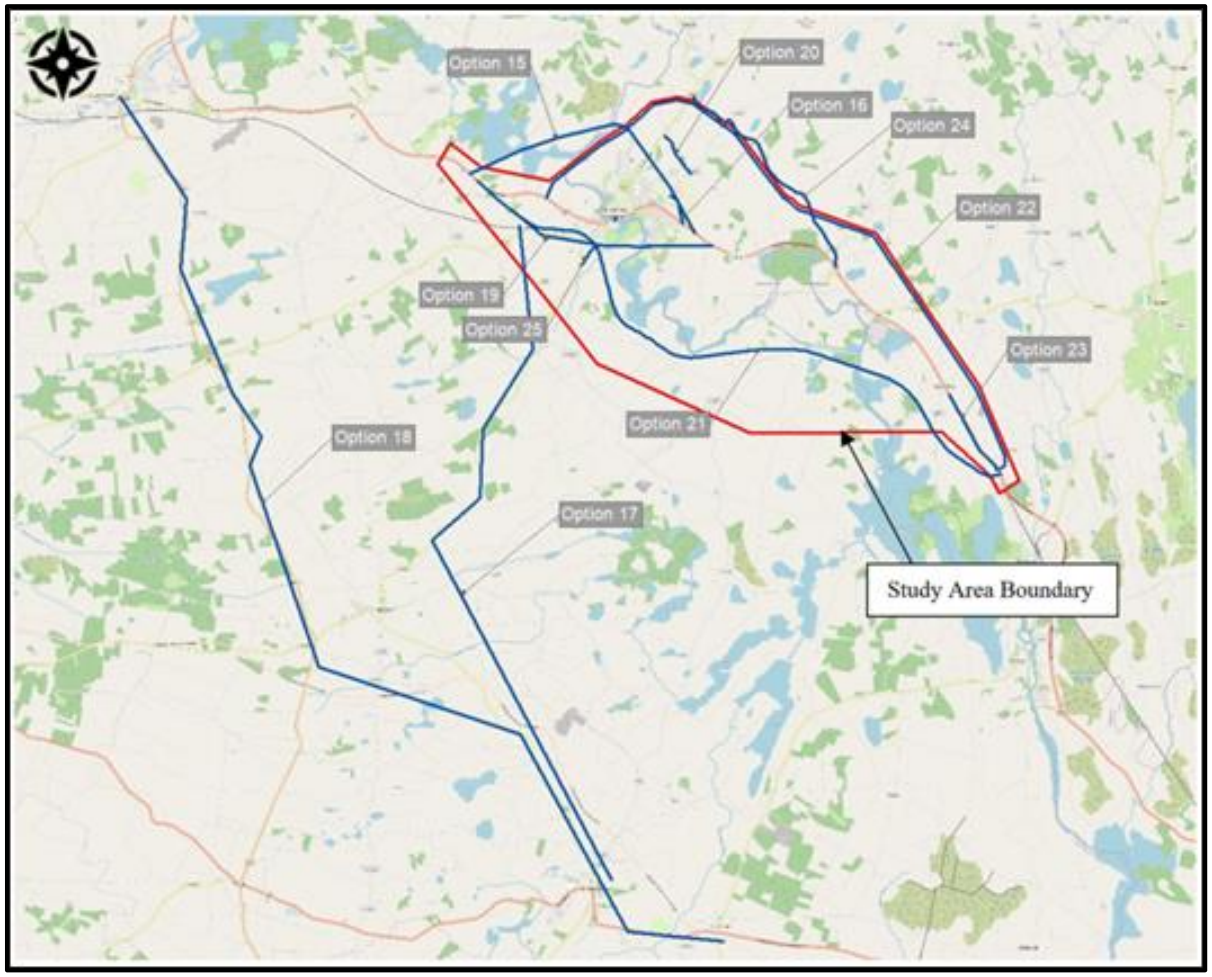

Plate 5.3.1 Additional Options Post Public Consultation No. 2

5.4 Summary

The following alternatives and options have been brought through to Phase 2 – Stage 1 Alternatives and Options to undergo the Preliminary Assessment:

Do-Something Alternatives

- Active Travel Initiatives
- Public Transport Alternatives including bus and rail
- Demand Management Alternative

Do-Something Options

- Do-Minimum – This is the Base Case and will be kept for comparison purposes
- Management Option (Blue West and Blue East)
- Do-Something Road Based Options

The Do-Something Road Based Options were split into two sections (i.e. West of Drumsna Junction (Node J) and East of Drumsna Junction (Node J) as that is the point at which all bypass options for Carrick-on-Shannon could be brought to a convergence so that they could be assessed from a common point.

- West of Drumsna Junction (Node J)

  - Dark Green Option
  - Purple West Option
  - Black Option
  - Orange Option
  - Cyan Option

- East of Drumsna Junction (Node J)

  - Purple East Option
  - Green Option
  - Yellow Option

Following Public Consultation No. 2, additional options were identified by members of the public for consideration. These additional options were assessed using the sifting methodology outlined in Section 5.2.2.2 to determine if such options merit inclusion as a Stage 1 Option. Whilst no additional new Stage 1 Options warranted inclusion from the suggestions, two modifications to existing Stage 1 Options were retained for consideration as Stage 2 Options.

6 Stage 1 Alternatives Assessment

6.1 Introduction

6.1.1 Overview

As outlined in Section 5.1, an *alternative*, as defined in TII Project Appraisal Guidelines (PAG) Unit 4.0 (*Consideration of Alternatives and Options*)[1], refers to a specific transport mode (road, rail, bus, air etc.) or demand management proposal (fiscal, control, Intelligent Transport Systems (ITS) etc.) which could address the need for an intervention. The assessment of the 'road alternative' is documented separately in Chapter 7 of this report as there are various option corridors for the road alternative in terms of intervention hierarchy to be assessed and compared to identify the best performing option.

This chapter sets out the Stage 1 Alternatives which were considered for assessment of their potential to deliver, or contribute towards, a sustainable transport solution along the N4 corridor between Carrick-on-Shannon and Dromod. The criteria under which these alternatives were assessed and the analysis which concluded whether these alternatives were worthy of further assessment is also detailed in this chapter.

The alternatives to be considered must be reasonable, proportionate, and relative to the project, with assessment and presentation reflecting the requirements of the EU Environmental Impact Assessment (EIA) directive[2]. As outlined in TII PAG Unit 4.0, the initial step focussed on drafting a long list of potential alternatives that may address the need for intervention. Alternatives on this initial list were then qualitatively assessed against the stated project objectives to establish, at a fundamental level, if these alternatives would respond, in whole or in part, to the transportation problems identified on the corridor. This initial long list included a range of alternatives which were developed incrementally from small scale improvements to more significant investments and were grouped under the headings of Active Travel, Public Transport and Demand Management, each of which is described in more detail below.

Due to the nature of alternatives, they are assessed separately, for their own merit, as stand-alone entities to determine how well they could resolve the transport issues identified and meet the project objectives and are not assessed against each other. Equally the alternatives are not compared against the options for the road alternative assessed in Chapter 7. A flowchart showing the Stage 1 assessment process is provided in Plate 6.1.1.

[1] Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 4.0 – Consideration of Alternatives and Options PE-PAG-02013. Available at: https://www.tiipublications.ie/library/PE-PAG-02013-01.pdf
[2] European Union, 2018. (Planning and Development) (Environmental Impact Assessment) Regulations. (SI 296 of 2018) Available from: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print

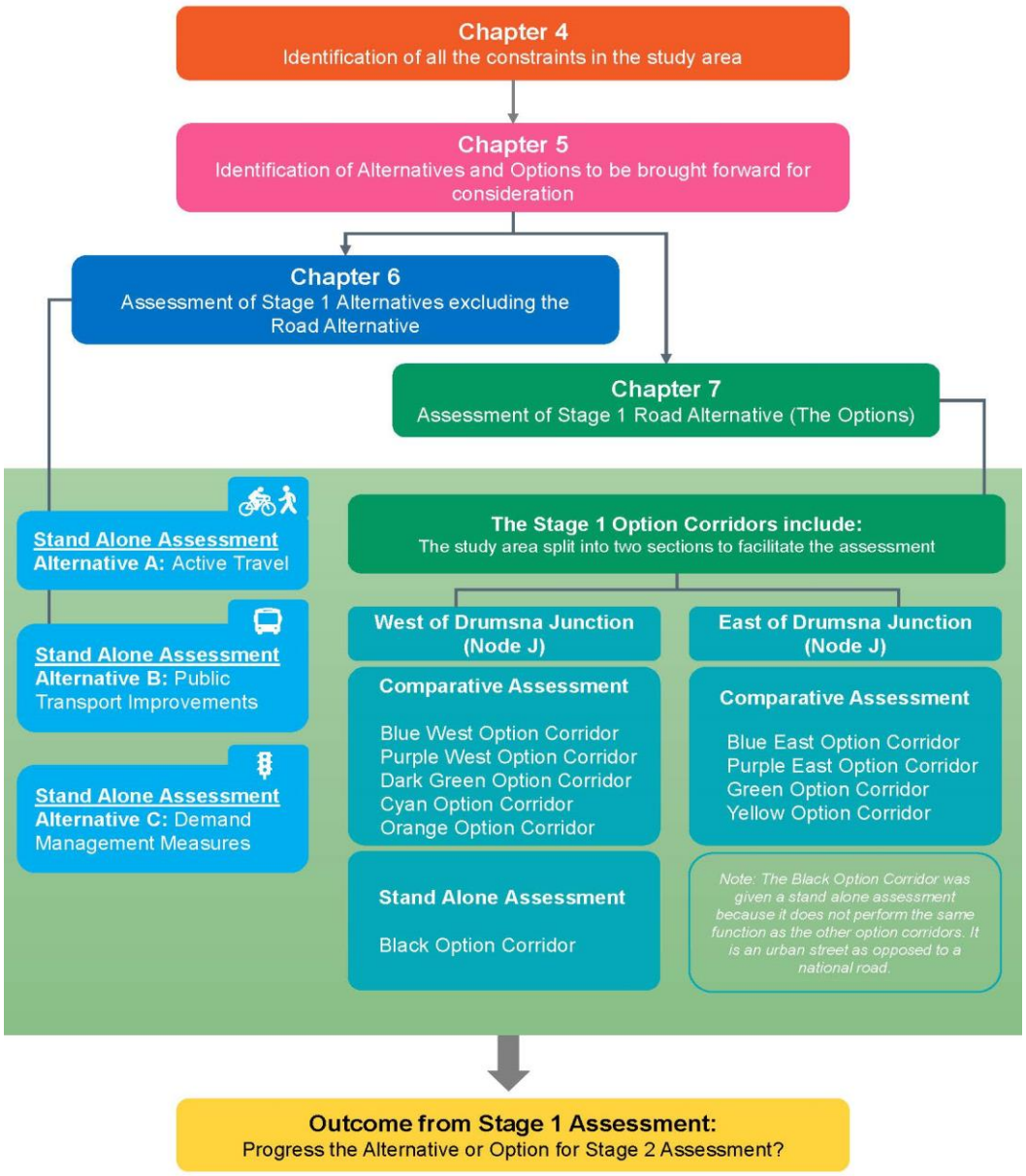

Plate 6.1.1 Flowchart of the Stage 1 Assessment Process

The alternatives will be assessed under the criteria of Engineering, Environment and Economy in this chapter. The Stage 1 Alternatives are described in Section 6.1.2 Description of Alternatives and shown on Figures 6.1.1.0, 6.1.2.0 and 6.1.3.0 Section 6.1.3 outlines the broad methodology utilised to carry out the Stage 1 assessment of alternatives.

6.1.2 Description of Alternatives

Analysis of traffic patterns in the study area has revealed that a considerable number of short distance trips within the Carrick-on-Shannon and Cortober area are made by car. This is a contributing factor to existing congestion on the N4. Improvements to the walking and cycling infrastructure within the town, in addition to enhancements to local bus services would support an increase in sustainable trip making. Measures to reduce the demand for such short trips is also considered in this assessment. These measures could lead to a reduction in traffic levels and congestion in the town. As part of the project appraisal process, these measures will be assessed as an alternative to building new road infrastructure. However, these measures could also form part of a wider multimodal transport solution for Carrick-on-Shannon and its environs.

Possible alternatives were tested against the project objectives and only the alternatives which were deemed feasible (excluding the road alternative) were included in the Stage 1 assessment (see Section 5.2.5 above for the Output of the Sifting Matrix). Post sifting, the alternatives to be assessed at Stage 1 are as follows:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

6.1.2.1 Alternative A: Active Travel

Alternative A comprises improvements to cycling and walking facilities and includes the elements as follows (Refer to Figure 6.1.2.0):

- Development of a comprehensive cycle network
- Improved facilities for cyclists (cycle parking, changing areas, e-bike charging, etc.)
- Improvements to pedestrian facilities (e.g. improved crossings and footpath provision)
- Improve permeability (non-motorised) within the town
- Potential pedestrianisation of key streets
- Construction of a new pedestrian and cycle bridge over the River Shannon

Alternative A will involve the addition of cycle facilities and walking facilities on the existing street network. This will involve additional road markings, signage and possible kerbing to delineate the space required for such facilities and will not require land acquisition and significant construction, with the exception of the additional dedicated pedestrian/cycle facility across the River Shannon. New infrastructure would be required to deliver an additional bridge crossing over the River Shannon adjacent to the existing bridge crossing.

6.1.2.2 Alternative B: Public Transport Improvements

Alternative B comprises improvements to public transport and includes the following measures (Refer to Figure 6.1.1.0):

- Development of an enhanced public transport network
- Increased frequency on the rail network
- Improved parking facilities at Carrick-on-Shannon railway station
- Linking of nearby urban settlements with Carrick-on-Shannon and key trip attractors in the town
- Increase in public transport (bus) services (i.e. up to every 20 minutes during peak periods)
- Development of a mobility hub in the town centre facilitating interchange with other modes
- Provision of demand responsive mini-bus services connecting isolated areas to Carrick-on-Shannon and Cortober

Alternative B will involve an improvement and/or new bus services on the existing street network. This will involve additional signage and possible bus-stops but will not require land acquisition and significant construction.

Alternative B will also include improvements to the rail service which will be accomplished without new rail infrastructure construction. The addition of new facilities at the rail station could include line markings and signage to delineate parking for cyclists and/or vehicles.

6.1.2.3 Alternative C: Demand Management

Alternative C involves reducing demand for car trips through Carrick-on-Shannon and includes the following measures (Refer to Figure 6.1.3.0):

- Rationalise parking along the existing N4 corridor
- Provision of Park & Stride[3] sites on periphery of town centre
- Development of a car free town centre
- Development of remote working hubs
- Delivery of centrally located mixed use developments

Alternative C will involve measures to reduce the need to make the trip by car in the first instance. As such, it will be a reduction measure as opposed to a provision measure with a reassignment of on-street parking/existing traffic lanes to provide walking or cycling facilities in the urban realm, which will not require land acquisition as lands already owned by the Local Authority could be utilised and will

[3] Park & Stride means leaving the car about 10 minutes' walk from the school gate and making the last leg of the journey to school on foot. For parents or grandparents doing the walk to and from the car is 15–20 minutes towards the recommended 30 minutes of physical exercise we should all be doing every day.

not require significant construction. The creation of Park and Stride sites will be located on existing brownfield sites or reassigned existing parking lots.

6.1.3 Assessment Methodology of Alternatives

The Stage 1 assessment of alternatives is undertaken under the assessment criteria of Engineering, Environment and Economy. It is a stand-alone assessment and requires consideration by each specialist. Each specialist will define the assessment criteria based on their expert opinion and best practice. Cognisance will be given to Chapter 3 of the PAG Unit 7 – Multi Criteria Analysis on what to include as sub-criteria.

Alternatives are assessed separately in their own right as stand-alone entities and alternatives are not assessed against each other because they do not share a commonality which affords comparison. Equally the alternatives are not compared against the options as, if they do not meet the Project Objectives on their own, the process moves onto the next level in the hierarchy with an assessment of 'interventions'. However, the alternatives are retained as could then be identified as complimentary to the options and may form part of the overall package that represents the optimum transport solution.

The potential impacts and their magnitude will be identified for each alternative, based on the seven-point scale, under each heading, in line with the TII PAG multi-criteria assessment. The seven-point impact scale is presented below in Table 6.1.1:

Table 6.1.1 TII PAG Unit 7.0 Multi Criteria Analysis Seven Point Scale

Assessment Score	Description
7	Major or Highly Positive
6	Moderately Positive
5	Minor or Slightly Positive
4	Not Significant or Neutral
3	Minor or Slightly Negative
2	Moderately Negative
1	Major or Highly Negative

If there is a particular element of one of the alternatives which gives the overall alternative a poor impact rating or equally if there is a particular element which gives a major or highly positive impact, this should be reflected in the qualitative description. This will inform the decision on which elements within the alternatives should progress to Stage 2 assessment.

6.2 Findings from Public Consultation No. 2

Public participation is an important part of the development of a project and in particular during the early phases of a project. Public Consultation No. 2 took place between 19 May 2021 and 25 June 2021 to inform the public of feasible alternatives and options identified and seek their feedback and suggestions on same. This consultation formed part of the option selection process.

Although an in-person consultation could not take place due to Government restrictions with respect to Covid-19, the consultation was conducted using an on-line consultation room which allowed the public to walk around virtually and view the project material as if they were at an in-person event. In addition, users could book a telephone call or online meeting to talk to the Project Liaison Officer (PLO) and a member of the project team, to discuss the project and consultation material.

Information boards documenting the work completed to date and the feasible alternatives and options identified were displayed. The alternatives included active travel measures, improvement to the public transport and measures to reduce demand as detailed in Section 6.1 and the options included the option corridors as detailed in Section 7.1. Maps showing the proposed option corridors with the key constraints gathered during the Constraints Study were also displayed in both pdf format and an interactive web map.

The analytics of the on-line consultation room and the project website showed the consultation room had 2,337 visitors during the public consultation period. Further detail on the statistics for the public consultation are available in Appendix A.6.2.1 Report on Public Consultation No. 2.

The PLO and representatives from the project team were available throughout the consultation period to answer questions and explain the material on display as needed. A copy of the brochure and feedback form was posted to anyone who requested a hard copy. This level of engagement is in excess of the level of engagement at in-person consultations held in the past at this stage of similar projects as it provided greater opportunity for individual meetings and feedback on the project.

Over 190 individual on-line meetings with landowners, stakeholders, business owners and residents within the study area were held during the consultation period. These were held at the request of the private individuals and drawings were prepared for each one to show the proximity of their property to the proposed option corridors. A copy of a map was also issued to a landowner upon request by post or email.

Submissions from the public of suggestions of possible modifications to these, or additional information on further constraints, which may not have been taken into account in the Constraints Study, were welcomed. In excess of 2,300 submissions were received.

The submissions received were reviewed by the project team (including the environmental specialists) and these along with information gathered through the individual meetings, informed the Stage 1 Assessment of alternatives and options for a transport solution. Broadly speaking to the west of Drumsna Junction (Node

J) a trend in the submissions was identified; residents living to the south of Carrick-on-Shannon objected to the Cyan, Orange and Blue West Option Corridors and residents living to the north of Carrick-on-Shannon objected to the Dark Green, Purple West, and Black Option Corridors.

Overall, the analysis of the submissions identified key themes which are summarised as follows:

1. **Previous Schemes and Need Case**

    a. Support for and objections to the alignment of the proposed project with national, regional and local planning policy.

    b. Support for project regarding easing of current traffic congestion and shortening of journey times.

    c. Requests for the documentation associated with previous route corridors from previous projects in this study area.

    d. Carrick-on-Shannon is the only section of this corridor that needs a new bypass and bridge and that the rest of the road is adequate.

    e. The existing N4 road should be upgraded instead of constructing a new bypass route.

    f. Support for project regarding easing of current traffic congestion and shortening of journey times.

    g. Concern that the current Dromod/Roosky dual carriageway cross-section (Type 2 DCW) design is inadequate and should not be replicated on this project.

    h. Queries regarding proposed cross-section type (e.g. single carriageway or dual carriageway).

    i. Anecdotal evidence that traffic delay and congestion is short-lived and only experienced on busy summer weekends e.g. Friday and Sunday evenings or Bank Holidays.

    j. Support for and objections to the alignment of the proposed project with national, regional and local planning policy.

2. **Active Travel and Alternative Modes**

    a. Identification of the potential interaction between the northern option corridors and the proposed new Blueway from Carrick-on-Shannon to Battlebridge outside Leitrim Village coupled with fears future Irish Waterway's masterplan to install greenways or blueways may be put in jeopardy.

    b. Identification of existing walking and cycle routes in the study area and noting how they may be negatively impacted.

    c. Safety concerns regarding the children in the local communities who walk and cycle to school.

    d. The desire for the provision of active travel facilities outside of the urban areas.

3. **Environment**

    a. Noting potential environmental impacts such as noise, air, and light pollution that a road could impose on the local community.

    b. Noting potential physical and mental health effects, including sleeping patterns of residents, particularly that of children due to traffic.

    c. Noting potential environmental impacts on biodiversity within the study area, with recurring examples including the Corncrake, Curlew and Warble.

    d. Identification of potential flood risk.

    e. Noting potential impacts on landscape and visual amenity and the peace and tranquillity currently experienced in the countryside.

    f. Noting potential impacts to amenity of the River Shannon and accessibility for users to same e.g. boating, fishing, leisure activities.

    g. Feedback was provided on the significance and location of historic and heritage assets within the study area which need to be considered.

    h. Queries regarding accommodation works necessary for the local residents along the N4, including concerns regarding severance of dwellings and farms.

    i. Concerns regarding the ability to continue to live in their homes in close proximity to the road.

4. **Economy**

    a. Devaluation of property for properties in close proximity to road.

    b. Concerns regarding possibility of compulsory acquisition of homes.

    c. Economy may be negatively impacted if towns are bypassed. Fears that local tourism and businesses may be impacted.

    d. Inadequate regional connectivity associated with the Black Option Corridor.

    e. Importance tourism plays in area highlighted- and how the project could support this/hinder this.

5. **Information Requests**

    a. Some of the submissions disliked the use of an on-line platform for the public consultation and noted difficulty with navigating the website to locate the relevant information.

    b. Requests for an extension of duration to the consultation process.

    c. More detailed maps which show more zoomed in detail at particular locations were requested.

    d. Concerns regarding local representatives expressing opinions prematurely on a potential preferred solution and requesting retraction of these statements.

6. **Other**

a. Queries regarding the widened corridor on the Purple and Dark Green Option Corridors to the west of Drumsna Junction close to the Hartley Bridge.

b. Concerns regarding attraction of unnecessary traffic into rural areas.

c. Noted potential for rise in crime as a result of a new road.

d. Design suggestions for alternative routes, links and junction forms.

6.3 Stage 1 Engineering Assessment of Alternatives

6.3.1 Introduction

An assessment of the engineering methods employed for the delivery of alternatives is required to establish if the alternative(s) are viable for this project.

This section details the Stage 1 assessment of the alternatives with respect to the engineering constraints identified in Section 4.2 Engineering of this report. Section 6.3.2 outlines the methodology that was used to carry out the study and Section 6.3.3 details the engineering assessment of the alternatives. A summary of the assessment is presented in Section 6.3.4.

6.3.2 Methodology

The engineering assessment criteria for the alternatives have been identified under the following headings: Geometry, Traffic Impacts and Constructability. The various assessment methodologies employed under each of these headings are outlined in Section 6.3.3. The alternatives were scored based on the seven-point scale, under each heading, in line with the TII PAG multi-criteria assessment. The seven-point impact scale is presented in Table 6.1.1 of this report.

6.3.3 Alternatives Assessment

6.3.3.1 Geometry

The geometric assessment does not apply to the assessment of the alternatives as it is not possible to assess the geometry of for example Demand Management Measures or Bus Services.

6.3.3.2 Traffic Impacts

The traffic modelling described in Chapter 3 Traffic Assessment illustrates how the alternatives perform against the Do-Minimum scenario for the future years of 2030 and 2045. The criteria assessed was the change in AADT over the River Shannon Bridge. The Do-Minimum scenario (±1%) is given a score of 4 (not significant or neutral). A change in AADT of up to ±10% from this scenario received a score of 3 or 5 depending on whether it is plus 10% or minus 10% respectively, where a reduction in AADT is deemed positive. A change in AADT between ±10% and ±20% from this scenario received a score of 2 or 6 depending on whether it is plus or minus respectively. A score of 1 or 7 was given to an alternative predicting a change in AADT of more than ±20% from this scenario. The final score for the assessment is based on the average change in AADT over the 2030 and 2045 scenarios. The Do-Minimum AADTs across the River Shannon Bridge for the years 2030 and 2045 are 16,844 and 17,066 respectively.

The assessment first estimated the changes that each alternative might make to the highway travel demand matrix then assigned the revised matrix to the road network.

It examined the extent to which the alternatives reduced traffic flows in the area, and specifically on the N4 in the vicinity of the River Shannon Bridge.

The changes to the trip matrices were estimated in different ways for the three alternatives:

- Alternative A: Active Travel – an assumed 4% reduction in car travel for journeys shorter than 5km, a distance assumed to short enough for to be reasonable for cycling. The effect is applied only in areas covered by the active travel measures
- Alternative B: Public Transport – the proposed measures were coded into the multimodal model WRM and the impacts on the highway matrix were used to factor the LAM matrices
- Alternative C: Demand Management – similar approach to Alternative A with assumed reductions in car trips from various policy interventions: car-trip rate reduction from planning policies applied to new developments, less need for car travel arising from greater permeability of the town for pedestrians and cyclists, policies to promote working locally, increased parking charges, on-street parking controls, and flexible working hours

Alternative A: Active Travel

The traffic modelling for Alternative A Active Travel indicates that there is a minor reduction of up to 0.8% in traffic volumes crossing the River Shannon Bridge which is attributed to modal shift from private car to the more sustainable modes of walking and or cycling. This is a not significant or neutral impact and has been assigned a PAG Score of 4.

Alternative B: Public Transport

For Alternative B Public Transport, the assessment was split into two distinct categories so that the impacts from bus improvements and the impact from rail enhancements can be determined independently.

Following a review of the existing bus route options, based on analysis of existing services, demand from neighbouring settlements with the town and links to key trip attractors, the following enhancements to bus service provision have been tested in the National Transport Authority's (NTA's) Western Regional Model (WRM) before applying the resultant mode shift to the Local Area Model (LAM) for Carrick-on-Shannon:

- Four new bus services (see Figure 6.1.1.0) serving key towns close to Carrick-on-Shannon at frequent 20 minute intervals in peak hours between 07:00-10:00 and 16:00-19:00. Hourly inter-peak and off-peak.
- A new variant of the existing route 23 bus service between Sligo and Dublin. An increased frequency of every 20 minutes at peak hours between 07:00-10:00 and 16:00-19:00 on the existing inter-urban service, stopping at all settlements between Sligo and Longford as current service with the addition of a stop in Collooney. Hourly inter-peak and off-peak.

The impact of implementing the bus measures was that there was up to a 0.5% reduction in the mode share for cars with the bus enhancements in place.

A separate rail enhancement assessment report was prepared to document the improvements that were assumed (refer to Appendix A.6.3.1). In summary the enhanced rail service was assumed to be in place in 2030 and had the following attributes:

- One train every 30 minutes leaving Sligo from 05:40 to 08:40 AM (allows trains to serve all stops on the line and arrive in Dublin in time to get people to work by 9AM)
- One train every 30 minutes leaving Dublin from 05:00 to 08:00 AM (allows trains to serve all stops on the line and arrive in Sligo in time to get people to work by 9AM)
- Outside of the peak periods there is one service per hour until 22.00 thus increasing the frequency from 8 trains a day to 18 trains per day
- Train speeds were increased by 10% with a reduction in journey time from 190 minutes to 170 minutes

The impact of implementing such measures on the rail, was that there was a 0.01% difference in the mode share for cars with the rail enhancements in place. The greatest impact was seen in a shift from bus to rail.

Table 6.3.3.1 N4 Corridor Mode Share

Mode	Reference Mode Share	Rail Test Mode Share (tested in isolation from bus improvements)
Car	97.16%	97.15%
Rail	1.28%	1.33%
Bus	1.55%	1.52%

Therefore, the overall traffic impact from the rail enhancement is a not significant or neutral impact and has been assigned a PAG score of 4.

Further predictive theoretical mathematical modelling tested the impact of doubling the frequency to 26 trains per day and halving the journey time to 85 minutes. This showed an uplift on rail demand by around 33% and reduction in car trips on the N4 by about 2% which will not achieve the project objectives. A significant level of intervention would be required at significant expense to achieve such a journey time, and it is not certain that such a level of intervention is possible without significant environmental impacts. However, rail will be reviewed again at Phase 3 as part of reporting on Alternatives in the Environmental Impact Assessment Report. A decision on whether additional modelling is necessary in the Phase 3 transport model will be informed by the All Island Rail Strategy, which will be available at that time. During the public consultation on the All Island Rail Strategy, as submission was made on behalf of this project to it.

Alternative C: Demand Management

For Alternative C there is a reduction of up to 10% in traffic volumes crossing the River Shannon Bridge which is classified as a minor or slightly positive impact based on the seven-point scale. This has been assigned a PAG Score of 5.

Summary of Traffic Impact of Alternatives

Alternative C – Demand Management offers the greatest reduction in AADT over the River Shannon Bridge, up to 10% in the Opening Year 2030. Alternative B Public Transport results in the least reduction in AADT over the River Shannon Bridge with the main contribution being from the bus measures, albeit it very small. However, the enhancements to rail do not provide enough improvement in traffic levels to meet the Project Objectives.

Table 6.3.3.2 Traffic Impact Assessment of the Alternatives

	Do-Minimum 2030 AADT	**Alternative A Active Travel**	**Alternative B Public Transport**		**Alternative C Demand Management**
Traffic (AADT on River Shannon Bridge)			**Bus Enhancements**	**Rail Enhancement**	
Year 2030	16,844	16,742	16,780	16,844	15,188
Change in AADT	N/A	-0.6%	-0.4%	-0.01%	-9.8%
Year 2045	17,066	16,932	16,984	Not Assessed	15,449
Change in AADT	N/A	-0.8%	-0.5%	N/A	-9.5%
Scoring					
PAG Score	**N/A**	**4**	**4**	**4**	**5**

6.3.3.3 Constructability

Constructability of the Active Travel Alternative will be complicated due to the extent of existing residential housing, commercial businesses, farms, local roads and accesses dotted along the length of the corridors. Disruption to residents and local traffic will need to be minimised throughout the construction period. Detailed construction sequencing and phasing of the works will be assessed as part of any potential Environmental Impact Assessment should this alternative be selected.

The construction impact from Alternative A Active Travel has a minor or slightly negative impact given the scale of the proposed works on new and proposed footways and cycle ways and the potential for numbers of individuals and property owners impacted and has been assigned a PAG Score of 3.

The construction impact from Alternative B Public Transport alternative would have a Not Significant or Neutral impact given the localised scale of the proposed works at implementing bus stops and bus bays, and the lack of physical construction associated with rail improvement in public space. It is anticipated that very few individuals and property owners would be impacted by the proposed public transport improvements and has been assigned a PAG Score of 4.

The construction impact from Alternative C Demand Management alternative would have a slight negative impact given the localised nature of the physical construction works and the potential for low levels of individuals impacted by the works. It has been assigned a PAG Score of 3.

6.3.4 Summary

6.3.4.1 Alternative A Active Travel

Any proposed new infrastructure will meet the contemporary design standards for its application e.g. Design Manual for Urban Roads and Streets, National Cycle Manual and TII Publications etc and will have a Moderately Positive impact on existing infrastructure. This alternative provides a not significant or neutral impact on the AADT over the River Shannon Bridge.

The construction of this new infrastructure will be complicated due to the extent of existing residential housing, commercial businesses, farms, local roads and accesses dotted along the length of the proposed new facilities. Disruption to residents and local traffic will need to be minimised throughout the construction period, and this alternative will provide a minor or slightly negative impact.

Overall Alternative A is assessed as having a Not Significant or Neutral impact.

6.3.4.2 Alternative B Public Transport Improvements

Any proposed new infrastructure will meet the contemporary design standards for its application e.g., Design Manual for Urban Roads and Streets, National Cycle Manual and TII Publications etc and will have a moderately positive impact on existing infrastructure. This alternative offers a slight reduction in AADT over the River Shannon Bridge in the order of 3%.

The construction impact from the proposals associated with this alternative would be not significant or neutral given the localised nature of the works in a public space.

Overall Alternative B is assessed as having a Not Significant or Neutral impact.

6.3.4.3 Alternative C Demand Management

Any proposed new infrastructure will meet the contemporary design standards for its application which will have a moderately positive impact. This alternative provides a slight reduction in AADT over the River Shannon Bridge having a minor or slightly positive impact.

Construction of any new infrastructure will be complicated due to the extent of existing residential housing, commercial businesses, farms, local roads and accesses, especially within Carrick-on-Shannon town. Disruption to residents and local traffic will need to be minimised throughout the construction period and this alternative will provide a slightly negative impact.

Overall Alternative C is assessed as having a Minor or Slightly Positive impact with a PAG Score 5.

Table 6.3.4.1 Stage 1 Engineering Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Geometry	N/A	N/A	N/A
Traffic Impacts	Not Significant or Neutral PAG Score 4	Not Significant or Neutral PAG Score 4	Minor or Slightly Positive PAG Score 5
Constructability	Minor or Slightly Negative PAG Score 3	Not Significant or Neutral PAG Score 4	Minor or Slightly Negative PAG Score 3
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**
Score / Impact level	**4**	**4**	**5**

6.4 Road Safety Impact Assessment of Alternatives

A Road Safety Impact Assessment (RSIA) was carried out for the Stage 1 assessment of the Alternatives described in Section 6.1.2. A copy of the Road Safety Impact Assessment is included in Appendix A.6.4.1.

This study examined the impact the Alternatives would have on the Road Safety within the study area. The RSIA considers effects on the network and takes account of all road users, including vulnerable road users in order to ensure that the implications on road safety of each Alternative are fully assessed as part of the Option Selection Process. The assessment indicates the road safety considerations which shall contribute to the selection of the preferred transport solution. The alternative proposals will not satisfactorily address the road safety issues identified in the Project Objectives however, they can contribute to safety improvements, generally.

Provisions for improved public transport services and/or public transport infrastructure would result in very small reduction in AADT in private vehicles. Likewise, the introduction of the Active Travel Alternative comprising a comprehensive cycle network and improved walking facilities, including a new pedestrian bridge over the River Shannon, would see a reduction in AADT by private vehicles. Enhanced permeability within Carrick-on-Shannon would also reduce the need for local trips to be made by car. Demand reduction proposals may see the reallocation of road space and vehicle restrictions among other possible traffic management approaches. These alternatives may improve vulnerable road user safety, traffic flows and may reduce congestion in the area. This may then possibly reduce the number of collisions overall with each of the Alternatives offering a Moderately Positive impact on road safety.

Active Travel: Proposals will improve safety for vulnerable road users in the urban areas of Carrick-on-Shannon and Cortober. It is also proposed to provide active travel facilities throughout the entire route. It is assumed that this would be via a shared use footpath/cycle track along the existing N4. Such a route would improve the facilities for vulnerable road users.

Public Transport: Public Transport improvements would improve safety for bus users at bus stops when provided to current standards. This Alternative would seek to increase bus usage which is to be encouraged.

Demand Management: This is a localised alternative in Carrick-on Shannon and does not address the strategic nature of the N4 route. The reduction in car trips is to be encouraged from both a sustainability and road safety viewpoint. All road users within Carrick-on Shannon would benefit in terms of road safety.

The impact of each Alternative was assessed and categorised as positive, negative or neutral from a safety perspective. An extract of the Alternatives Safety Ratings is provided in Table 6.4.1 below.

Table 6.4.1 Alternatives Safety Rating

	Active Travel Proposals	Public Transport Proposals	Demand Management Proposals
Safety Rating	Moderately Positive	Moderately Positive	Moderately Positive

6.5 Stage 1 Environmental Assessment of Alternatives

6.5.1 Stage 1 Population and Human Health Assessment of the Alternatives

6.5.1.1 Introduction

This section details the Stage 1 Population and Human Health assessment of the alternatives.

This is a broad ranging topic which *"covers the existence, activities and health of people, usually considering people as groups or 'populations'"* (EPA 2015)[4]. Aspects examined in this section primarily relate to potential impacts on socio-economic activities (settlement patterns, population characteristics, activities, and economic) and social well-being and health of people at a community level.

Criteria relevant to the assessment of socio-economic activities include journey characteristics, journey amenity, general amenity, community severance, and economic effects relating to business, tourism and employment and relate to the constraints identified in Section 4.4.

Other aspects relevant to population such as natural amenity, built and natural heritage, ecosystem services, material assets and nuisance are dealt with in the following sections:

- Section 6.5.2, Material Assets Non-Agriculture
- Section 6.5.3, Material Assets Agriculture
- Section 6.5.4, Air Quality
- Section 6.5.5, Climate
- Section 6.5.6, Noise and Vibration
- Section 6.5.7, Archaeological, Architectural and Cultural Heritage
- Section 6.5.8, Landscape and Visual
- Section 6.5.9, Biodiversity
- Section 6.5.10, Hydrology

[4] Extracted from the Advice Notes for Preparing Environmental Impact Statements (EPA draft September 2015)

- Section 6.5.11, Hydrogeology
- Section 6.5.12, Soils and Geology

Human health impacts are primarily considered through an assessment of the environmental pathways by which health can be affected such as air, noise, water or soil. Therefore, the health assessment relies on the assessments in the following sections and draws on the findings as necessary to examine whether the effects arising from any identified impacts may have a health impact and to ensure that the effects which may have a health impact are fully considered:

- Section 6.5.4, Air Quality to identify the predicted air quality values adjacent to the proposed alternatives
- Section 6.5.6, Noise and Vibration to identify the predicted noise levels at properties adjacent to the proposed alternatives
- Section 6.5.10, Hydrology to identify areas with any potential impacts on surface water and areas of flood risk
- Section 6.5.11, Hydrogeology to identify areas with any potential impacts on groundwater
- Section 6.5.12, Soils and Geology to identify if there are any areas of contaminated soils

The health assessment also considers health improvement and improvement to services. Other aspects, such as changes in traffic flows which are dealt with in Chapter 3, Traffic Assessment and Cross-Section, have also been considered in relation to the assessment of Socio-economic and Health impacts to ensure that the effects of these issues on population and human health have been addressed.

Section 6.5.1.2 outlines the methodology utilised to carry out the assessment, Sections 6.5.1.3 details the options assessment and a summary is presented in Section 6.5.1.4.

6.5.1.2 Methodology

The assessment in relation to Population and Human Health has been split into two aspects, namely socio-economic activities (Population) and local community health (Human Health). The methodology for these two aspects is set out separately below.

Population

The assessment of Population requires an understanding of the community, built up through background research, site visits, and conversations with local people and community representatives. For the Stage 1 Assessment, information has been collected from the following sources:

- Primary data sources (e.g., demographic data from Census 2016[5] and Census 2011[6] produced by the Central Statistics Office)
- Maps of the study area, including Ordnance Survey Ireland (OSI) Discovery Series 1:50,000 Sheet 33[7]
- Spatial data, including Google Maps and Google Streetview, Open Street Map, Department of Education school maps, and church and parish location maps, supplemented by site visits
- Relevant environmental data collected by other disciplines during their studies
- A review of relevant planning document including the Leitrim County Development Plan (2015-2021)[8] and the Roscommon County Development Plan (2022-2028)[9], the prevailing Carrick-on-Shannon Local Area Plan (2010-2019)[10] and the Cortober Area Plan (2015)[11]
- A review of secondary sources including the National Planning Framework[12] and the National Development Plan[13], the Regional Spatial and Economic Strategy 2020-2032 (NWRA-RSES)[14]
- A review of previous Environmental Impact Assessments (EIAs), including of the Environmental Impact Assessment Report for the N4 Dromod-Rooskey Bypass (2004) and the Route Corridor Selection Report (2009) prepared by Roughan & O'Donovan which culminated in a preferred route corridor

[5] Central Statistics Office, 2017. Census 2016 Reports. Available from: https://www.cso.ie/en/census/census2016reports/ [Accessed July 2021]
[6] Central Statistics Office, 2012. Census 2011 Reports. Available from: https://www.cso.ie/en/census/census2011reports/ [Accessed July 2021]
[7] Ordnance Survey Ireland, 2021. OSi 1:50,000 Discovery Series Sheet 33. Available from: https://sites.google.com/site/theirelandwalkingguide/publications/maps/osi-discovery/sheet33 [Accessed July 2021]
[8] Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021. Available from: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan/County_Development_Plan_2015-2021/ [Accessed July 2021]
[9] Roscommon County Council, 2022. Roscommon County Development Plan 2022-2028. Available from: https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/stage-3-amendments/stage-3-adoption-of-plan Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/
[10] Leitrim Council, 2010. Carrick-on-Shannon Local Area Plan 2010-2019. Available from http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Local-Area-Plan/Amendment-2-Carrick-on-Shannon-2010-2019/ [Accessed July 2021]
[11] Roscommon County Council, 2014. Cortober Area Plan 2014-2020. Available from: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/2-Cortober-Area-Plan.pdf [Accessed July 2021]
[12] Government of Ireland, 2018. Project Ireland 2040 National Planning Framework. Available From https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf [Accessed July 2021]
[13] Government of Ireland, 2018. Project Ireland 2040 National Development Plan 2018-2027. Available From: https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null [Accessed August 2020]
[14] The Northern and Western Regional Assembly, 2020. Regional Spatial and Economic Strategy 2020-2032 (RSES). Available from: https://www.nwra.ie/rses/ [Accessed July 2021]

- Observation of local settlement and travel patterns and identification of community facilities
- Websites identifying local walks and trails, angling rivers and lakes [15] [16] [17] [18]

Features relevant to the assessment of Population are discussed in detail in the preceding Chapter 4 - Constraints Study. Many of these relate to the community facilities which are concentrated in Carrick-on-Shannon and Cortober. These include shops and retail centres, and services such as hairdressers, schools, sports facilities and playing fields, churches and religious facilities, cemeteries, marinas and moorings, hotels and accommodation, parks and areas of amenity. In addition, there are numerous businesses in and outside of the urban areas which are important for the local economy and employment. There are also linear amenities, most notably the River Shannon, part of the Shannon-Erne Blueway, which is used for boating, kayaking, rowing and angling, and also footpaths, sli-na'slainte routes and cycle routes.

In terms of sensitivity, direct impacts on churches or other religious facilities or sites would be of profound significance, but nearby roads would not necessarily have a significant impact if noise levels are acceptable on standard indices. Noise could have significance in the case of visits to cemeteries, although many established cemeteries are located beside major roads.

Schools and nursing homes are also sensitive to noise and to air quality effects while playing fields have a degree of sensitivity to noise and air quality effects. These facilities would also be vulnerable to physical severance, including where there could be a need for at-grade road crossings as part of Active Travel measures; even when assisted by signalised pedestrian or cycle lights.

Direct impacts on businesses would have both an economic and employment impact depending on the size and local significance of the business. However, businesses also benefit from improvements in accessibility and reduced traffic congestion.

The Stage 1 Preliminary Alternatives Assessment considers the potential effects that the alternatives could present at a community level, rather than for individuals or identifiable properties, although effects on individual businesses are discussed. Physical effects on individual properties are addressed separately in Section 6.5.2 Material Assets- Non-Agriculture, but this assessment does treat the principal communities of Carrick-on-Shannon, Cortober, Jamestown, Drumsna and Aghamore as constraints along with other named communities or clusters of residential properties. It also takes into account the effect of possible demolitions or acquisitions where these could impact on the wellbeing of the residual community.

[15] Fermanagh Tourist Information Centre, 2021. Kingfisher Cycle Trail. Available from: https://kingfishercycletrail.com/ [Accessed June 2021]
[16] Waterways Ireland, 2021. Blueways. Available from https://www.bluewaysireland.org/ [Accessed June 2021]
[17] Leitrim Tourism, 2021. Walks and Trails. Available from: https://leitrimtourism.com/things-to-do/walks-and-trails/ [Accessed August 2021]
[18] Inland Fisheries Ireland, 2021. Carrick on Shannon Coarse Angling Centre. Available from: https://fishinginireland.info/coarse/shannon/carrickonshannon/ [Accessed August 2021]

Population Assessment Criteria

The Population assessment is primarily qualitative, although quantitative data will be taken into account where available or relevant to the stage of the assessment, including traffic volumes, pedestrian and cyclist counts, journey time, accident statistics and property counts. There are five principal assessment criteria for the assessment of Population as below. For the preliminary alternatives, an assessment is made of access to community facilities and workplaces.

- Journey Characteristics and Connectivity

This criterion takes account of journey patterns based on the nature of the transport network and observed or projected journeys to urban destinations, workplaces and community facilities. Sub-criteria include journey time, journey time reliability, accessibility, and journey connectivity (the availability of connections between desired origins and destinations). These sub-criteria depend also on traffic data and are assessed for all road users including private drivers, commercial drivers, public transport users, cyclists and pedestrians.

- Journey Amenity

Relevant effects arise from the proximity to, volume of, or speed of traffic, as it affects the pleasantness, and perceived or actual safety of pedestrians, cyclists, public transport users and drivers. This will also be affected by the facilities available for these road users (e.g. pavement footpaths, cycle paths, crossing facilities, etc), the physical separation of vehicular traffic from pedestrians or cyclists, the nature of any junctions to be negotiated, the proportion of HGVs and the location of public transport stops, including for school buses. For vulnerable road users, age and physical ability are taken into account. Particular issues include the exposure presented by road crossings or junctions, and the legibility of the transport network, i.e. being able to find one's way (including signage).

- General Amenity and Community Facilities

Community facilities may be directly or indirectly impacted. There can also be effects on residential quality of life or community wellbeing, or on amenity and recreation, due to a combination of environmental effects (e.g. noise or visual) for which significance has been identified in respective chapters of the assessment. Impacts may also arise where traffic adversely affects people's perception of community identity and belonging. This effect can arise from proximity to traffic (see also severance), from changes in traffic volumes on connecting local roads, or from changes in neighbourhood interaction. There are links between General Amenity and health, or social inclusion given the importance of access to community facilities used by sensitive receptors.

- Community Severance

This refers to the ability of people to access community facilities, workplaces, friends or neighbours, particularly as it affects sensitive receptors such as older people, children or people with disabilities. Physical severance can take the form of new severance, for example due to the insertion into the landscape of a new transport facility, or of relief from severance, for example from reductions in

vehicle traffic or the provision of crossings facilities. Social severance can also occur where people feel contained without road boundaries causing their social interaction to diminish. Higher or lower traffic volumes can affect both forms of severance.

- Economic

These arise from changes in economic activity affecting local businesses or employment, either directly or indirectly. These effects can occur due to direct impacts on business premises, from changes in accessibility, or from changes in development opportunities for the local economy.

Population Scoring

The appraisal of impacts for the Population assessment is based on a multi-criteria analysis (MCA) as described in the TII Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 (PE-PAG-02031). The number and significance of individual effects are assessed and converted to the assessment scores provided in Table 6.5.1.1. Equal importance weighting is applied to the five criteria listed above for the assessment of potential impacts relevant to Population. The Preliminary Alternatives are rated relative to the baseline environment using qualitative as well as quantitative analysis and professional judgement of their significance using the scoring definitions listed in Table 6.1.1 of this report.

Human Health

Human health assessment focuses on three main areas: *health protection, health improvement and improving services* and are the sub-criteria used in the human health assessment. For this Stage 1 Assessment, *health improvement and improving services* are combined as a single assessment as there are no distinct differentiating factors between the alternatives in terms of these two criteria.

There is no specific guidance on the assessment of human health. However, a review of current and emerging guidance on assessing health in Environmental Impact Assessments was undertaken and is included in Appendix A.6.5.1 and forms the basis for the methodology set out here. The assessment utilises a standards-based approach.

The assessment of each alternative includes both a quantitative and qualitative assessment. Firstly, each alternative is assessed under the two sub-criteria, namely *health protection and combined health improvement and improving services*, and the level of potential impact and its significance is assigned. Following this an overall assessment of each alternative is completed and scored based on the seven-point scale listed in Table 6.1.1 of this report.

Sub-criterion 1: Health Protection

Health protection impacts are primarily considered through an assessment of the environmental pathways by which health can be affected, including:

- Noise and Vibration – for example potential exposure of people to noise emissions from vehicles and construction activities

- Air – for example potential exposure of people to dust and air emissions from vehicles and construction activities
- Water – for example potential exposure of people to changes in water quality (surface and ground water) or changes in water flows – flood risk
- Soils – for example potential exposure of people to contaminated land

The results of technical assessments of noise, air, soil and water and any potential hazard directly attributed to what is proposed by the Alternative on these elements informed the health protection assessment.

These technical assessments use standards[19] (such as air quality standards) in order to identify whether significant impacts will arise or not. It is important to point out that health standards do not only exist to protect robust groups within the population but are primarily intended to protect the vulnerable. The standards are set at levels for which there will be no significant health effects, but do not exclude each and every effect, i.e. slight or moderate health effects are possible even below the levels at which health based standards would apply.

Sub-criterion 2: Health improvement and improving services

Projects that have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance, could contribute to improving the health and wellbeing of socio-economically deprived communities.

The assessment of human health for the project, in terms of health improvement, includes an assessment on how the project would impact on the socio-economics of the community.

Improving access to services such as hospitals or recreational facilities will have an impact on the health of a community. Therefore, the assessment of human health for the project includes an assessment on whether or not the project will improve access to these services.

Opportunities for health improvements and improved access to services due to the alternatives were identified and each alternative scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes
- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents
- Potential for improved public transport and an improved environment for cycling and walking within Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in health benefits

[19] The term standards in this instance covers guidelines for example noise guidelines as such standard are not currently available.

Significance of Human Health Impacts

There is a difficulty in assigning levels of significance to human health impacts. In medicine, as in all science, the concept of statistical significance is used. This involves attaching a value to significance, often expressed as a percentage level of confidence in the data. Confidence measures of 95% or even 99% are often used to measure levels of certainty or changes that are not due to chance alone.

This is a valid approach for the study of the impacts on a *population* but does not absolutely exclude a response on an *individual*. However, it is difficult to assign levels of significance to individual human health impacts without detailed information about that individual. Thus, the significance of health effects is assessed on a group or community basis rather than on an individual basis. There is such a variability in human response that one could never identify all possible individual effects and so, in accordance with the guidance referred to above, it is considered to be more appropriate to assess the significance of health effects at a population level. The significance criteria for the assessment of the health of communities are therefore as outlined in Table 6.5.1.1 below.

Table 6.5.1.1 Significance Criteria Used in the Assessment of Community Health Protection Impacts

Significance Criteria / Degree of Impact	Definition
Major or Highly Negative	The project has the potential to negatively impact on the health status with an associated change in morbidity or impact on the health status of communities or groups of people
Moderately Negative	A moderately negative impact on health status but no change in morbidity or mortality can be attributed to the project
Minor or Slightly Negative	A small negative impact on reported symptoms but no change in health status can be attributed to the project
Not Significant or Neutral	No significant human health impacts are apparent
Minor or Slightly Positive	A small positive impact on reported symptoms but no change in health status can be attributed to the project
Moderately Positive	A moderately positive impact on health status but no change in morbidity or mortality can be attributed to the project
Major or Highly Positive	The project has the potential to positively impact on the health status with an associated change in morbidity or impact on the health status of communities or groups of people

Asthma can be used as an example when using these significance criteria:

- An imperceptible impact would be one with no measurable effect on asthma
- A slight impact might be a temporary increase in symptoms but no change in the severity of the underlying condition or treatment required
- A moderate impact might be an increased use of inhalers attributable to the proposed road development but no change in underlying condition and no effect on the vast majority of asthmatics

- A significant effect might be an individual becoming asthmatic or an individual's asthma becoming measurably more severe as a result of the project
- A very significant effect might be a group of individuals becoming asthmatic or their asthma becoming measurably more severe as a result of the project

A profound effect might be a measurable increase in the incidence or severity of asthma in a community as a result of the project.

6.5.1.3 Stage 1 Population and Human Health Assessment of Alternatives

Stage 1 Population Assessment of Alternatives

Alternative A: Active Travel

This alternative comprises improvements to cycling and walking facilities. An improved infrastructure for walking and cycling would facilitate a move to active transportation with benefits for journey patterns, journey amenity and health. Improved pedestrian crossings and footpaths, and a comprehensive cycle network, supported by new signage, road markings and kerbing, will allow for more permeability, providing a positive impact on journey characteristics by allowing pedestrians and cyclists to reach their destinations easily and swiftly. Journey amenity will be improved in terms of greater safety and through the separation of pedestrians and cyclists from vehicles. Cyclist amenity will be enhanced by the proposals for cycle parking. There will be a positive impact for journey characteristics and amenity due to pedestrianisation of key areas, combined with reduced severance with the provision of a new pedestrian and cycle bridge across the River Shannon. Some negative impacts on vehicle traffic flow and general amenity can be expected during construction.

Facilities for active travel could potentially lead to a transference of a proportion of local journeys from private vehicles. This would have economic benefits in other respects by improving the general environmental amenity.

Alternative B: Public Transport Improvements

Alternative B comprises improvements to public transport. The availability of enhanced and frequent public transport, including a minibus service to outlying areas would have a positive impact on journey characteristics and complement investment in active travel, particularly by facilitating journey patterns for people with limited mobility or without access to a private vehicle. The development of a mobility hub and demand-responsive minibus services would be an innovative complementary benefit for journey characteristics, especially if providing a link between Cortober (including the station) and Carrick-on-Shannon to which significant severance currently applies at the R368/N4 junction and crossings of the N4 to the pedestrian bridge across the Shannon. Additional signage and bus stops, along with the improvements to footpaths and pedestrian crossings, would have a positive impact on journey amenity and accessibility of public transport users once in town. Public transport improvements would themselves reduce vehicle demand and support additional active travel. Some negative impacts on vehicle traffic flow and general amenity can be expected during construction.

Increased car parking at the railway station and new rail infrastructure would encourage more use of rail services and have a positive impact on journey characteristics. At present, it can be difficult to find spaces and overflow of parking on to adjacent road is an annoyance for local residents and can present a hazard. Bicycle theft has also been an issue. Therefore, new car parking and cycle facilities would also have a positive impact on journey amenity.

Alternative C: Demand Management

Alternative C involves reducing demand for car trips through Carrick-on-Shannon and is a reduction measure rather than a provision measure. It would not require land development and significant construction. A reassignment of on-street parking/existing traffic lanes to provide walking or cycling facilities would rather have a positive impact on the urban realm and therefore on general amenity in the town. Measures to reduce demand for car trips, such as changes in junction radii, introducing shared pedestrian/cycle/vehicle space, reduced speed limits and parking reductions on some streets, and time restricted vehicle entry, would all have a positive effect by removing unnecessary demand and inducing some transfer of journeys to active travel or public transport. The negative impact on vehicle journey time and driver journey amenity must be considered, but as informing a strategic decision through a comparison with the positive impact for general amenity and the journey amenity of pedestrians and cyclists.

A key consideration will be to avoid reduction in business activity in the town centre. The creation of Park and Stride sites will have a positive impact in this respect. In general, businesses in Carrick-on-Shannon have performed better than in some other rural towns, although there has been a gradual replacement of traditional shops by cafes and services. These enterprises would benefit from environmental enhancements made possible by reduced car use but are also dependent on customer access and accessible car parking.

Table 6.5.1.2 Stage 1 Population Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Journey characteristics and connectivity	More connectivity due to pedestrian and cycle paths and crossings PAG Score 7	Potential for improved connectivity between town and hinterland PAG Score 6	Easier local necessary car journeys, and incentive to transfer to walking or cycling PAG Score 6
Journey amenity	Improved journey amenity for pedestrians and cyclists, especially at roundabout junctions PAG Score 7	Improved safety in some cases. Reduced time spent in congestion. Social inclusion benefits PAG Score 5	Improved safety due to reduced traffic PAG Score 5
General amenity and community facilities	Improved physical health and quality of life PAG Score 6	Links to active travel with benefits for health PAG Score 5	More agreeable environment and health benefits PAG Score 6
Community severance (relief from)	Facilitated crossings of roads and junctions PAG Score 7	Reduced severance through direct connections PAG Score 5	Reduced severance at junctions due to transfer of a proportion of traffic PAG Score 5
Economic	Positive impact as access and parking to shops and businesses can be easier and more direct than by car. Permits brief stops at shops with particular benefits for Main and Bridge Street. PAG Score 5	Positive impact on businesses on Main and Bridge Street in particular. PAG Score 6	Balance between improved environment conducive to business and retail and maintaining vehicle access and parking. PAG Score 6
Scoring			
Qualitative assessment	**Major** or **Highly Positive**	**Minor** or **Slightly Positive**	**Moderately Positive**
Score / Impact level	**7**	**5**	**6**

Stage 1 Human Health Assessment of Alternatives

The Alternatives which have been considered feasible for this project comprise of public transport proposals and measures to improve active travel and demand management measures. The aim of these proposals is to encourage a shift away from private car usage, therefore reducing the number of private vehicles on the section of the N4 under consideration. This has the potential to relieve existing and forecast capacity issues in the study area. A description of these alternatives is provided in Section 6.1 and can be categorised as follows:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

Sub-criterion 1: Health Protection

Alternative A: Active Travel

The only measure within Alternative A that may have an impact on the protection of human health is the provision of a new pedestrian/cycle facility across the River Shannon west (upstream) of the existing bridge. The noise, air quality, soils and water assessments all consider this to be Not Significant or Neutral and as such it is also Not Significant or Neutral from a protection to human health perspective and given a scoring of 4.

Alternative B: Public Transport Improvements

The noise, air quality, soils and water assessments all consider Alternative B to be Not Significant or Neutral and as such it is also Not Significant or Neutral from a protection to human health perspective and given a scoring of 4.

Alternative C: Demand Management

The noise, air quality, soils and water assessments all consider Alternative C to be not significant or neutral and as such it is also Not Significant or Neutral from a protection to human health perspective and given a scoring of 4.

Sub-criterion 2: Health improvement and improving services

The alternatives have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance, could contribute to improving the health and wellbeing of socio-economically deprived communities. Accessibility to businesses and community facilities in Carrick-on-Shannon, Cortober and the wider study area along with the Business Parks in both towns will be better facilitated by the project and the resulting reduction in congestion. It will also bring with it benefits to business and public facilities in Carrick-on-Shannon town centre by reducing noise and air pollution. This all translates into an increased potential for economic prosperity for the Western Region, which in turn will play a part in reviving the Irish economy.

The human health assessment includes an assessment on how the alternatives would impact on the socio-economics of the community and improve access to services

such as hospitals or recreational facilities as this will have an impact on the health of a community.

Opportunities for health improvements and improved access to services were identified and each alternative scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes
- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents
- Potential for improved public transport and an improved environment for cycling and walking within Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in health benefits
- Improved access to services including health services. This may include improved access and decreased journey times to health care facilities or hospitals and decreased waiting times for ambulances in cases of emergencies.

The overall assessment of the Stage 1 Alternatives, in terms of human health is presented in Table 6.5.1.3 below.

Table 6.5.1.3 Stage 1 Human Health Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Protection of Human Health	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Health improvement and improving services	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Scoring			
Overall Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

6.5.1.4 Summary

With respect to Population, each of the Stage 1 Alternatives is assessed to have a positive impact based on the criteria listed. The alternative of Active Travel is assessed to have the most positive impact based on connectivity and journey amenity especially.

With respect to Human Health each of the Stage 1 Alternatives are deemed to have a Not Significant or Neutral impact.

6.5.2 Stage 1 Material Assets Non-Agriculture Assessment of the Alternatives

6.5.2.1 Introduction

This section details the Stage 1 assessment of the Alternatives with respect to the Material Assets Non-Agriculture constraints identified in Section 4.5 Material Assets Non-Agriculture of this report.

The Stage 1 Alternatives are described in Section 6.1.2 and are presented on figures 6.1.1.0, 6.1.2.0 and 6.1.3.0.

Section 6.5.2.2 outlines the methodology utilised to carry out the assessment of alternatives, Section 6.5.2.3 details the assessment and a summary is presented in Section 6.5.2.4.

6.5.2.2 Methodology

The assessment of Material Assets Non-Agriculture is conducted in the context of the constraints identified in Section 4.5 of this report and the following alternatives proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

For this assessment, the potential impacts on the following were assessed:

- The following property types:
  - Residential properties
  - Commercial and industrial properties
  - Amenity Spaces (Recreation, Tourism and Leisure)
  - Proposed developments
- The infrastructure for both public and private utilities/service providers

The assessment of each alternative includes both a quantitative and qualitative assessment. Firstly, each potential impact on Material Assets Non-Agriculture is quantified and then the level of impact and its significance assigned for each impact as per Table 6.5.2.1. Following this an overall assessment of the cumulative impacts for the alternative is completed and scored based on the seven-point scale listed in Table 6.1.1 of this report.

Assessment Methodology for Material Assets Excluding Utilities and Services

For the purposes of assessing direct impacts on properties, the extents of the works required for each alternative were considered.

Level of Impact

The potential impact of the alternative on non-agricultural properties was assessed according to the significance criteria detailed in Table 6.5.2.1.

Table 6.5.2.1 Criteria for Assessing the Significance of Impact on Non-Agricultural Properties

Significance Level / Degree of Impact	Definition
Major or Highly Negative	A non-agricultural property of national or regional importance is fully required and will be removed by the proposed Alternative
Moderately Negative	A non-agricultural property or other material asset is fully required and may result in the demolition or acquisition of a dwelling or, where acquisition of a property results in loss of employment and total or partial loss of the business
Minor or Slightly Negative	Part of a non-agricultural property or other material asset is required
Not Significant or Neutral	An impact on a property which is currently occupied by a public right-of-way, e.g. a road or the non-agricultural property

The level of impacts for residential, commercial and industrial properties have been considered under three categories:

- All properties considered as full acquisitions are Major or Highly Negative or Moderately Negative impacts depending on the significance of the asset
- Any property holding partially impacted, depending on the extent of the landtake these impacts vary from Minor or Slightly Negative to Not Significant or Neutral
- An impact on a property which is currently occupied by a public right-of-way, e.g. a road or the non-agricultural property is considered to be Not Significant or Neutral

Assessment Methodology for Utilities and Services Infrastructure

The locations of existing utilities were requested from the relevant utility service providers. At this stage of the assessment of Alternatives, it is difficult to consider all utilities that are impacted by all the Alternatives.

There are considerable numbers of low voltage ESB lines, servicing every home and business in the study area. These services were not assessed as part of this assessment, as they are considered to be a minor constraint and could be readily diverted where necessary. The ESB services that have been assessed (see bullet list below) are considered to be the major utilities for this service provider and pose more significant constraints for the Project.

Similarly, there are numerous small diameter foul, combined and surface water sewers and watermains throughout the Study Area that have not been considered as part of this assessment, as they are considered to be a minor constraint and could be readily diverted where necessary. The assessment has been carried out based on

the larger diameter, more critical services, as detailed in the bulleted list below, as these pose more significant constraints for the Project.

In summary, as a preliminary assessment of the Alternatives, impacts on larger utilities and services were assessed. The following utilities and services were considered for the assessment:

- ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)
- ESB High Voltage Underground Lines (HV UG)
- ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)
- ESB Substations
- Irish Water watermains with pipe diameter greater than 300mm
- Irish Water foul or combined sewers with pipe diameters greater than 300mm
- Water/wastewater treatment plants
- Telecoms Antennas
- Eir underground services
- E-Net services
- BT services – BT were contacted however it is their policy to not provide electronic data for large swathes of areas however, they did confirm that there are BT fibre optic cables within the N4 study area. BT services are present within the N4 study area at the following locations:
    - Leitrim Leisure Centre
    - Rosebank Retail Park
    - Along the railway line
    - At the train station

In addition, the existing waste facilities within the study area have been identified in Section 4.5 Material Assets Non-Agricultural Constraints. The methodology described above for Material Assets Non-Agriculture excluding utilities and services assessment was also used for the assessment of waste facilities. The extents of the works for each alterative was examined against these constraints identified and any waste facility within this footprint was assessed as an impact.

Level of Impact

The potential impact of the alternatives on non-agricultural properties was assessed according to the significance criteria detailed in Table 6.5.2.2.

Table 6.5.2.2 Criteria for Assessing the Significance of Impact on Non-agricultural Properties

Significance Level / Degree of Impact	Definition
Major or Highly Negative Profound	Removal of a service or utility that is of national or regional importance
Moderately Negative	Major diversion of High Voltage ESB lines (38kV, 110kV or 220kV) or fibre optic telecoms
Minor or Slightly Negative	Minor diversion of High Voltage ESB lines (38kV, 110kV or 220kV) or fibre optic telecoms
Not Significant or Neutral	The diversion of low and medium voltage ESB network, telecommunications or water supply or foul sewer services

6.5.2.3 Alternatives Assessment

Three alternatives are proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

Alternative A: Active Travel

The only measure within Alternative A that may have an impact on Material Assets Non-Agriculture is the provision of a new pedestrian/cycle facility across the River Shannon west (upstream) of the existing bridge. However, any landtake potentially associated with this crossing would be from existing paved public lands.

Alternative A: Active Travel is considered to be Not Significant or Neutral from a Material Assets Non-agriculture perspective and given a PAG scoring of 4.

Alternative B: Public Transport Improvements

Alternative B: Public Transport Improvements will have no impacts on Material Assets Non-Agriculture as there is no direct impact on a material asset including utilities/services and is considered to be Not Significant or Neutral and given a PAG scoring of 4.

Alternative C: Demand Management

Alternative C: Demand Management will have no material impacts on Material Assets Non-Agriculture and is considered to be Not Significant or Neutral and given a PAG scoring of 4.

6.5.2.4 Summary

The overall assessment of the Stage 1 Alternatives, in terms of material assets non-agriculture is presented in Table 6.5.2.3 below.

Table 6.5.2.3 Stage 1 Material Assets- Non- Agriculture Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Material Assets Non-agriculture excluding Utilities and Services	The only measure for this alternative that may impact on Material Assets is the provision of a new pedestrian / cycle facility across the River Shannon west (upstream) of the existing bridge. It is not envisaged that there would be any landtake however, any landtake that potentially be associated with this crossing would be from public lands and as such is considered Not Significant or Neutral.	No direct impact on a material asset expected.	No direct impact on a material asset expected.
Utilities and Services	No direct impact on utilities / services expected.	No direct impact on utilities / services expected.	No direct impact on a material assets expected.
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact level	**4**	**4**	**4**

6.5.3 Stage 1 Material Assets – Agriculture Assessment of the Alternatives

6.5.3.1 Introduction

This section details the Stage 1 assessment of the alternatives with respect to the agricultural constraints identified in Section 4.6 Material Assets – Agriculture of this report.

Section 6.5.3.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 6.5.3.3 with Section 6.5.3.4 outlining the general summary of the Material Assets – Non-Agriculture assessment of the alternatives.

6.5.3.2 Methodology

The following guidelines and legislation were referred to when undertaking this Stage 1 Alternatives assessment:

- European Union (2018) (Planning and Development) (Environmental Impact Assessment) Regulations (SI 296 of 2018)
- Environmental Protection Agency (EPA) (August 2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports[20]
- Transport Infrastructure Ireland (TII) (2016) Project Appraisal Guidelines Unit 7.0 - Multi Criteria Analysis, PE-PAG-02031[1]

This assessment is a combination of a desktop assessment of available data sources combined with the on-site survey conducted in August 2020 as part of the Constraints Study. The desktop study considered the following sources of information:

- Aerial mapping/photography[21]
- Property Registration Authority of Ireland (PRAI)[22] database
- Soil mapping data from the Teagasc Irish Soil Information System[23]

[20]Environmental Protection Agency (EPA), August 2017. Guidelines on the Information to be contained in Environmental Impact Assessment Report. Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf
[21] Google Aerial Mapping, 2021. Available at: https://www.google.com/maps
[22]Property Registration Authority, 2021. Available at: https://www.landdirect.ie/index
[23]Teagasc, Irish Soil Information System. Available at: http://gis.teagasc.ie/soils/

- Data regarding agriculture in Counties Roscommon and Leitrim from the Central Statistics Office (CSO) [24] [25] [26]

Information regarding the location and types of farm yards, farm types, land use/cropping and land quality was obtained from the site survey and examination of the afore mentioned desktop sources of information. The information in Table 4.6.1 of Section 4.6.2.3, Material Assets – Agriculture Constraints Study is used to categorise the sensitivity of farms. The following features have been identified from desktop and site survey information sources:

- Farm size and type was determined by referencing the CSO data for the study area and farm types were also recorded from the field survey
- Yards and farm facilities were identified using aerial photography[21] and a site survey
- Dairy, equine farms, horticultural and other high sensitivity enterprises were identified from aerial photography[21] and site survey. Their folios were identified using the PRAI[22] data
- Good and poor quality land and areas of woodland/scrub/forestry were initially identified by using the Teagasc Irish Soils Information System[23], aerial photography[21] and where possible verified with site surveying

6.5.3.3 Stage 1 Material Assets- Agriculture Assessment of Alternatives

The assessment criteria as set out in Section 3.1.5 of the 2016 PAG Guidelines[1] are used in this assessment. Viability of farms is in the low – medium range at the locations of all the alternatives. This is assessed with reference to farm size, enterprise types and soil types (see Sections 4.6.3.2 and 4.6.3.3 of the Constraints Study). The viability of high sensitivity land parcels (e.g. dairy and equine) is assumed to be higher than medium enterprises (e.g. beef and sheep).

The Do-Something alternatives are described in section 6.1 of this document. These alternatives will have minimal impacts on agriculture, requiring no landtake to allow for improvements to cycling and walking facilities, improvements to public transport and introducing measures to reduce demand for traffic. The impacts from the Do-Something alternatives are assessed as Neutral i.e. 4 on the PAG scoring scale.

[24] Central Statistics Office, December 2012. Census of Agriculture 2010 – Final Results. Available from: https://www.cso.ie/en/media/csoie/releasespublications/documents/agriculture/2010/full2010.pdf [Accessed September 2021]
[25] Central Statistics Office, 2020. Statistics, Agriculture, Census of Agriculture 2010, Agrimap. Available from: http://census.cso.ie/agrimap/ [Accessed September 2021]
[26] Central Statistics Office, 2020. Statistics, Agriculture, Crops and Livestock June Final Results, Table 4. Available from: https://www.cso.ie/en/releasesandpublications/er/clsjf/cropsandlivestocksurveyjunefinal2018/ [Accessed on September 2021]

Table 6.5.3.1 Stage 1 Material Assets- Agriculture Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Assessment Criteria 1 – Farm Size	25 ha (CSO data) compared to national average of 31.2ha PAG Score 2	25 ha (CSO data) compared to national average of 31.2ha PAG Score 2	25 ha (CSO data) compared to national average of 31.2ha PAG Score 2
Assessment Criteria 2 – Farm Type	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total) PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total) PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total) PAG Score 3
Assessment Criteria 3 – Landtake Sub-criteria – Landtake	No landtake is expected for cycling and pedestrian facilities. Potential developments will be on-line with existing road infrastructure and located in urban centres. Soil quality will be reflective of the general study area (i.e. medium quality overall)	No landtake proposed for park & ride facilities and bus lanes. Potential developments will be on-line with existing road infrastructure and located in urban centres. Soil quality will be reflective of the general study area (i.e. medium quality overall)	No landtake required for traffic management measures on the existing road network. Potential developments will be on-line with existing road infrastructure and located in urban centres. Soil quality will be reflective of the general study area (i.e. medium quality overall)
Sub-Criteria – Impacts On farm yards	Any potential impact on farm yards likely to be along the edges of existing roads with potential disturbance to farm yard entrances – impacts would either be ‘Not Significant or Neutral’ or ‘Minor or Slightly Negative’. PAG Score 4	Any potential impact on farm yards likely to be along the edges of existing roads with potential disturbance to farm yard entrances – impacts would be ‘Not Significant or Neutral’ or ‘Minor or Slightly Negative’. PAG Score 4	Any potential impact on farm yards likely to be along the edges of existing roads with potential disturbance to farm yard entrances – impacts would be ‘Not Significant or Neutral’ or ‘Minor or Slightly Negative’. PAG Score 4

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Assessment Criteria 4 – Severance (length off-line)	Landtake proposed would be mainly on-line with existing roads and would not cause significant severance. PAG Score 4	Landtake proposed would be on-line with existing roads and would not cause significant severance. PAG Score 4	Landtake proposed would be on-line with existing roads and would not cause significant severance. PAG Score 4
Assessment Criteria 5 – Viability	Expected overall impact is likely to be slight adverse or Neutral. Baseline level is low - medium viability. PAG Score 4	Expected overall impact is likely to be slight adverse or Neutral. Baseline level is low - medium viability. PAG Score 4	Expected overall impact is likely to be slight adverse or Neutral. Baseline level is low - medium viability. PAG Score 4
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral** Impacts on high sensitivity enterprises unlikely – baseline is low – medium sensitivity. Potential impacts confined to edge of farm and no proposed landtake.	**Not Significant** or **Neutral** Impacts on high sensitivity enterprises unlikely – baseline is low – medium sensitivity. Potential impacts confined to edge of farm and no proposed landtake.	**Not Significant** or **Neutral** Impacts on high sensitivity enterprises unlikely – baseline is low – medium sensitivity. Potential impacts confined to edge of farm and no proposed landtake.
Overall PAG Score	PAG Score 4	PAG Score 4	PAG Score 4

6.5.3.4 Summary

All three alternatives scored 4 in the assessment. Based on this, the expected overall impact is likely to be Not Significant or Neutral for the alternatives presented for this project.

6.5.4 Stage 1 Air Quality Assessment of the Alternatives

6.5.4.1 Introduction

This section details the Stage 1 assessment of the alternatives with respect to the Air Quality constraints identified in Section 4.7 Air Quality of this report.

The Stage 1 Alternatives are presented on Figures 6.1.1.0, 6.1.2.0 and 6.1.3.0.

Section 6.5.4.2 outlines the methodology that was used to carry out the air quality assessment, including the assessment criteria. The air quality assessment is presented in Section 6.5.4.3 with Section 6.5.4.4 outlining the general summary of the Stage 1 Air Quality assessment of the alternatives.

6.5.4.2 Methodology

The three alternatives were each given stand-alone assessments to identify their individual potential impacts and were not rated against each-other.

The multi-criteria air quality assessment was undertaken with reference to the TII Project Appraisal Guidelines for National Roads Unit – 7.0 – Multi Criteria Analysis[1]. The assessment includes both a quantitative and qualitative element. Each impact is scored qualitatively based on the seven-point scale and an integer is assigned according to the impact level as listed in Table 6.1.1 of this report.

Using a combination of the impact scores and professional judgement a determination as to the level of the impact of each alternative was provided. The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[27] were also referred to when undertaking this assessment, particularly Table 3.3 in determining the significance of the impact.

The Air Quality assessment has been prepared in accordance with the Transport Infrastructure Ireland (TII) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes[28] and in accordance with the requirements of the TII Project Management Guidelines[33], and the TII Project Manager's Manual, 2019[29] and the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 2016[1] .

In December 2022, TII published PE-ENV-01107: Air Quality Assessment of Proposed National Roads – Standard to supersede the 2011 TII Air Quality Guidelines. Section 1.9 of PE-ENV-01107 states that '*where projects requiring*

[27] Environmental Protection Agency (EPA), 2017. Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf]
[28] National Roads Authority NRA, 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes, 2011. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf
[29] Transport Infrastructure Ireland (TII), 2019. Project Manger's Manual for Major National Road Projects PE-PMG-02042. Available at: https://www.tiipublications.ie/library/PE-PMG-02042-01.pdf

approval under Section 51, Section 177AE or Part 8 have, at the date of publication of this SD, commenced planning and design, and in particular, where technical advisor contracts have been executed, this SD should be:

- *treated as advice and guidance;*
- *employed to the greatest extent reasonably practicable; and*
- *applied in a proportionate manner, having regard to the characteristics and location of the project/maintenance works and the type and characteristics of potential impacts*.'

As this air quality assessment was undertaken well in advance of the publication of the new guidance, the assessment relied on the 2011 guidance.

6.5.4.3 Stage 1 Air Quality Assessment of Alternatives

The alternatives assessment comprises three alternatives:

- Alternative A: Active Travel - includes improvements to cycling and walking facilities
- Alternative B: Public Transport - includes improvements to public transport
- Alternative C: Demand Management - reduces demand

Alternative A: Active Travel

From an air quality perspective Alternative A is likely to result in a positive impact for existing sensitive properties[30] along the existing N4 and through Carrick-on-Shannon. The potential change in traffic volumes will depend on the modal shift towards active travel and any potential significant reduction in private vehicles along the road networks. Overall, there is potential for a Minor or Slightly Positive impact to air quality from this alternative.

Alternative B: Public Transport

From an air quality perspective Alternative B is likely to result in a positive impact for existing sensitive properties along the existing N4 and through Carrick-on-Shannon. The potential change in traffic volumes will depend on the modal shift towards public transport and any potential significant reduction in private vehicles along the road networks. Overall, there is potential for a Minor or Slightly Positive impact to air quality from this alternative.

Alternative C: Demand Management

From an air quality perspective Alternative C is likely to result in a positive impact for existing sensitive properties along the existing N4 and through Carrick-on-Shannon. The potential change in traffic volumes will depend on the reduced demand and any resulting potential significant reduction in private vehicles along

[30] Department of House, Planning and Local Government, 2021. National Planning Applications. Available from: https://data.gov.ie/dataset/national-planning-applications]

the road networks. Overall, there is potential for a Minor or Slightly Positive impact to air quality from this alternative.

Table 6.5.4.1 Stage 1 Air Quality Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Traffic Volumes	Modal shift resulting in a reduction in private vehicles	Modal shift resulting in a reduction in private vehicles	Reduced demand resulting in reduction in private vehicles
Scoring			
Qualitative assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**
Score / Impact level	**5**	**5**	**5**

6.5.4.4 Summary

The air quality assessment concludes that all three alternatives would result in a potential Minor or Slightly Positive impact to air quality dependent on the reduction in private vehicles on the existing road network.

6.5.5 Stage 1 Climate Assessment of the Alternatives

6.5.5.1 Introduction

This section details the Stage 1 assessment of the alternatives with respect to the Climate constraints identified in Section 4.8 Climate of this report.

The Stage 1 Alternatives are presented on Figures 6.1.1.0, 6.1.2.0 and 6.1.3.0.

Section 6.5.5.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 6.5.5.3 with Section 6.5.5.4 outlining the general summary of the Stage 1 Climate assessment of the alternatives.

6.5.5.2 Methodology

The three alternatives were each given stand-alone assessments to identify their individual impacts and were not assessed against each other.

The multi-criteria climate assessment was undertaken with reference to the TII Project Appraisal Guidelines for National Roads Unit – 7.0 – Multi Criteria Analysis. The assessment includes both a quantitative and qualitative element. Each impact is scored qualitatively based on the seven-point scale[1] and an integer is assigned according to the impact levels listed in Table 6.1.1.

Using the impact scores and professional judgement a determination as to the level of the impact of each alternative was provided. The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[27] were also referred to when undertaking this assessment, particularly Table 3.3 in determining the significance of the impact.

The Climate assessment has been prepared in accordance with the requirements of the TII Project Management Guidelines 2019**Error! Bookmark not defined.**, and the TII P roject Manager's Manual, 2019[29] and the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 2016[1].

6.5.5.3 Stage 1 Climate Assessment of Alternatives

The alternatives assessment comprises three alternatives:

- Alternative A includes improvements to cycling and walking facilities
- Alternative B includes improvements to public transport
- Alternative C reduces demand

Alternative A: Active Travel

This is likely to result in a positive impact to climate as the potential change in traffic volumes will depend on the modal shift towards active travel. Any potential significant reduction in private vehicles along the road networks has the potential to reduce carbon emissions. There would be embodied carbon associated with the

construction phase, however this is not expected to be significant, dependent on the works involved. There is potential for a Minor or Slightly Positive impact to climate from this alternative.

Alternative B: Public Transport

This is likely to result in a positive impact to climate as the potential change in traffic volumes will depend on the modal shift towards public transport. Any potential significant reduction in private vehicles along the road networks has the potential to reduce carbon emissions. There would be embodied carbon associated with the construction phase, however this is not expected to be significant, dependent on the works involved. There is potential for a Minor or Slightly Positive impact to climate from this alternative.

Alternative C: Demand Management

This is likely to result in a positive impact to climate as the potential change in traffic volumes will depend on the reduced car trips. Any potential significant reduction in private vehicles along the road networks has the potential to reduce carbon emissions. There would be embodied carbon associated with the construction phase, however this is not expected to be significant, dependent on the works involved. There is potential for a Minor or Slightly Positive impact to climate from this alternative.

Table 6.5.5.1 Stage 1 Climate Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Vehicle Kilometres	Modal shift resulting in a reduction in traffic volumes and reduction in vehicle kilometres travelled	Modal shift resulting in a reduction in traffic volumes and reduction in vehicle kilometres travelled	Reduced demand resulting in a reduction in traffic volumes and reduction in vehicle kilometres travelled
Embodied Carbon	Low embodied carbon, dependent on works	Low embodied carbon, dependent on works	Low embodied carbon, dependent on works
Scoring			
Qualitative assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**
Score / Impact level	**5**	**5**	**5**

6.5.5.4 Summary

The climate assessment concludes that all three alternatives would result in a potential Minor or Slightly Positive impact to climate dependent on the reduction in vehicle kilometres travelled on the existing road network and the embodied carbon associated with the works.

6.5.6 Stage 1 Noise and Vibration Assessment of the Alternatives

6.5.6.1 Introduction

This section details the Stage 1 assessment of the alternatives with respect to the Noise and Vibration constraints identified in Section 4.9 Noise and Vibration of this report.

The Stage 1 Alternatives are presented on Figures 6.1.1.0, 6.1.2.0 and 6.1.3.0.

Section 6.5.6.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 6.5.6.3 with Section 6.5.6.5 outlining the general summary of the Noise and Vibration assessment of the alternatives.

6.5.6.2 Methodology

The noise impact assessment has been conducted in accordance with the relevant guidance provided in Section 5.0 of the National Roads Authority (NRA) 2004 Guidelines for the Treatment of Noise and Vibration in National Road Schemes[31], Section 2 of the 2014 Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes[32] and in accordance with the requirements of the TII Project Management Guidelines 2019[33] the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 2016[1] and Design Manual for Roads and Bridges (DMRB) (UKHA, 2020)[34].

In terms of operational noise, the NRA 2004 Noise and Vibration Guidelines[31] and the TII Noise Guidelines 2014[32] consider it appropriate to set the design goal for road traffic noise for new national roads in Ireland as follows:

- Day-evening-night 60 dB L_{den} (free field)

Both the NRA 2004[31] and TII 2014[32] noise documents referred to above acknowledge that it may not always be sustainable to achieve this design goal. In such circumstances, nevertheless, a structured approach should be taken in order to ameliorate as far as practicable road traffic noise through the consideration of measures such as alignment changes, barrier type (e.g., earth mounds) or low noise road surfaces.

[31]NRA, 2004. Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Treatment_of_Noise_and_Vibration_in_National_Road_Schemes.pdf
[32] Transport Infrastructure Ireland (TII), 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Good_Practice_Guidance_for_the_Treatment_of_Noise_during_the_Planning_of_National_Road_Schemes.pdf
[33] Transport Infrastructure Ireland (TII), 2019. Project Management Guidelines PE-PMG-02041
[34] Design Manual for Roads and Bridges (DMRB) (UKHA, 2020).

6.5.6.3 Assessment Criteria

The assessment of potential noise impacts and ranking of option corridors is generally based primarily upon property counts, a review of the likely requirement for mitigation measures based on the indicative noise footprint for each alternative, and changes in traffic flows. As there are no corridors associated with the alternatives, it is not possible to do a property count and so the assessment is entirely qualitative.

Impact Rating Score

Based on the quantitative and qualitative analysis undertaken for each corridor option, all options have been assessed against the following scoring system based on the TII Project Appraisal Guidelines for National Roads Multi Criteria Analysis as listed in Table 6.1.1 of this report.

6.5.6.4 Stage 1 Noise and Vibration Assessment of Alternatives

Alternative A: Active Travel

From a noise point of view this alternative is likely to result in a neutral to potentially positive impact for existing noise sensitive properties along the existing N4 and through Cortober and Carrick-on-Shannon. The potential change in traffic noise levels will depend on the modal shift towards active travel and any potential significant reduction in private vehicles along the road networks.

Alternative B: Public Transport Improvements

From a noise point of view this option is likely to result in a neutral to potentially positive impact for existing noise sensitive properties along the existing N4 and along through Carrick-on-Shannon. The potential change in traffic noise levels will depend on the modal shift towards public transport and any potential significant reduction in private vehicles along the road networks.

Alternative C: Demand Management

From a noise point of view this option is likely to result in a neutral to potentially positive impact for existing noise sensitive properties along the existing N4 and along through Carrick-on-Shannon. The potential change in traffic noise levels will depend on the success of demand reduction on the use of private vehicles along the road networks.

6.5.6.5 Summary

All alternatives are assessed as having a Not Significant or Neutral impact with respect to noise and vibration.

Table 6.5.6.1 Stage 1 Noise and Vibration Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Potential change in traffic noise levels	Neutral to Not Significant (Positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.	Neutral to Not Significant (Positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.	Neutral to Not Significant (Positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact level	**4**	**4**	**4**

6.5.7 Stage 1 Archaeological, Architectural and Cultural Heritage Assessment of the Alternatives

6.5.7.1 Introduction

This section details the Archaeological, Architectural and Cultural Heritage assessment of the alternatives with respect to the Archaeology, Architectural and Cultural Heritage constraints identified in Section 4.10 Archaeology, Architectural and Cultural Heritage of this report.

The Stage 1 Alternatives are presented on Figures 6.1.1.0, 6.1.2.0 and 6.1.3.0. The sites are referenced as per the Leitrim County Development 2015-2021, noting that the Draft Leitrim County Development Plan 2023-2029 will come into effect on 21 March 2023. The proposed additions and deletions to the protected structures listed in the new Plan have been reviewed and this assessment of the Alternatives remains unchanged.

Section 6.5.7.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 6.5.7.3 with Section 6.5.7.4 outlining the general summary of the Stage 1 Archaeological, Architectural and Cultural Heritage assessment of the alternatives.

6.5.7.2 Methodology

Analysis of traffic patterns in the study area has revealed that a considerable number of short distance trips within the Carrick-on-Shannon and Cortober area are made by car. This is a contributing factor to existing congestion on the N4. Improvements to the walking and cycling infrastructure within the town, in addition to enhancements to local bus services would support an increase in sustainable trip making. As part of the project appraisal process, these measures have been assessed as an alternative to building new road infrastructure. Alternatives assessed are as follows:

- Alternative A: Active Travel
- Alternative B: Public Transport improvements
- Alternative C: Demand Management

The Alternatives Assessment has been carried out with reference to the TII Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes[35] and Assessment of Architectural Heritage Impacts of National

[35] Transport Infrastructure Ireland, 2005. Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Assessment-of-Archaeological-Heritage-Impact-of-National-Road-Schemes.pdf

Road Schemes[36], although it should be noted that the guidelines themselves predate the establishment of an alternative options/preliminary options assessment process.

The methodology addressed an area comprising a 250m buffer either side of where interventions may be required as part of the alternatives. This enables a meaningful assessment of potential positive and negative direct and indirect impacts upon the archaeological, architectural and cultural heritage resource.

A positive impact is possible if it results in a change that improves or enhances the setting of an archaeological/architectural monument/structure with the scale varying from imperceptible positive, if the impact is capable of measurement but is without noticeable consequences, to minor or slightly positive to moderately positive depending on the degree to which it enhances the integrity or sensitivities of the site.

A direct impact occurs where an asset is within the potential footprint of interventions required as part of the alternatives. An indirect impact may occur where the asset is within the 250m wide buffer zone of the proposal. For the purposes of this assessment, the establishment of cycle ways and traffic management measures within the existing road network are not considered to represent interventions that may negatively affect the archaeological, architectural or cultural heritage resource. This is due to the fact that such measures represent a re-use of the existing road network which is neutral when applied to potential impacts on the resource under assessments – these types of impact are classified as neutral.

Measurements are taken from the edge of the proposed interventions to the upstanding remains of a site or structure, or to the edges of features/monuments where they are visible on aerial photography. Where no upstanding remains are visible, and there is no visible indication of subsurface remains (e.g. cropmarks), the measurement is taken from the edge of the potential interventions to the centre of the site as recorded by the RMP, NIAH etc. These measurements are noted as "Distance from Alternative" in the assessment tables herein.

Potential impacts on key constraints have been assessed, including recorded monuments, protected structures, NIAH structures and designed landscapes.

Assessment Criteria

The TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi Criteria Analysis [1](hereafter referred to as the TII PAG) was used as a basis for the assessment of potential impacts on the archaeological, architectural and cultural heritage resource. Impacts were assessed on a scale of 1 – 7 as listed in Table 6.1.1 of this report.

The assessment was informed by the Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Specifically, the significance of effects, as detailed in Table

[36] Transport Infrastructure Ireland, 2005. Guidelines for the Assessment Architectural Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Assessment_of_Architectural_Heritage_Impact_of_National_Road_Schemes.pdf

3.3 of that document, have been aligned with those impacts described above. This alignment is demonstrated in Table 6.5.7.1.

Table 6.5.7.1 Alignment of TII and EPA Impact Guidelines

TII Guidelines	EPA Guidelines
Majorly Positive 7	Profound Positive
	Very Significant Positive
Moderately Positive 6	Significant Positive
	Moderately Positive
Minor or Slightly Positive 5	Slight Positive
	Not Significant Positive
Not Significant or Neutral 4	Imperceptible
	Not Significant
Minor or Slightly Negative 3	Slightly Negative
Moderately Negative 2	Moderately Negative
	Significant Negative
Major or Highly Negative 1	Very Significant Negative
	Profound Negative

Due to the more condensed nature of the TII scale of impacts in comparison with that provided by the EPA, the impact assessment detailed in Section 6.5.7.3 remains high level at this stage.

6.5.7.3 Stage 1 Archaeological, Architectural and Cultural Assessment of Alternatives

Three alternatives are proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

For the most part all of the alternatives relate to interventions, initiatives and works located primarily on and within the existing street network, with some elements (e.g. mobility hub (Alternative B); park and stride sites (Alternative C)) provided on existing brownfield/parking areas and therefore, have broadly similar landscape and visual impacts. All of the alternatives, but more so Alternative A, provide for an enhanced pedestrian/cycle friendly environment within Carrick-on-Shannon and Cortober. Alternative A also provides for an enhanced pedestrian/cycle network along the full length of the N4 within the study area.

Alternative A: Active Travel

Alternative A comprises improvements to cycling and walking facilities and includes the elements as follows:

- Development of a comprehensive cycle network
- Improved facilities for cyclists (cycle parking, changing areas, e-bike charging, etc.)
- Improvements to pedestrian facilities (e.g. improved crossings and footpath provision)
- Improve permeability (non-motorised) within the town
- Potential pedestrianisation of key streets
- Construction of a new pedestrian and cycle bridge

The construction of a new pedestrian and cycle bridge represents the only intervention that may negatively affect the archaeological, architectural and cultural heritage resource. The location of the new pedestrian/cycle bridge across the River Shannon west (upstream) of the existing bridge is within the context of a protected view upstream from the existing bridge and the structure will interrupt views of the river and harbour from the bridge. The proposed bridge will be of sufficiently high level to allow for cruising on the river and will also offer new views upstream and downstream to the existing bridge. However, the tie-in of the bridge will also impact on the existing open space on the Cortober side of the river and the quay road/harbour edge area on the Carrick-on-Shannon side of the river. The harbour/river quay walls are protected structures, and the surrounding area lies within the Architectural Conservation Area (ACA) of Carrick-on-Shannon town.

Table 6.5.7.2 Alternative A: New Pedestrian and Cycle Bridge

Site Ref.	Name	Statutory Protection?	Distance from alternative	Impact Type	Potential Impact level
AH 64	Historic Town (Carrick-on-Shannon)	Yes	0m	Direct	Significant Negative
BH 4 /AH 64	Carrick-on-Shannon Bridge	No	25m SE	Indirect	Significant Negative
BH 4	Historic quay side	Yes	0n	Direct	Significant Negative
BH 4	Limestone steps	Yes	20m SE	Indirect	Slight Negative
BH 4	Post Box	Yes	40m south	Indirect	Imperceptible Negative
AH 63	House 17th century	No	50m south	Indirect	Imperceptible Negative
AH 64	Fortification	Yes	75m east	Neutral	N/A
BH 4	ACA	Yes	0m	Direct	Significant Negative

Alternative B: Public Transport Improvements

Alternative B comprises improvements to public transport in and around Carrick-on-Shannon, and includes the following measures:

- Development of an enhanced public transport network
- Increased frequency on the rail network
- Improved parking facilities at Carrick-on-Shannon railway station
- Linking of nearby urban settlements with Carrick-on-Shannon and key trip attractors in the town
- Increase in public transport services (i.e. up to every 20 minutes during peak periods)
- Development of a mobility hub in the town centre facilitating interchange with other modes
- Provision of demand responsive mini-bus services connecting isolated areas to Carrick-on-Shannon and Cortober

Alternative B will involve an improvement and/or new bus services on the existing street network. This will involve additional signage and possible bus-stops but will not require land acquisition and significant construction.

Alternative B will also include improvements to the rail service which will be accomplished without new rail infrastructure construction. The addition of new facilities at the rail station could include line markings and signage to delineate parking for cyclists and/or vehicles.

This alternative will not negatively affect the archaeological, architectural and cultural heritage resource, as it represents changes to the existing travel network. As such the alternative is considered to be neutral.

The assessment is presented in the summary Table 6.5.7.3.

Alternative C: Demand Management

Alternative C involves reducing demand for car trips through Carrick-on-Shannon and includes the following measures:

- Rationalise parking along the existing N4 corridor
- Provision of Park & Stride sites on periphery of town centre
- Development of a car free town centre
- Development of remote working hubs
- Delivery of centrally located mixed use developments

Alternative C will involve measures to reduce the need to make the trip by car in the first instance. As such, it will be a reduction measure as opposed to a provision measure with a reassignment of on-street parking/existing traffic lanes to provide walking or cycling facilities or urban realm, which will not require land acquisition

and significant construction. The creation of Park and Stride sites will be located on existing brownfield sites or reassigned existing parking lots.

This alternative will not negatively affect the archaeological, architectural and cultural heritage resource. Proposals include for the reduction and removal of traffic within the town centre, which would overall have a moderately to significant positive impact on the built heritage environment, especially, including the designated Architectural Conservation Area. As such the alternative is considered to be Moderately Positive.

The assessment is presented in the summary Table 6.5.7.3.

Table 6.5.7.3 Stage 1 Archaeological, Architectural and Cultural Heritage Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Impacts to number of sites subject to statutory protection	Major or Highly Negative: 0 Moderately Negative: 3 Minor or Slightly Negative: 1 Not Significant or Neutral: 2	None predicted.	Potential positive impacts on the overall built heritage resource of the town of Carrick-on-Shannon, including protected structures and the ACA.
Impacts to number of sites not subject to statutory protection	Major or Highly Negative: 0 Moderately Negative: 1 Minor or Slightly Negative: 0 Not Significant or Neutral: 0	None predicted.	Potential positive impacts on the overall built heritage resource of the town of Carrick on Shannon, including structures of architectural merit that may not be subject to statutory protection.
Scoring	**2**	**4**	**6**
Qualitative assessment	The construction of a new pedestrian and cycle bridge has the potential to have a Moderately Negative impact on a number of archaeological and built heritage sites subject to statutory protection.	The alternative proposed will not affect the archaeological, architectural or cultural heritage resource and as such the overall affect is Not Significant or Neutral.	The alternative proposed has the potential to result in a Moderately Positive impact on the built heritage environment of Carrick-on-Shannon, due to the removal of traffic.
Score / Impact level	**Moderately Negative**	**Not Significant** or **Neutral**	**Moderately Positive**

6.5.7.4 Summary

Of the alternatives assessed, Alternative A has the potential to negatively affect the archaeological and architectural heritage resource, due to the construction of a new pedestrian and cycle bridge, adjacent to the existing Carrick-on-Shannon River Shannon Bridge. This would result in direct and indirect impacts on sites and structures that are subject to statutory protection. The remaining proposals associated with this alternative would be neutral in relation to the archaeological, architectural and cultural heritage resource.

Alternative B would be neutral in relation to the archaeological, architectural and cultural heritage resource. This is due to the reuse of the existing road network as part of the alternative proposed. No interventions would be required as part of the proposal.

Alternative C would have an overall Moderately Positive impact on the historic built heritage environment of Carrick-on-Shannon, due to the removal of traffic from the town and the pedestrianisation of streets. This positive impact can be applied to structures that are subject to statutory protection and the overall ACA, along with the structures of built heritage merit within the town that are present.

6.5.8 Stage 1 Landscape and Visual Assessment of the Alternatives

6.5.8.1 Introduction

This section describes the Stage 1 assessment of the alternatives in the context of the Landscape and Visual constraints identified in Section 4.11 Landscape and Visual of this report. The alternatives are described in Section 6.1.2 Description of Alternatives.

The Stage 1 Alternatives are presented on Figures 6.1.1.0, 6.1.2.0 and 6.1.3.0.

Section 6.5.8.2 outlines the methodology utilised to carry out the Landscape and Visual assessment of alternatives. The Landscape and Visual assessment of the alternatives is provided in Section 6.5.8.3 with associated summary assessments and scorings presented in Section 6.5.8.4.

6.5.8.2 Methodology

The landscape and visual assessment has been carried out in accordance with the following guidelines:

- Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads – Standard December 2020, Transport Infrastructure Ireland, (TII, 2020)[37]
- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft August 2017 Environmental Protection Agency, (EPA, 2017)[38]
- Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013 Landscape Institute & Institute of Environmental Management and Assessment, (GLVIA, 2013)[39]
- Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis Transport Infrastructure Ireland, (TII, 2016)[1]

The overarching approach to the landscape and visual assessment of the alternatives follows the following key steps:

- The principal landscape and visual receptors within the study area identified in the constraints study

[37] TII, 2020. Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads – Standard December 2020, Transport Infrastructure Ireland
[38] Environmental Protection Agency, 2017. Guidelines on the Information to be contained in Environmental Impact Assessment Reports. Available from: http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed May 2020]
[39] Landscape Institute, 2013. Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013, Landscape Institute & Institute of Environmental Management and Assessment

- The likely impacts of each of the alternatives on the landscape and visual receptors is identified and assessed, indicating which, if any, of these are likely to be significant
- The impact of each alternative on the landscape and visual receptors is assessed and is scored on a seven point scale in accordance with the Project Appraisal Guidelines (TII, 2016)[1]. The scale ranges from 7 to 1 as listed in Table 6.1.1 of this report

The assessment involved desktop studies and fieldwork comprising professional evaluation by experienced landscape specialists.

Sources of Information

The assessment is based on understanding the character of the existing landscape and visual environment with specific reference to:

- Leitrim County Development Plan 2015-2021 (LCC, 2015)[8]
- Carrick-on-Shannon Local Area Plan 2010-2019 (LCC, 2010)[10]
- Landscape Assessment of County Leitrim (LCC, 2020)[40]
- Roscommon County Development Plan 2022-2028 (RCC, 2022)[9]
- Cortober Local Area Plan 2008-2014 (RCC, 2008)[11]
- Landscape Character Assessment of County Roscommon (RCC, 2022)[41]
- Site-based reviews of the landscape and visual environment

The following online resources have also been accessed as part of the assessment:

- Ordnance Survey Ireland Geohive (http://map.geohive.ie/mapviewer.html)[42]
- National Monuments Service: Historic Environment Viewer (https://maps.archaeology.ie/HistoricEnvironment/)[43]
- Environmental Protection Agency GIS Mapping (https://gis.epa.ie/EPAMaps/)[44]
- Google Aerial Photography and Mapping (https://www.google.ie/maps)[45]

[40] Environmental Resources Management, 2002. Comhairle Chontae Liatroma, Landscape Assessment of County Leitrim Reference 17896.
[41] MosArt Landscape-Architecture-Research, Macroworks, Judy Osborne et. al., 2008. Landscape Character Assessment of County Roscommon. Available from: https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/stage-3-amendments/stage-3-adoption-of-plan
[42] Ordnance Survey Ireland, 2021. GeoHive Mapping Service. Available from: http://map.geohive.ie/mapviewer.html [Accessed August 2021]
[43] National Monuments Service, 2021. Historic Environment Viewer Available from: https://maps.archaeology.ie/HistoricEnvironment/
[44] Environmental Protection Agency, 2021 GIS Mapping. Available from: https://gis.epa.ie/EPAMaps/
[45] Google, 2021. Google Aerial Photography and Mapping. Available from https://www.google.ie/maps

6.5.8.3 Alternatives Assessment

Three alternatives are proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

For the most part all of the alternatives relate to interventions, initiatives and works located primarily on and within the existing street network, with some elements (e.g. mobility hub (Alternative B); park and stride sites (Alternative C) provided on existing brownfield/parking areas and therefore, have broadly similar landscape and visual impacts.

The principal exception is the requirement in Alternative A for a new pedestrian/cycle bridge to be provided across the River Shannon west (upstream) of the existing bridge. The location of the proposed bridge is within the context of a protected view upstream from the existing bridge and the structure will interrupt views of the river and harbour from the bridge. The proposed bridge will be of sufficiently high level to allow for cruising on the river and will also offer new views upstream and downstream to the existing bridge. However, the tie-in of the bridge will also impact on the existing open space on the Cortober side of the river and the quay road/harbour edge area on the Carrick-on-Shannon side of the river. The harbour/river quay walls are protected structures, and the surrounding area lies within the Architectural Conservation Area (ACA) of Carrick-on-Shannon town.

All of the alternatives, but more so Alternative A, provide for an enhanced pedestrian/cycle friendly environment within Carrick-on-Shannon and Cortober. Alternative A also provides for an enhanced pedestrian/cycle network along the full length of the N4 within the study area.

The landscape and visual assessment of the alternatives is presented in Table 6.5.8.1.

Table 6.5.8.1 Stage 1 Landscape and Visual Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Landscape (Townscape) Aspects	Positive streetscape interventions in Carrick-on-Shannon and Cortober and along existing road network. New pedestrian / cycle bridge in Carrick-on-Shannon would be high level (for cruising) and would impact existing open space with mature trees on Roscommon side of river and Quay Street / harbour area on Leitrim side of river. Alternative A will not result in a significant reduction in traffic congestion in Carrick-on-Shannon and Cortober, which will maintain the adverse effects of traffic on the townscape character.	No significant landscape / townscape impacts expected.	No significant landscape / townscape impacts expected.
Visual Aspects	Positive streetscape interventions in Carrick-on-Shannon and Cortober and along existing road network. New pedestrian / cycle bridge in Carrick-on-Shannon impacts protected view west over river / harbour from existing bridge. Alternative A will not result in a significant reduction in traffic through Carrick-on-Shannon and Cortober, which will maintain the adverse effects of traffic on the townscape / visual character.	No significant visual impacts expected.	No significant visual impacts expected.

Scoring			
Qualitative assessment	Localised temporary / short-term Significant Negative impact Localised medium / longer-term Slightly Negative impact **Minor** or **Slightly Negative**	Imperceptible or Not Significant impact **Not Significant** or **Neutral**	Imperceptible or Not Significant impact **Not Significant** or **Neutral**
Score / Impact level	**3**	**4**	**4**

6.5.8.4 Summary

All the alternatives provide for an enhanced pedestrian/cycle friendly environment within Carrick-on-Shannon and Cortober. Alternative A also provides for an enhanced pedestrian/cycle network along the full length of the N4 within the study area, however it is unlikely to reduce current traffic levels, which is having an adverse effect on the townscape and visual character of the towns. In addition, the provision of the new cycle/pedestrian footbridge will have an adverse impact on the quay side in Carrick-on-Shannon.

The other alternatives seek to either improve public transport (Alternative B), or to reduce traffic demand (Alternative C), and while either should reduce traffic on the existing N4 to some extent, they may not remove increasing pressures on the network and the associated quality of the townscape and visual environment.

6.5.9 Stage 1 Biodiversity Assessment of the Alternatives

6.5.9.1 Introduction

This section details the environmental assessment of the Stage 1 Preliminary Alternatives described in Section 6.1 with respect to the Biodiversity constraints identified in Section 4.12 Biodiversity of Chapter 4 – Constraints Study.

Section 6.5.9.2 outlines the methodology that was used to carry out the assessment and Section 6.5.9.3 details the assessment and a summary is presented in Section 6.5.9.4.

The principal objectives of the assessment are to:

- Evaluate the alternatives based on ecological criteria, as per the National Road Authority (NRA) Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)[46] and Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (2018)[47]
- Assess the significance of the likely impacts on each of the biodiversity receptors potentially impacted by each alternative. As per Transport Infrastructure Ireland (TII) guidance[46], this step discounts biodiversity receptors or ecological sites where the risk of significant impacts is unlikely, considering where the application of standard mitigation and best practice during construction is unambiguous and success is highly likely
- To assess each alternative in accordance with Transport Infrastructure Ireland's Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (TII, 2016)[1]

In fulfilling these objectives, an assessment of the likely or potential impacts that the alternatives will have on ecological receptors will be carried out. This will provide an informed judgment surrounding the alternatives' impact with knowledge of the potential ecological consequences.

6.5.9.2 Methodology

The process by which the proposed alternatives were assessed was as follows:

- The key ecological receptors within the study area were identified based on a combination of desktop studies, consultation (with relevant bodies/organisations) and field surveys

[46] National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

[47] Chartered Institute for Ecology and Environmental Management (CIEEM), 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1.pdf

- The key ecological receptors were assigned an ecological valuation based on a geographic frame of reference ranging from international to local importance
- The likely impacts of each of the alternatives on the key ecological receptors were identified and assessed, indicating which, if any, of these were likely to be significant, and at what geographical level
- The impacts of alternatives on the key ecological receptors were scored in accordance with the TII approach[1], on a seven-point scale ranging from 'Major or Highly Negative' to 'Major or Highly Positive'[48]

A final determination as to the significance of the impacts caused by the alternatives was then provided.

Key Ecological Receptors

Key ecological receptors are those biodiversity receptors confirmed, or likely to occur, within the overall study area with an ecological value of local importance (higher value) or greater; and therefore, likely to be impacted by transport alternatives:

- Designated sites for nature conservation (e.g. SACs, SPAs, NHAs, pNHAs and Nature Reserves)
- Sensitive habitats (e.g. non-designated areas of Annex I habitat[49], non-Annex I semi-natural woodland habitats and watercourses[50])
- Ecological sites (identified from a combination of desktop and field assessment)

The key ecological receptors were initially identified in the constraints study detailed in Section 4.12 Biodiversity based on collation of available existing information, from the desk study and consultations with relevant bodies/organisations, and focus on the known/potential ecological value for the habitats/species present. In the case of the ecological sites, the boundaries were initially defined based on interpretation of orthophotography and collation of available existing habitat information.

Walkover surveys of the constraints study area were undertaken in August and September 2020, along with specialist habitat surveys of two locations within the River Shannon floodplain:

1. Northwest of Carrick-on-Shannon in the townlands of Corryolus and Cloonman

[48] In respect of the Black Option and the Active Travel and Public Transport Option, these are not comparatively compared, rather assessed as standalone assessments. However, they are similarly described in as far as is possible based on the detail provided of likely or potential impacts on key ecological receptors.

[49] The short-hand names of Annex I habitats is used in this assessment, as per NPWS, 2019. The Status of European Habitats and Species in Ireland. Volume 2: Habitat Assessments. Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol2_Habitats_Article17.pdf

[50] Watercourses are referred to as per EPA, 2022. Online Map Viewer. Available at: https://gis.epa.ie/EPAMaps/

2. In the townlands of Cortober, Cordrehid, Attirory, Rinnacurreen and Drumkeeran to the south of Carrick-on-Shannon

This was further supplemented by an additional field survey undertaken in February 2021. The aim of the field surveys was a ground truthing exercise to verify the orthophotography interpretation and selection of ecological sites, refine site boundaries, assess the ecological evaluation of each of the identified ecological sites and to document additional ecological sites not identified in the desk study.

In some cases, a small number of ecological sites were viewed from a distance, owing to limited access or winter river levels covering certain areas (EC29, EC30, EC31, EC32, EC48, EC52, EC77 and EC80). In a small number of situations ecological sites could not be viewed at a distance due to the local topography or limited access (EC02, EC03 and EC05). However, assumptions have been made on the value of those ecological sites based on local information gathered during previous surveys and the desk study, as necessary.

Where possible, during the site walkover surveys, habitat types were classified using the Guide to Habitats in Ireland (Fossitt, 2000)[51] and the likelihood or potential for Annex I habitat types was confirmed where possible or inferred based on the professional judgement of the surveyor, with reference to the Interpretation manual of European Union Habitats EUR 28 (CEC, 2013)[52]. Where it was not possible to confirm the presence of Annex I habitats, a precautionary approach was adopted with regards to the identification of the potential presence of Annex I habitats within an ecological site.

Ecological Valuation

The key ecological receptors identified have been valued with regard to ecological valuation guidance set out in Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)[46] and Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018)[47].

The following geographic frame of reference is used when valuing the key ecological receptors:

- International importance
- National importance
- County importance
- Local importance (higher value)

All Annex I habitats that lie outside of European sites, are valued as being of at least national importance, given that these habitats are of high conservation concern. Priority Annex I habitat types that lie outside of European sites may be valued as

[51] Fossitt, J.A., 2000. A Guide to Habitats in Ireland. Heritage Council, Kilkenny. Available at: https://www.npws.ie/sites/default/files/publications/pdf/A%20Guide%20to%20Habitats%20in%20Ireland%20-%20Fossitt.pdf

[52] Commission of the European Communities (CEC), () 2013. Interpretation manual of European Union Habitats EUR28. European Commission, DG Environment. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

being of international importance given that they are of the highest conservation concern at a European level (i.e., natural habitat types in danger of disappearance[53]).

For individual sites (e.g. designated sites, watercourses or ecological sites identified during the Constraints Study), the overall ecological valuation for each of the key ecological receptors was based upon the highest value receptor known to be present, or potentially present, within the ecological site.

Assessment Criteria

The assessment of the alternatives included both a quantitative and qualitative assessment. Firstly, the impacts on each key ecological receptor are assessed.

Although a given alternative may impact upon a particular key ecological receptor, the direct impact(s) on the site may not necessarily directly impact on the highest value receptor(s). This is accounted for in the assessment as much as possible, based on the level of ecological information available.

To assess the likely ecological impacts of the alternatives on individual key ecological receptors, the following criteria are applied, with the use of professional judgement as to the likelihood of significant effects occurring:

- Potential impacts on an ecological receptor of national/international importance were assessed as being Major or Highly Negative
- Potential impacts on an ecological receptor of county importance were assessed as being Moderately Negative
- Potential impacts on a receptor of local importance (higher value) were assessed as being minor or Slightly Negative

To assess the likely cumulative overall ecological impacts for the alternatives, the following criteria were applied, in conjunction with the use of professional judgement as to the likelihood of significant effects occurring:

- Biodiversity impacts are Major or Highly Negative if:
    - the impact is directly on one or more designated sites valued as international or national importance (i.e. SAC, SPA, pNHA or NHA)

    or

    - the impacts associated with constructing a road within the option corridor would likely result in an adverse effect on the integrity of the SAC/SPA/pNHA/NHA site (i.e. for SAC/SPA this could equate to the loss of qualifying interest habitat or undermining the conservation objectives, and for pNHA/NHA this could relate to the loss of features for which the site is designated)
- Biodiversity impacts are Moderately Negative if:

[53] From the definition of "*priority natural habitat types*" in Article 1(d) of the Habitats Directive. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

- the impact is directly on one or more non-designated ecological sites valued as national or county importance, or numerous ecological sites valued as local high importance

or

- the impacts associated with constructing a road within the option corridor would likely result in permanent/long-term effects on non-qualifying interest Annex I habitat or on a species population considered to be of national importance

or

- Impacts associated with constructing a road within the option corridor would likely have permanent/long-term effects on a habitat(s) or on a species population considered to be of county/local (high) importance

- Biodiversity impacts are Minor or Slightly Negative if:
  - the impact is directly on a small number of ecological sites valued as local high importance

  or

  - the impacts associated with constructing a road within the option corridor would likely have permanent/long-term effects on a habitat(s) or on a species population considered to be of local (high) importance

Considering these cumulative impacts each alternative was then scored, based on the seven-point scale and an integer was assigned according to the impact significance as listed in Table 6.1.1 of this report.

As the alternatives are each assessed individually and are not assessed against each other an assessment score is assigned but they are not assigned as Least Preferred, Intermediate or Preferred.

6.5.9.3 Alternatives Assessment

The Alternatives which have been considered feasible for this project comprise of public transport proposals and measures to improve active travel and demand management measures. The aim of these proposals is to encourage a shift away from private car usage, therefore reducing the number of private vehicles on the section of the N4 under consideration. This has the potential to relieve existing and forecasted capacity issues in the study area. A description of these alternatives has been provided within previous sections of this report but can be categorised as follows:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

For the most extent all of the alternatives relate to interventions, initiatives and works primarily on and within the existing street network, with some elements (e.g. mobility hub (Alternative B); park and stride sites (Alternative C)) provided on existing brownfield/parking areas and therefore, have broadly similar biodiversity

impacts. Neither of these alternatives interact with any ecological sites or watercourses identified.

The principal exception to this is the requirement in Alternative A with the inclusion of a new pedestrian/cycle bridge to be provided across the River Shannon west (upstream) of the existing bridge. The inclusion of this new pedestrian/cycle bridge would result in potentially significant effects on the River Shannon, a river of national importance, including shading effects, direct disturbance to species within the watercourse, potential contamination of the watercourse from construction run-off, etc.

All of the alternatives, but more so Alternative A, provide for an enhanced pedestrian/cycle friendly environment within Carrick-on-Shannon and Cortober. Alternative A also provides for an enhanced pedestrian/cycle network along the full length of the N4 within the study area.

The alternatives (i.e. Active Travel, Public Transport and Demand Management Measures) are subject to stand alone assessments rather than a comparative assessment as these could be implemented as standalone measures or implemented as complementary measures to the Option Corridors assessed in Chapter 7 of this report as part of the overall transport solution. Table 6.5.9.1 shows which ecological receptors are impacted by the alternatives.

Table 6.5.9.1 Breakdown of the Key Ecological Receptors which are Impacted by the Proposed Alternatives

	Receptors of International Importance Impacted	Receptors of National Importance Impacted	Receptors of County Importance Impacted	Receptors of Local Importance (Higher Value) Impacted
Alternative A: Active Travel	N/A	River Shannon	N/A	N/A
Alternative B: Public Transport	N/A	N/A	N/A	N/A
Alternative C: Demand Management	N/A	N/A	N/A	N/A

Table 6.5.9.2 Stage 1 Biodiversity Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Significant impact on sites of International Importance (Major or Highly Negative) (Number)	0	0	0
Significant impact on sites of National Importance (Major or Highly Negative) (Number)	1	0	0
Significant impact on sites of County Importance (Moderately Negative) (Number)	0	0	0
Significant impact on sites of Local Importance (Higher Value) (Minor or Slightly Negative) (Number)	0	0	0
Scoring			
Qualitative Assessment	Potential impacts on the River Shannon (a nationally important watercourse). On a precautionary basis assuming a new cycle / pedestrian bridge will be constructed over the River Shannon. Will be reassessed if no new bridge / structures are required. **Moderately Negative**	It is not envisaged that this alternative would require greenfield landtake therefore, no likely impacts of any ecological sites or watercourses are predicted **Not Significant** or **Neutral**	It is not envisaged that this alternative would require greenfield landtake therefore, no likely impacts of any ecological sites or watercourses are predicted **Not Significant** or **Neutral**
Score / Impact Level	**2**	**4**	**4**

6.5.9.4 Summary

Neither Alternative B or Alternative C (i.e. Public Transport Improvements or Demand Management) will impact directly on any watercourses or any ecological sites, at any geographical scale. Additionally, given the nature and scale of the works as outlined in Section 6.1 neither of these Alternatives are likely to result in indirect effects on any ecological sites.

The majority of proposed measures contained within Alternative A will not result in any impacts to ecological sites identified. However, Alternative A does propose the construction of a new pedestrian/cycle bridge across the River Shannon, a nationally important watercourse. Likely significant effects are predicted on the River Shannon as a result of the construction of a new pedestrian/cycle bridge.

6.5.10 Stage 1 Hydrology Assessment of the Alternatives

6.5.10.1 Introduction

This section details the Stage 1 assessment of the alternatives in the context of the hydrological constraints identified in Section 4.13 Hydrology of this report.

Section 6.5.10.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 6.5.10.3 and a summary provided in Section 6.5.10.4.

6.5.10.2 Methodology

The principal objectives of the study are to:

- Complete a desk study and field investigations to obtain relevant hydrological data for each proposed alternative
- Identify and describe sites of known potential hydrological interest
- Assess the significance of the likely impacts of the proposed alternatives on each of these hydrological receptors
- To evaluate and compare each alternative based on hydrological criteria, as per NRA (2008) Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes[54], taking into account interactions with other environmental disciplines
- To assess each alternative in accordance with the TII (2016) Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis [1]
- Based on the above assessment, to determine the scale of the impact of each of the alternatives

In fulfilling these objectives, an assessment on the likely impacts of the alternatives on hydrological constraints and ecological receptors, can be carried out. An informed choice can therefore be made with the knowledge of the potential ecological consequences. This enables the importance of the proposed effects and the scope for mitigating these to be appropriately evaluated.

The extent of the overall study area has been identified and detailed in Chapter 4 Constraints Study, refer to Hydrology Constraints Figures 4.13.1.0 to 4.13.4.5.

The TII PAG Guidelines provide criteria for ranking of the identified hydrological constraints within the assessment study area. Criteria for rating an impact significance that may arise at each hydrological constraint are provided within Box 4.4 of the TII PAG Guidelines and are reproduced in Table 6.5.10.1. The impact significance assessment takes into account the attribute importance and the predicted scale and duration of the likely impacts.

[54] NRA, 2008. Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available from: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

Table 6.5.10.1 Criteria for Rating Impact Significance at Route Selection Stage – Rating of Significant Environmental Impacts at Route Selection Stage from Box 4.4 of the Guidelines and associated TII PAG Scores

Impact Level	Attribute Importance				
	Extremely High**	**Very High**	**High**	**Medium**	**Low**
Profound (PAG Major or Highly Negative, 1)	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant (PAG Major or Highly Negative, 1)	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on Significant proportion of attribute		
Moderate (PAG Moderately Negative, 2)	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight (PAG Minor or Slightly Negative, 3)		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible (Not Significant or Neutral, 4)			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

***In rating impacts on an 'European site' account must be taken of Article 6(3) and 6(4) of the Habitats Directive (Council Directive 92/43/EEC). Also see guidance contained within Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev 2, National Roads Authority, 2008)*

The TII Guidelines qualitative significance rating of environmental impacts has been correlated with the equivalent qualitative and quantitative assessment scores from the TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi-Criteria Analysis [1]. It should be noted that only negative potential impacts are considered in the TII Guidelines whereas the TII PAG multi-criteria assessment is based on the seven-point scale presented in Table 6.1.1 of this report.

Table 6.5.10.2 Correlation of TII Guidelines Significance Rating to an equivalent TII PAG Score

Significance Rating (TII Guidelines)	Equivalent PAG (Description)	Equivalent PAG (Value)
Profound	Major or Highly Negative	1
Significant	Major or Highly Negative	1
Moderate	Moderately Negative	2
Slight	Minor or Slightly Negative	3
Imperceptible	Not Significant or Neutral	4

The final stage of the assessment methodology was to ensure that the requirements of the TII PAG Unit 7.0 - Multi-Criteria Analysis were also met by assigning a score to each alternative option based on the scoring procedure within these Guidelines. Where a positive score is assigned, they are from the TII PAG scoring system.

Using the impact scores and professional judgement, the preferred, intermediate or least preferred alternative options were identified.

6.5.10.3 Alternatives Assessment

The impact of the alternatives with their many components on hydrology will essentially be aimed at reducing and managing traffic numbers. Such alternatives will result in reduction in private car numbers from the existing situation which potentially will reduce slightly the pollutant loads from the road drainage. The drainage currently is running off via outfalls and over the edge discharges to the watercourses and with reduced traffic numbers there may be a slightly reduced risk of traffic accidents and spillages that might contribute to a serious pollution incident from a HGV or smaller pollution risks from private vehicles. In terms of the effect on the water quality in the receiving watercourses and the downstream River Shannon the alternatives are unlikely to generate sufficient reduction in pollutant load as to register a perceptible impact on surface water quality due to the dilution available in this waterbody. However, the initiative is to take local private cars off the network entirely and replace with sustainable trips and may have a slightly more measurable positive impact on the smaller watercourses. Some components of the smarter travel alternative will require some infrastructure works, however it is assumed that these will be located on existing roads, or brownfield sites and are already serviced by existing drainage networks, therefore there is no anticipated impact on hydrology as part of the Stage 1 assessment of alternatives. (e.g. Park and stride facilities and new cycle/walking facilities). It is therefore considered that the alternatives represent a Not Significant or Neutral impact on hydrology.

Table 6.5.10.3 Stage 1 Hydrology Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
ASSESSMENT CRITERIA	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Floodplains and Flood Risk	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
River Shannon	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Minor Watercourses	Not Significant or Neutral	Minor or Slightly Positive	Minor or Slightly Positive
Surface Water Resources	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Hydro-ecology	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Soft sediments	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

6.5.10.4 Summary

All alternatives are assessed as having a Not Significant or Neutral impact with respect to hydrology.

6.5.11 Stage 1 Hydrogeology Assessment of the Alternatives

6.5.11.1 Introduction

This section details the Stage 1 assessment of the alternatives with respect to the hydrogeological constraints identified in Section 4.5 Hydrogeology of this report.

The Stage 1 Alternatives are presented on figures 6.1.1.0, 6.1.2.0 and 6.1.3.0.

Section 6.5.11.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 6.5.11.3 with Section 6.5.11.4 outlining the general summary of the Hydrogeology assessment of the alternatives.

6.5.11.2 Methodology

This assessment was prepared in accordance with the requirements of the National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009[55].

The NRA Guidelines provide criteria for ranking of the identified hydrogeological constraints within the assessment study area. Criteria for rating an impact significance that may arise at each hydrogeological constraint are provided within Box 4.4 of the NRA Guidelines[55] and in Table 7.5.11.1. The impact significance assessment takes into account the attribute importance and the predicted scale and duration of the likely impacts.

Table 6.5.11.1 Criteria for Rating Impact Significance at Route Selection Stage – Rating of Significant Environmental Impacts at Route Selection Stage from Box 4.4 of the Guidelines

Impact Level	Attribute Importance				
	Extremely High**	**Very High**	**High**	**Medium**	**Low**
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on Significant proportion of attribute		

[55] NRA, 2009. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

Impact Level	Attribute Importance				
	Extremely High**	**Very High**	**High**	**Medium**	**Low**
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

***In rating impacts on an 'European site' account must be taken of Article 6(3) and 6(4) of the Habitats Directive (Council Directive 92/43/EEC). Also see guidance contained within Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev 2, National Roads Authority, 2008)*

The NRA Guidelines[56] qualitative significance rating of environmental impacts have been correlated with the equivalent qualitative and quantitative assessment scores from the TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi-Criteria Analysis [1], as shown in Table 6.5.11.2. It should be noted that only negative potential impacts are considered in the NRA Guidelines[56] whereas the TII PAG[1] multi-criteria assessment is based on the seven-point scale presented in Table 6.1.1 of this report.

Table 6.5.11.2 Correlation of NRA Guidelines Significance Rating to an Equivalent TII PAG[1] score

Significance Rating (NRA Guidelines[55])	Equivalent PAG (Description)	Equivalent PAG (Value)
Profound	Major or Highly Negative	1
Significant	Major or Highly Negative	1
Moderate	Moderately Negative	2
Slight	Minor or Slightly Negative	3
Imperceptible	Not Significant or Neutral	4

The final stage of the assessment methodology was to ensure that the requirements of the TII PAG Unit 7.0 - Multi-Criteria Analysis[1] were also met by assigning a score to each alternative option based on the scoring procedure within these Guidelines. Where a positive score is assigned, they are from the TII PAG scoring system.

Using the impact scores and professional judgement, the preferred, intermediate or least preferred alternative options were identified.

6.5.11.3 Stage 1 Hydrogeology Assessment of Alternatives

Alternative A (Active Travel) this includes the construction of a new pedestrian and cycle bridge over the River Shannon. This would include intrusive works adjacent to the River Shannon which may encounter groundwater the underlying aquifer and/or require temporary dewatering. The impact would be temporary on a small portion of the underlying regionally important aquifer. The regionally important aquifer is considered of high importance and therefore the potential impact is considered to be imperceptible.

It is expected that Alternative B (Public Transport Improvements) requires very limited construction works and no excavations associated. Therefore, the likely impacts are expected to be minimal and considered to be imperceptible on any hydrogeological constraint.

Alternative C (Demand Management) may involve the use of brownfield sites. This may include minimal construction works including reassignment of road space/parking measures. This has the potential to present temporary impact on small proportion of the underlying regionally important aquifer. The regionally important aquifer is considered of high importance and therefore the potential impact is considered to be imperceptible.

Table 6.5.11.3 Stage 1 Hydrogeology Stage 1 Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Aquifer classification (groundwater quality)	Imperceptible impact	Imperceptible impact	Imperceptible impact
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact level	**4**	**4**	**4**

6.5.11.4 Summary

All three alternatives were assigned a PAG score of 4 in the assessment. Based on this, the expected overall impact on hydrogeological constraints is likely to be insignificant (Not Significant or Neutral) for the alternatives presented for this project.

6.5.12 Stage 1 Soils and Geology Assessment of the Alternatives

6.5.12.1 Introduction

This section details the Soils and Geology Environmental Assessment of the Stage 1 alternatives with respect to the soils and geology constraints identified in Section 4.17 Soils and Geology of the Constraints Study.

The soils and geology constraints are presented with the Stage 1 Alternatives in Figures 6.1.1.0 to 6.1.3.0.

Section 6.5.12.2 outlines the methodology that was used to carry out the assessment, along with the assessment criteria which were used and presents the assumptions that were adopted as part of the assessment. The assessment is presented in Section 6.5.12.3 with the summary of the assessment presented in Section 6.5.12.4.

The alternatives are referenced as Alternative A Active Travel, Alternative B Public Transport Improvements and Alternative C Demand Management and are described in Section 6.1.2.

6.5.12.2 Methodology

This assessment has been prepared in line with the following guidance:

- NRA, 2009 Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology on National Road Schemes (herein referred to as NRA Guidelines).[56]
- The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.[57]
- NRA, 2008 Environmental Impact Assessment of National Road Schemes – a Practical Guide.[58]

The NRA Guidelines provide useful criteria for rating of the identified soils and geology constraints (herein referred to as Criteria) that are presented in Table 4.15.11 of the Section 4.17 Soils and Geology of the Constraints Study. Each criterion comprises of individual attributes which have been assigned an

[56] National Roads Authority, 2009. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, Ireland: Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

[57] Environmental Protection Agency, 2017. Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft. Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed: 17 February 2021]

[58] National Roads Authority, 2008. Environmental Impact Assessment of National Road Schemes – a Practical Guide. Available at: https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf

Importance using Box 4.1 of the NRA Guidelines. The Importance ratings are listed in the table below.

Table 6.5.12.1 Ratings for the Significance of Environmental Impact[59]

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small Adverse**	**Moderately Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderately	Profound / Significant	Profound
High	Imperceptible	Moderately / Slight	Significant / Moderately	Severe / Significant
Medium	Imperceptible	Slight	Moderately	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderately

The 'Magnitude of Impact' assesses the impact that each alternative has on each criterion attribute, a 'Magnitude of Impact' is assigned using Box 5.1 of the NRA Guidelines as presented in the table above. The magnitude of the potential impacts that may arise for each criterion attribute have been assessed based on the information that is currently available.

A 'Significance of impact' has then been determined from the table above based on the 'Importance of Attribute' and the 'Magnitude of Impact'. The terminology adopted in the assessment table in Section 6.5.12.3 to describe the significance of an impact is that used in Box 5.4 of the NRA Guidelines as it is more succinct and more appropriate for the purposes of this assessment.

It should be noted that the alternatives are assessed separately in their own right as stand-alone entities and are not assessed against each other.

The negative potential impacts of the alternatives on Soils and Geology have been considered in the analysis. The positives were taken into account by reducing the overall negative impacts of individual attributes.

Once a significance of impact was determined for each associated criterion attribute for each alternative, an overall impact rating was assigned to that criterion using the TII Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 - Multi-Criteria Analysis (MCA)[1]. TII PAG multi-criteria assessment is based on the seven-point scale presented in Table 6.1.1 of this report.

Assessment Criteria

A sensitivity analysis was not undertaken for the alternatives assessment as these have been assessed as standalone assessments in which the criteria identified as part of the constraints study is considered. The soils and geology criteria which

[59]Box 5 Guidelines for Assessment of Ecological Impacts of National Road Schemes https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

have been considered as part of the Stage 1 Preliminary Alternatives Assessment are as follows:

- Soil Deposits (well-drained soil types which are important for agriculture)
- Bedrock (Karst)
- Bedrock (Volcanic Geology)
- Landslide Susceptibility
- Contaminated Sites
- Economic Geology
- Geological Heritage
- Earthworks

6.5.12.3 Alternatives Assessment

The do-something alternatives are described in section 6.1.2 of this document. Based on the information available these alternatives will have a Minor or Slightly Negative, or Not Significant or Neutral impact on soils and geology.

Table 6.5.12.2 Stage 1 Soils and Geology Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Soil Deposits	The impact on soil types that are important for agriculture (well drained) is Imperceptible.	The impact on soil types that are important for agriculture (well drained) is Imperceptible.	The impact on soil types that are important for agriculture (well drained) is Imperceptible.
Bedrock (Karst)	The impact on karst features is Imperceptible.	The impact on karst features is Imperceptible.	The impact on karst features is Imperceptible.
Bedrock (Volcanic Geology)	The impact on volcanic bedrock formations is Imperceptible.	The impact on volcanic bedrock formations is Imperceptible.	The impact on volcanic bedrock formations is Imperceptible.
Landslide Susceptibility	The impact on landslide susceptibility is Imperceptible.	The impact on landslide susceptibility is Imperceptible.	The impact on landslide susceptibility is Imperceptible.
Contaminated Sites	Proposed new pedestrian / cycle links will have a moderate / slight impact on some historical quarry and pit sites and potential areas of made ground across Carrick-on-Shannon.	The improved parking facilities at Carrick-on-Shannon railway station will have a slight impact on an area of potential contamination.	The impact on contaminated sites is Imperceptible.
Economic Geology	As the proposed works for Alternative A are predominately throughout Carrick-on-Shannon and Cortober the impact on economic geology is considered Imperceptible.	The impact on economic geology is Imperceptible.	The impact on economic geology is Imperceptible.
Geological Heritage	The impact on Geological Heritage areas is Imperceptible.	The impact on Geological Heritage areas is Imperceptible.	The impact on Geological Heritage areas is Imperceptible.

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Earthworks	A potential new pedestrian and cycle bridge over the River Shannon will have a moderate / slight impact on earthworks. The earthworks at the proposed location may comprise of soft soil and made ground.	The impact on earthworks is expected to be imperceptible.	The impact on earthworks is expected to be imperceptible.
Scoring			
Qualitative assessment	Slight impact on identified contaminated sites and on earthworks. **Minor** or **Slightly Negative**	Minimal impact on 1 identified contaminated site. **Not Significant** or **Neutral**	No impact on Soils and Geology. **Not Significant** or **Neutral**
Score / Impact level	**3**	**4**	**4**

6.5.12.4 Summary

Each of the Alternatives have been assessed against the Soils and Geology criteria. Alternative A is considered as having a Minor or Slightly Negative impact due to the intersection of potential new pedestrian/cycle links with identified historic quarry or pit sites and potential made ground areas and also due to the earthworks associated with the proposed new pedestrian and cycle bridge. The impact of Alternatives B and C on Soils and Geology is considered Not Significant or Neutral.

6.6 Stage 1 Economic Assessment of Alternatives

6.6.1 Introduction

As part of the Stage 1 Assessment of Alternatives an economic assessment of each of these alternatives was completed. Alternatives to be assessed are described in detail in Section 6.1.2 and include the following:

- Alternative A: Active Travel - comprises improvements to cycling and walking facilities
- Alternative B: Public Transport - includes improvements to public transport
- Alternative C: Demand Management - comprises reducing demand for car trips through Carrick-on-Shannon/Cortober

Section 6.6.2 outlines the methodology utilised to carry out the cost assessment, Sections 6.6.3 details the cost and a summary is presented in Section 6.6.4.

6.6.2 Methodology

The methodology adopted in preparing the Stage 1 cost estimates comprises a high level costing of the civil works elements associated with each of the proposed measures contained within each alternative. These costs were then categorised using the cost ranges set out in Chapter 5 of the National Development Plan but with an additional three ranges included to account for lower ranges. These categories are set out in Table 6.6.1 below.

Table 6.6.1 Cost Range Categories

Category	Cost Range	PAG Score
i	€0 - €1M	7
ii	€1M - €10M	7
iii	€10M+	6
A	€20M - €50M	5
B	€50M - €100M	4
C	€100M - €250M	3
D	€250M - €500M	2
E	€500M - €1BN	1
F	€1BN+	1

For Alternative B Public Transport, it is not possible to quantify the operational cost for bus and rail services in isolation. Therefore, for the purposes of the Stage 1 assessment, only the new physical infrastructure elements were considered (e.g. car park improvements, bus stops and Intelligent Traffic Systems (ITS)).

Similarly, for Alternative C, there is little infrastructure associated with implementing demand management measures as this alternative relies primarily on policy change. Therefore, costs associated with Alternative C are minimal in contrast to the other measures. The ultimate target of alternative is to secure public support which will in turn support the making of more sustainable trips. At Stage 2, specific demand management measures which can be delivered as part of the project without relying on policy change will be included in the project and the costs.

Due to the nature of the works associated with the alternatives and the variability in infrastructure required, it is not possible to quantify exact costs for the civil works in the absence of further investigation and studies. Therefore, a pragmatic approach has been implemented to estimate cost quoting ranges which is more appropriate for the purposes of the assessment at Stage 1.

6.6.3 Assessment of Alternatives

Table 6.6.2 Cost Estimate Range – Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Cost Range Category (€ M)	(iii)	(ii)	(i)
Scoring			
Qualitative Assessment	**Moderately Positive**	**Major** or **Highly Positive** However, the operational costs of Public Transport are not considered	**Major** or **Highly Positive**
PAG Score / Impact Level	**6**	**7**	**7**

6.6.4 Summary

From a new infrastructure and civil construction cost perspective, Alternative C is the most cost-effective alternative. However, there is a great deal of change required in policy and public opinion to implement this. Alternative A is the least cost effective, requiring the highest investment in construction. Alternative B lies in between both options, but it must be noted that the operational costs associated with bus and rail have not been assessed at this stage.

6.7 Alternatives Framework Matrix

A summary of the Engineering, Environment and Economic assessments outlined in the preceding sections are presented below in Table 6.7.1 to Table 6.7.2 with the overall ranking from each of these tables included in Framework Matrix Presented in Table 6.7.3. Alternatives are assessed separately in their own right as stand-alone entities and alternatives are not assessed against each other. Equally the alternatives are not compared against the options as these will be complementary to the options and may form part of the overall package that represents the optimum transport solution.

Table 6.7.1 Stage 1 Engineering Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Geometry	N/A	N/A	N/A
Traffic Impacts	Not Significant or Neutral	Not Significant or Neutral	Minor or Slightly Positive
Constructability	Minor or Slightly Negative	Not Significant or Neutral	Minor or Slightly Negative
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**
Score / Impact Level	**4**	**4**	**5**

Table 6.7.2 Stage 1 Environmental Summary Assessment Matrix of Alternatives

STAND ALONE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Population	Major or Highly Positive	Minor or Slightly Positive	Moderately Positive
Human Health	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Material Assets Non-Agriculture	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Material Assets Agriculture	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Air Quality	Minor or Slightly Positive	Minor or Slightly Positive	Minor or Slightly Positive
Climate	Minor or Slightly Positive	Minor or Slightly Positive	Minor or Slightly Positive
Noise and Vibration	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Archaeology, Architecture and Cultural Heritage	Moderately Negative	Not Significant or Neutral	Moderately Positive
Landscape and Visual	Minor or Slightly Negative	Not Significant or Neutral	Not Significant or Neutral
Biodiversity	Moderately Negative	Not Significant or Neutral	Not Significant or Neutral
Hydrology	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Hydrogeology	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Soils and Geology	Minor or Slightly Negative	Not Significant or Neutral	Not Significant or Neutral
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**	**Moderately Positive**
Score / Impact level	**4**	**5**	**6**

Table 6.7.3 Economic Summary Assessment Matrix of Alternatives

NON-COMPARATIVE ASSESSMENT			
Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Cost Range Category (€ M)	(iii)	(ii)	(i)
Scoring			
Qualitative Assessment	**Moderately Positive**	**Major** or **Highly Positive** However, the operational costs of Public Transport are not considered	**Major** or **Highly Positive**
PAG Score / Impact Level	**6**	**7**	**7**

Table 6.7.4 Framework Matrix of Alternatives

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Engineering	Not Significant or Neutral	Not Significant or Neutral	Minor or Slightly Positive
Environment	Not Significant or Neutral	Minor or Slightly Positive	Moderately Positive
Economy	Moderately Positive	Major or Highly Positive However, the operational costs of Public Transport are not considered	Major or Highly Positive
Progress to Stage 2?	YES with the exception of the new pedestrian / cycle bridge over the River Shannon	YES with the exception of significant rail service improvements	YES

6.8 Recommendation

Following the Stage 1 Alternatives assessment is it recommended that all the Alternatives are progressed to the Stage 2 assessment for a more detailed analysis in the Option Selection Process with the following exceptions:

- Alternative A: The traffic modelling (see Section 6.4 Engineering) indicates that there is a minor reduction of up to 0.8% in traffic volumes crossing the River Shannon Bridge which is attributed to modal shift from private car to the more sustainable modes of walking and or cycling. This is insignificant or neutral. However, the pedestrian/cycle bridge element of Alternative A proposal has potential negative environmental impacts attributed to it as detailed in Sections 6.5.1 to 6.5.12. Thus, the additional pedestrian/cycle bridge over the River Shannon element of Alternative A is not advanced as it does not deliver sufficiently on the Project Objectives in terms of providing congestion relief or minimising environmental impacts
- Alternative B: improvements to rail services element of Alternative 2 public transport do not deliver sufficiently on the Project Objectives. This is demonstrated in detail in Appendix A.6.3.1 Enhanced Rail Service Model Test. The modelling analysis showed that the introduction of an enhanced rail service along the Sligo to Dublin railway line is forecast to result in no meaningful impacts on traffic levels. Therefore, further consideration of rail services improvements will not be taken forward to the Stage 2 Alternatives

7 Stage 1 Option Corridors Assessment

7.1 Introduction

7.1.1 Overview

This chapter details the assessment of the Stage 1 Option Corridors identified as part of the road alternative which were considered for their potential to deliver or contribute towards a sustainable transport solution along the N4 corridor between Carrick-on-Shannon and Dromod. An *option*, as defined in TII PAG Unit 4.0[1] (*Consideration of Alternatives and Options*), refers to a specific road-based measure (new route, road upgrade, junction improvements etc.). An option corridor is defined as a corridor within which the existing road could be maintained, optimised, and improved or new road infrastructure could be constructed. The Stage 1 Assessment of the remaining alternatives is documented in Chapter 6 of this report and the road alternative is not compared against those alternatives.

The option corridors were assessed under the criteria of Engineering, Environmental and Economy in this chapter. The Stage 1 Option Corridors are described in Section 7.1.2. and shown on Figures 7.1.1.1. Section 7.1.3 outlines the broad methodology utilised to carry out the assessment of option corridors.

7.1.2 Description of Option Corridors

A total of 10 option corridors have been taken forward for Stage 1 Assessment. Of these, six option corridors are to the west of Node J at Drumsna Junction (Blue West, Cyan, Orange, Purple West, Dark Green and Black) and four option corridors are to the east of Node J (Blue East, Green, Yellow and Purple East). The option corridors are presented in the order that they were incrementally developed with the Blue Option Corridor west and east of Drumsna Junction representing the minimal intervention option plus the maximum reuse of the existing infrastructure. The Management Option was brought through the initial sifting even though it was apparent that it would have difficulty in meeting some of the project objectives, especially in the urban area. However, it was brought through Stage 1, in line with PAG Unit 4, to ensure that an equivalent assessment of it was completed to inform the true viability of the option in more detail than the sifting exercise. All other option corridors include varying portions of new infrastructure. Figure 7.1.1.1 presents an overview of the option corridors and nodes. A flowchart showing the Stage 1 assessment process is provided in Plate 7.1.1.

[1] Transport Infrastructure Ireland, 2016. Project Appraisal Guidelines for National Roads Unit 4.0- Consideration of Alternatives and Options PE-PAG-02013 October 2016. Available from: https://www.tiipublications.ie/library/PE-PAG-02013-01.pdf

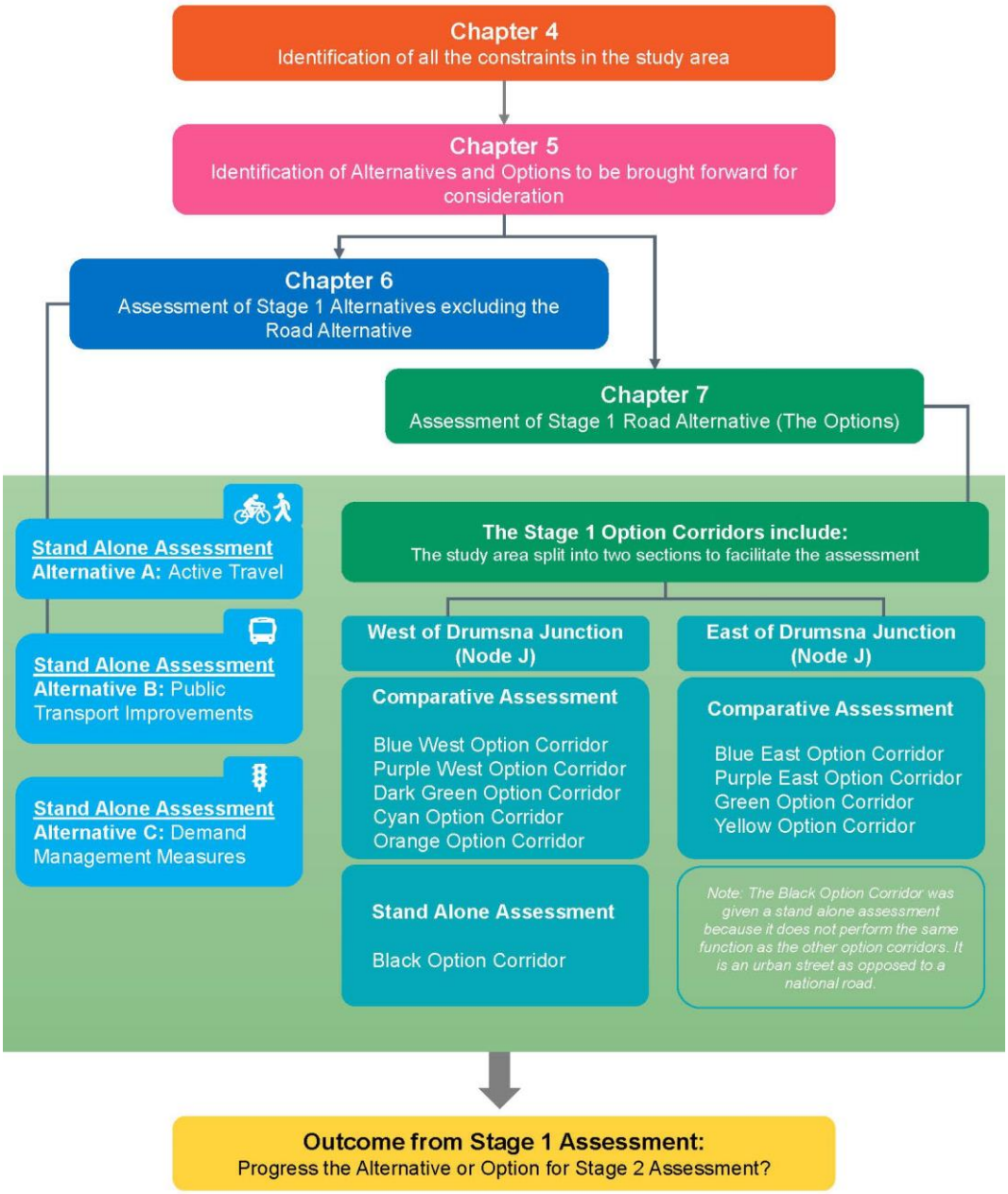

Plate 7.1.1 Stage 1 Assessment Process Flowchart

7.1.2.1 Option Corridors West of Drumsna Junction (Node J)

Cyan Option Corridor

The Cyan Option Corridor is an off-line proposal, south of the existing N4 which deviates from the existing N4 at Cloongownagh at Node A approximately 2.3km to the northwest of Cortober, Co. Roscommon. It progresses in an easterly direction and has a link back connecting to the existing N4 at Node B at Tumna. It continues eastwards in proximity to the existing railway line, crosses the R368 east of the railway station at Node C, crosses the River Shannon at Cordrehid and rejoins the existing N4 at a junction at Lissenghan at Node D. The existing N4 between Lissenghan at Node D and Drumsna Junction at Node J will be subject to an on-line upgrade as shown on Plate 7.1.2.

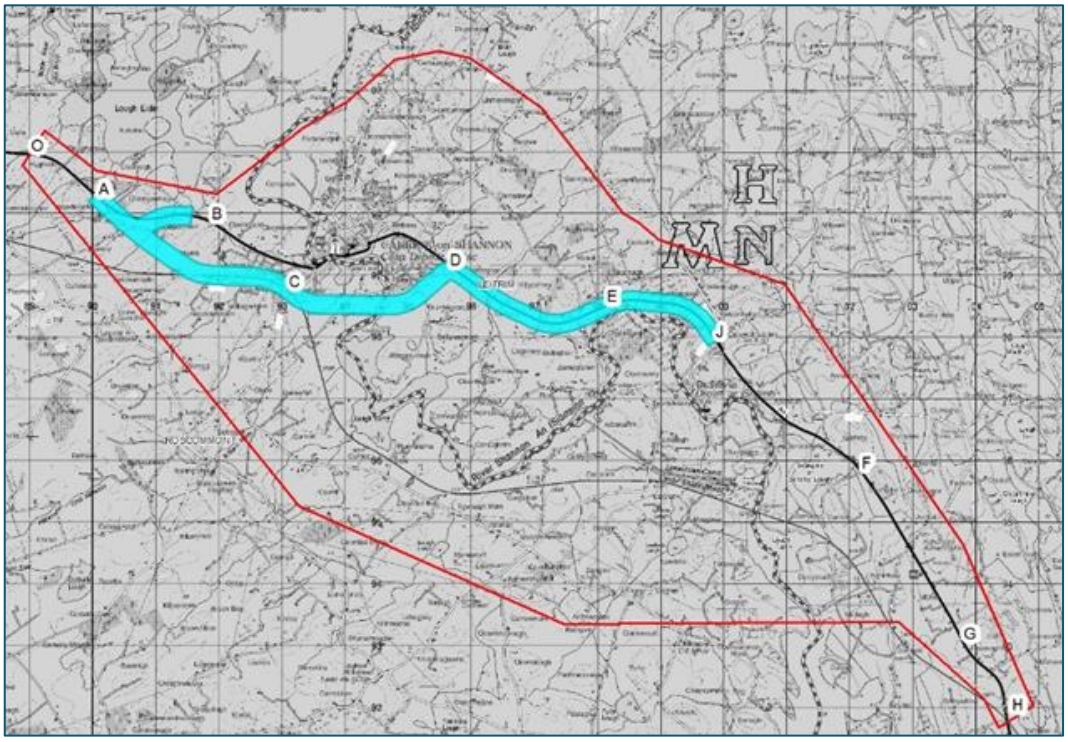

Plate 7.1.2 Cyan Option Corridor

Orange Option Corridor

The Orange Option Corridor commences at Node B where it deviates from the existing N4 at Meera approximately 1.0km to the northwest of Cortober. It continues to the rear of the West Gate Business Park, crossing the R368 east of the railway station at Node C. It crosses the River Shannon at Cordrehid and rejoins the existing N4 at a junction at Lissenghan at Node D before following the existing N4 to the Drumsna Junction at Node J. An on-line upgrade is proposed for the existing N4 between Lissenghan at Node D and Drumsna Junction at Node J as shown on Plate 7.1.3.

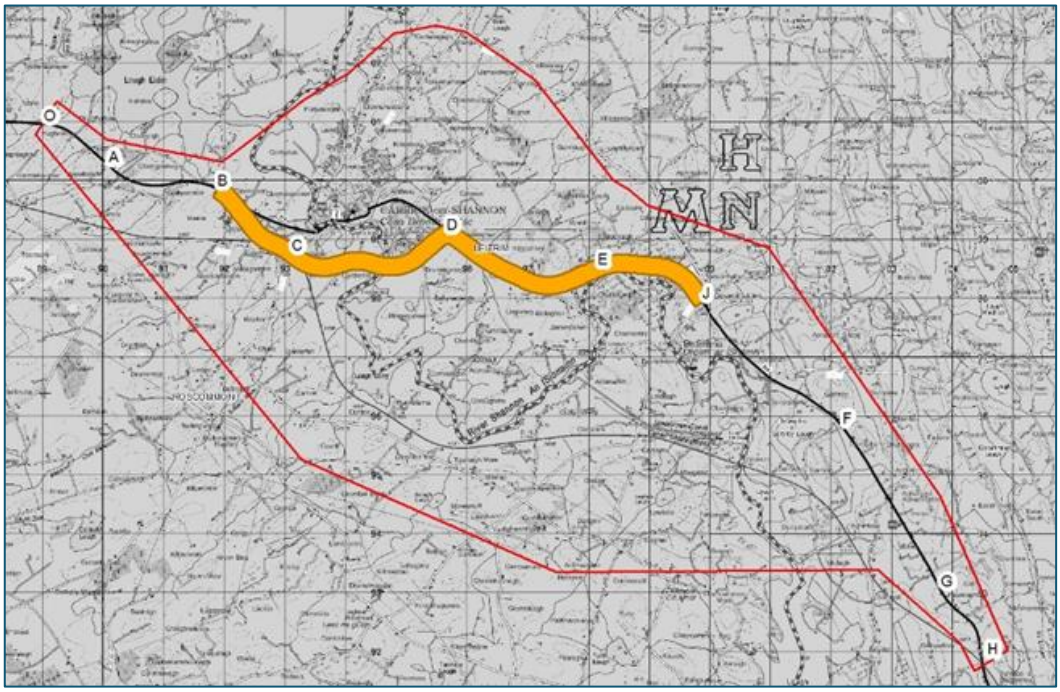

Plate 7.1.3 Orange Option Corridor

Purple West Option Corridor

The Purple Option Corridor is located north of the existing N4 and deviates from the N4 at Tumna at Node B approximately 1.5km to the northwest of Cortober. It continues north-eastwards, with a junction at the R280 at Cartown. It continues south-eastwards and rejoins the existing N4 at a junction at Tully at Node E. It then continues with an on-line upgrade of the existing N4 to the Drumsna Junction at Node J as shown on Plate 7.1.4.

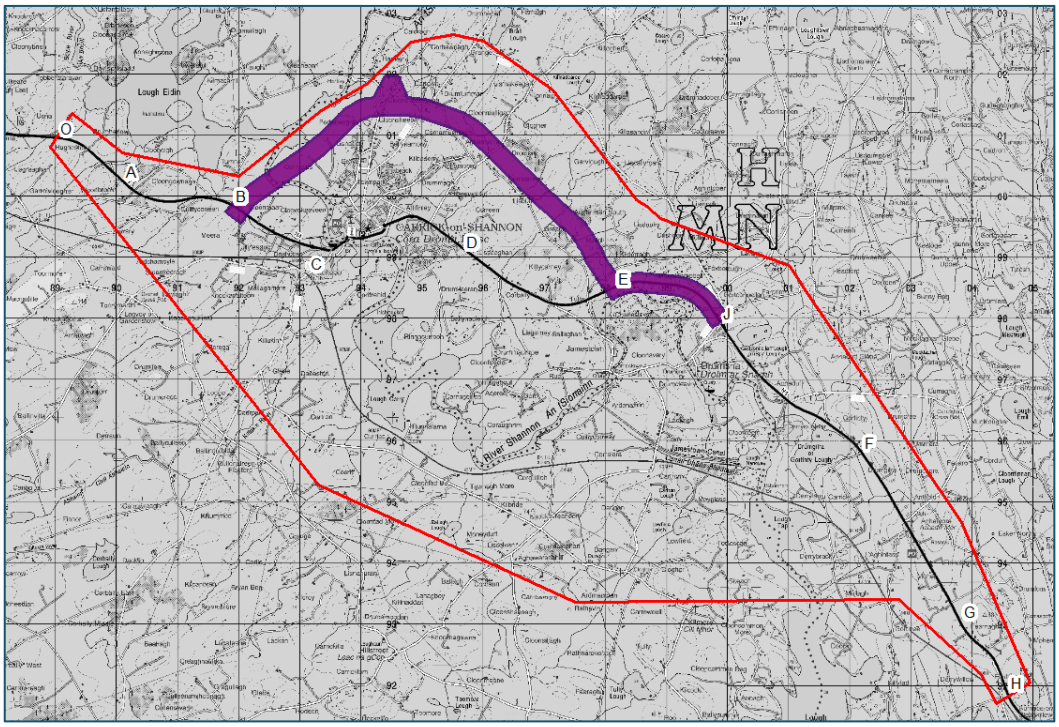

Plate 7.1.4 Purple West Option Corridor

Dark Green Option Corridor

The Dark Green Option Corridor deviates from the existing N4 at Tumna at Node B approximately 1.5km to the northwest of Cortober. It continues north-eastwards, crossing the River Shannon at Corryolus, and meets the R280 at a junction at Cartown. It continues south-eastwards and rejoins the existing N4 at the Drumsna Junction at Node J as shown on Plate 7.1.5.

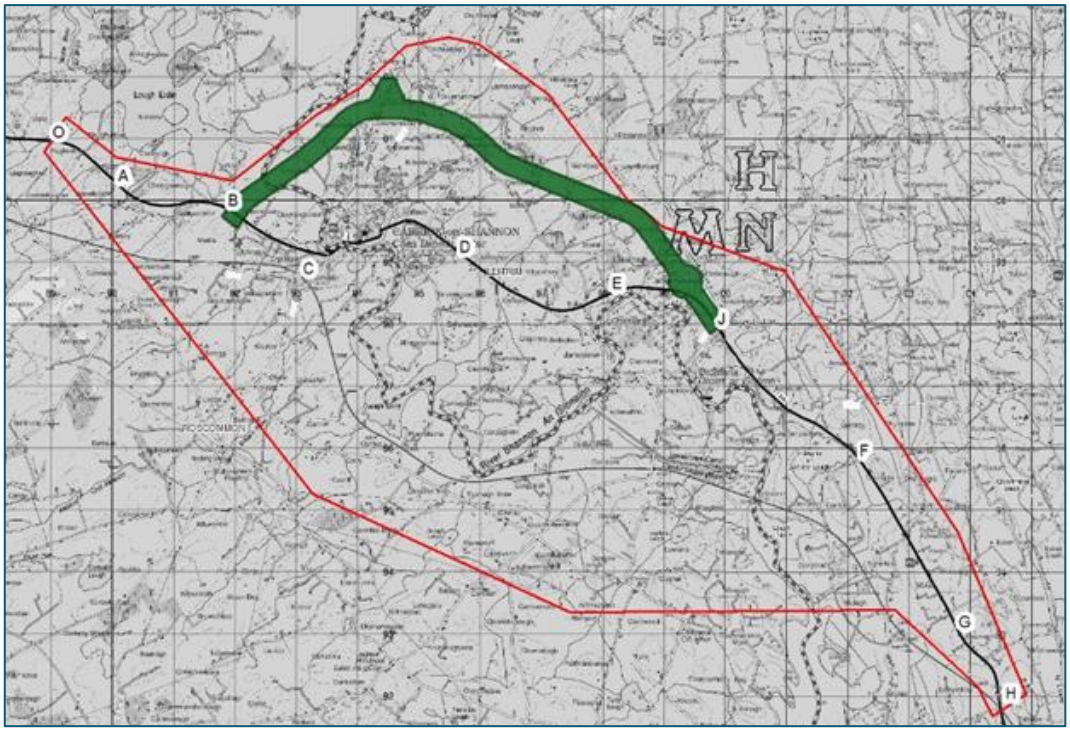

Plate 7.1.5 Dark Green Option Corridor

Blue West Option Corridor

The Blue West Option Corridor comprises the Management Option which considers interventions on the existing infrastructure to address the identified transport problems. It commences at Node O in Usna and follows the existing N4 to Node J at Drumsna Junction as shown on Plate 7.1.6. It includes a rationalisation of a number of junctions and private accesses between Cloonman & Drumsna Junction, and also includes an upgrade of the existing roundabouts to signalised junctions.

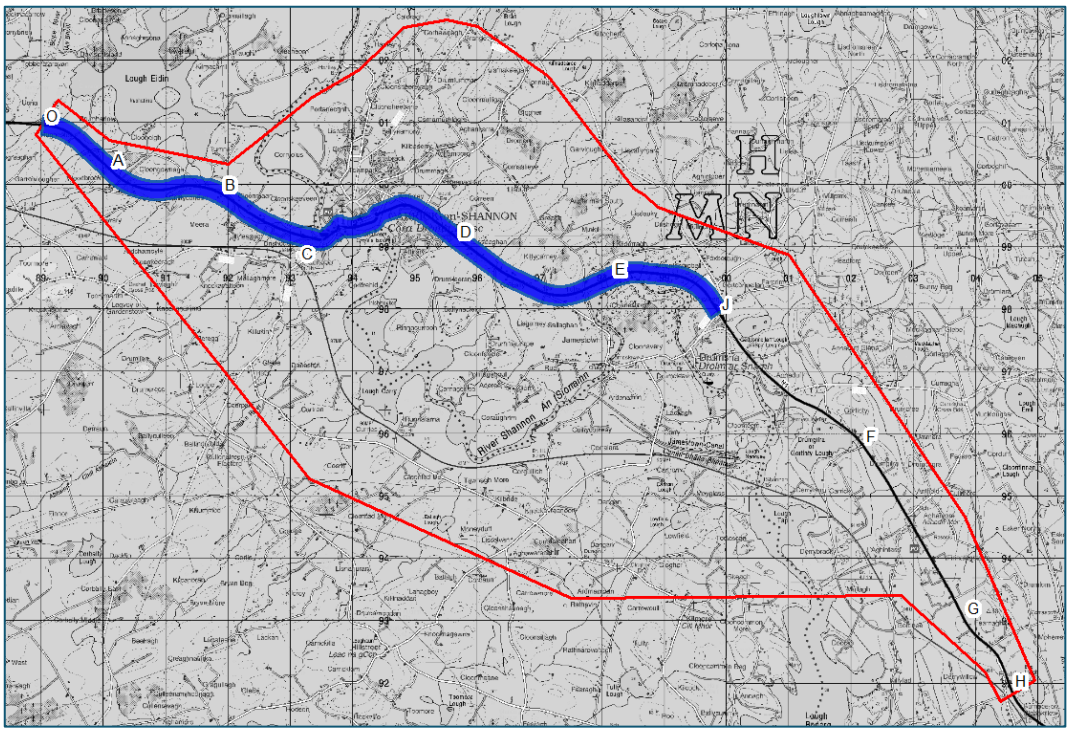

Plate 7.1.6 Blue West Option Corridor

Black Option Corridor

The Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon. It was identified initially for its potential to address the lack of connectivity between the R280, Summerhill Road, Castlecara Road and onto the N4. As part of the Option Sifting process (See Appendix A.5.2.3), the Black Option was tested to establish whether it alone can address the project objectives thus negating the need to invest more significantly in an off-line bypass option corridor. It was then tested in combination with an off-line bypass to understand whether it retains a function even if an off-line bypass is also required. Given the location of this option corridor within the urban environment, and its function to provide connectivity for all modes in the northwest of the town, this option corridor was assessed as an urban street with the physical infrastructure required to support active travel measures. This option corridor is shown on Plate 7.1.7.

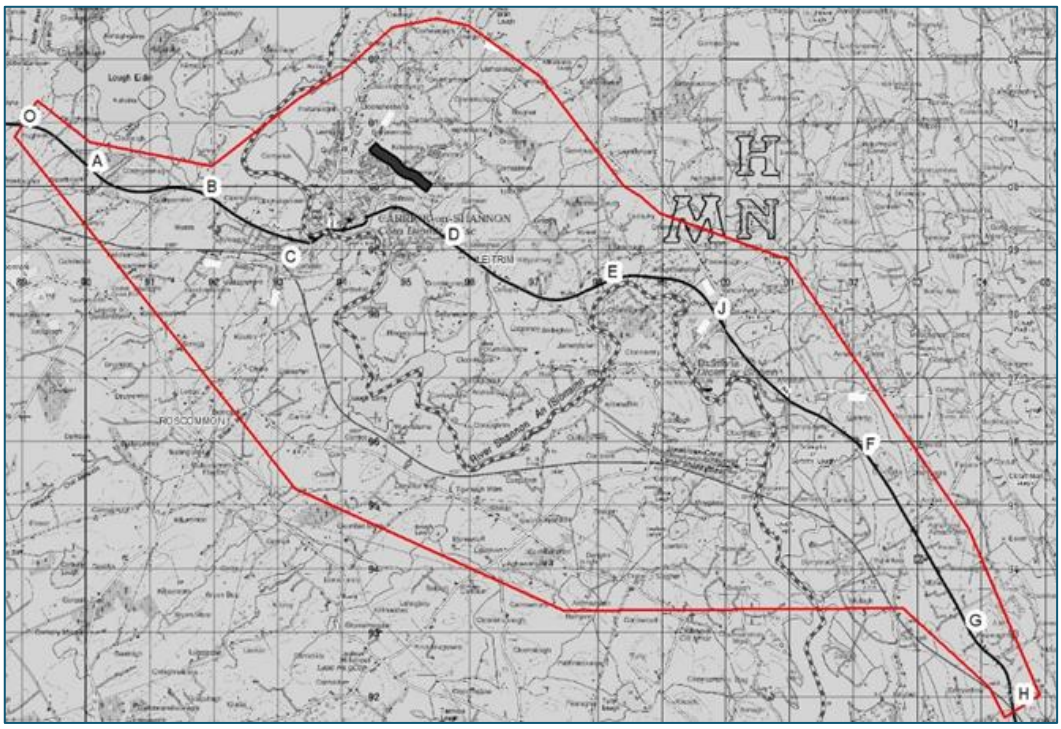

Plate 7.1.7 Black Option Corridor

7.1.2.3 East of Drumsna Junction (Node J)

Green Option Corridor

The Green Option Corridor comprises a full on-line upgrade of the existing N4 single carriageway between Lissenghan at Node J and Faulties at Node H as shown on Plate 7.1.8.

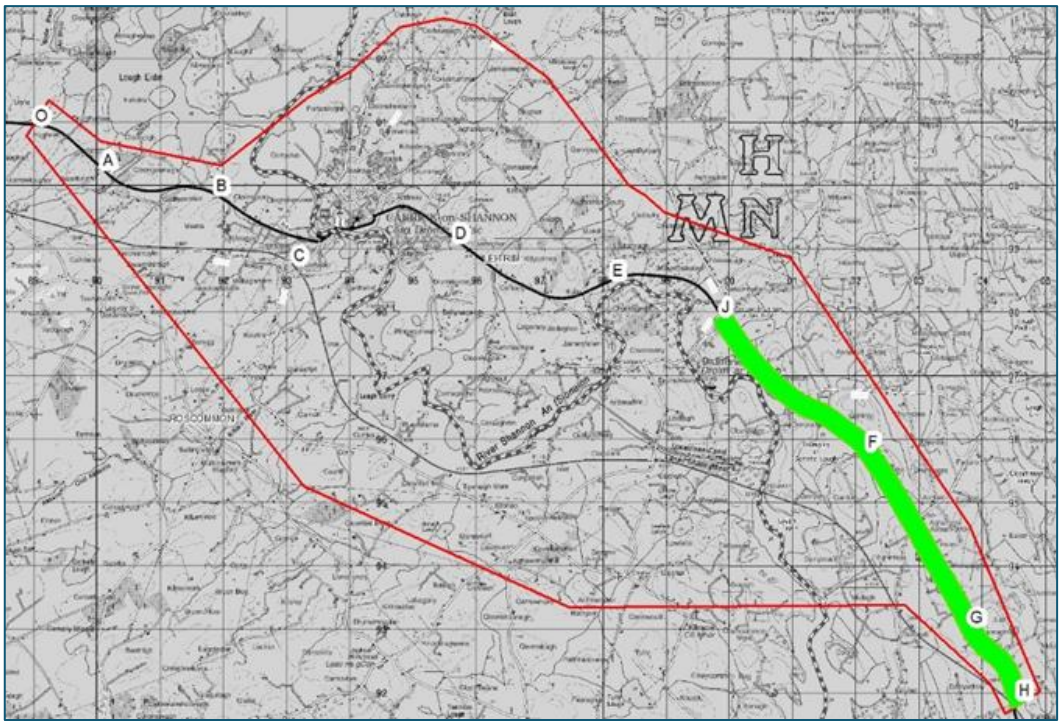

Plate 7.1.8 Green Option Corridor

Yellow Option Corridor

The Yellow Option Corridor comprises an on-line upgrade of the existing N4 single carriageway between Lissenghan at Node J and Fernaught, with a short off-line section proposed between Fernaught at Node G and Faulties at Node H as shown on Plate 7.1.9.

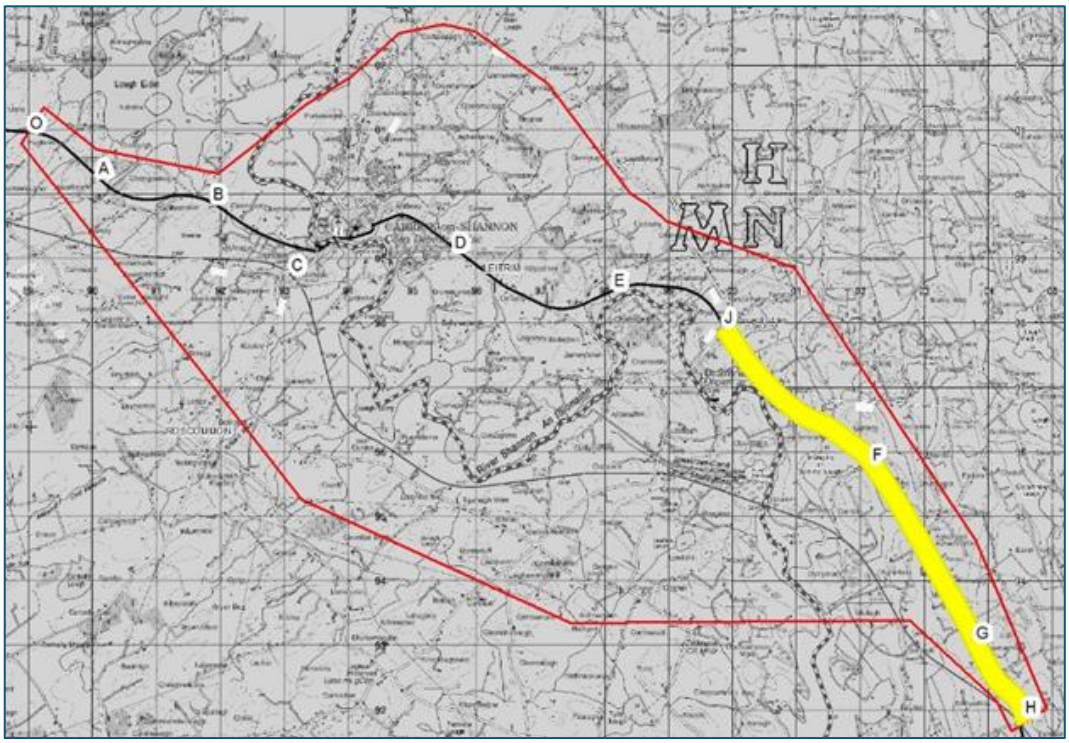

Plate 7.1.9 Yellow Option Corridor

Purple East Option Corridor

The Purple Option Corridor comprises an on-line upgrade of the existing N4 between Drumsna Junction at Node J and Drumgildra at Node F. A short off-line deviation to the east of Aghamore is proposed between Nodes F and G with the remaining N4 upgraded between Aghamore at Node G and Faulties at Node H as shown on Plate 7.1.10.

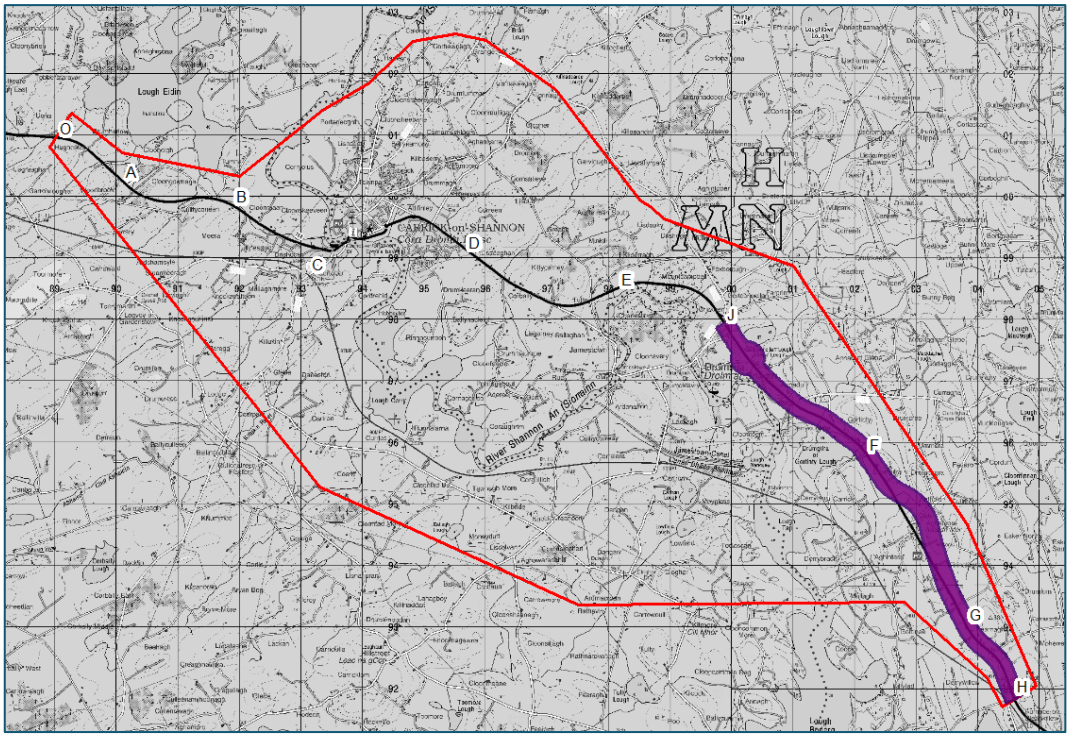

Plate 7.1.10 Purple East Option Corridor

Blue East Option Corridor

The Blue Option Corridor comprises the Management Option which considers interventions on the existing infrastructure to address the identified transport problems. It does not propose a full on-line upgrade as per the Green Option Corridor, but it does involve rationalising accesses which are directly on to the N4 and this would include the provision of some parallel access roads, albeit less extensive than the Green Option Corridor. It follows the existing N4 between Node J at Drumsna Junction and Faulties at Node H as shown on Plate 7.1.11.

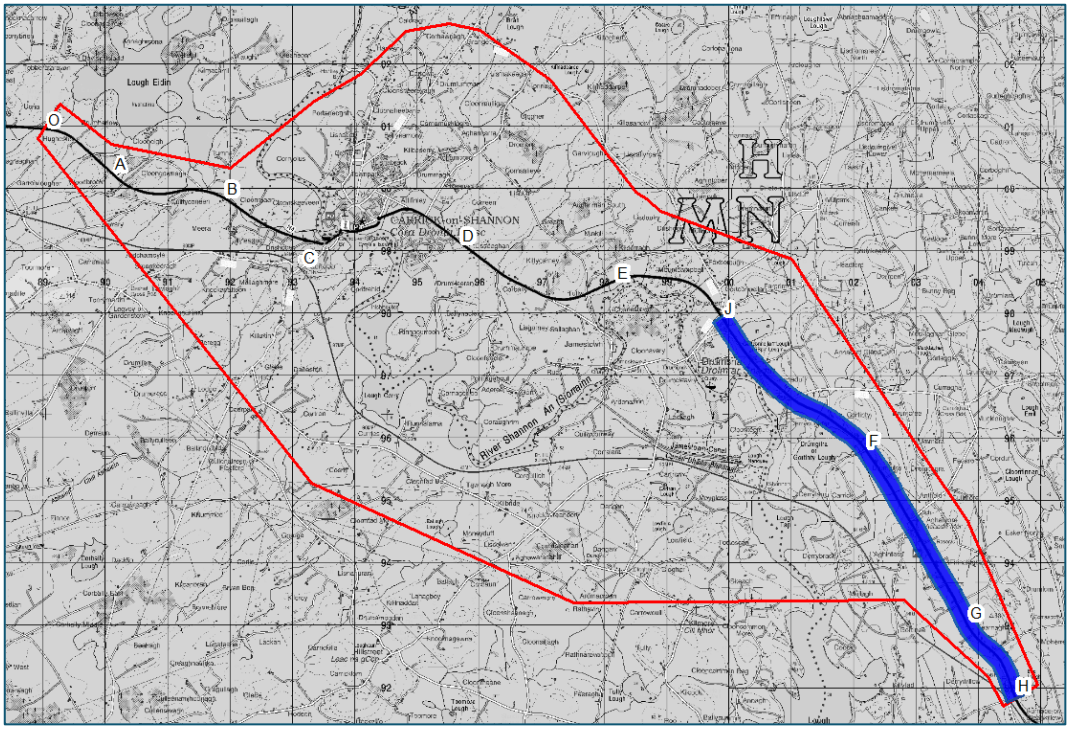

Plate 7.1.11 Blue East Option Corridor

7.1.3 Assessment Methodology of Option Corridors

The Stage 1 Assessment of these option corridors is undertaken under the assessment criteria of Engineering, Environment and Economy. It is a comparative assessment and requires consideration by each specialist. Each specialist will define the assessment criteria based on their expert opinion and best practice. Cognisance will be given to Chapter 3 of the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (PAG, 2016)[2] on what to include as sub-criteria.

The assessment was undertaken on 300m wide corridors, while taking cognisance of the design and the indicative fenceline within the corridor, for all option corridors with the exception of the Black Option Corridor which used a 150m wide corridor.

The assessments were split into two sections west of Drumsna Junction (Node J) and east of Drumsna Junction (Node J). After the initial option sifting process, it was determined that a road based transport solution along the section of the N4

[2] Transport Infrastructure Ireland, 2016. Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis. Available from: https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf

under consideration would seek to maintain/utilise the existing Drumsna Junction overbridge. This resulted in a common point (Node J) where all options converge, making this point the ideal location to split the assessment.

The cross-section has not yet been determined however, a fenceline has been developed within the corridor which predicts the worst-case landtake scenario within which a road design could sit accounting for earthworks, attenuation ponds etc. which was utilised for the assessment of all topics under the Engineering, Environmental criteria. As the cross-section has not yet been determined, in an effort to understand the cost implications of the various scenarios, the Economy section assesses the minimum cross-section i.e. the Management Option, in addition to a Type 1 Single Carriageway and a Type 2 Dual Carriageway. Cost estimates are presented for each. This is further developed in the Stage 2 Economy assessment.

As set out in the National Development Plan 2021 – 2030, the intervention hierarchy prioritises the maintenance of the existing network, followed by optimising its use before moving to new infrastructure i.e. maintain, optimise, improve, new. Upgrades to existing infrastructure or investment in new road networks will be considered where other interventions have been demonstrated to be inadequate at meeting the Project Objectives, with an increasing level of cost occurring as move from optimise to improve to new infrastructure. Therefore, it is also necessary to assess the incremental build-up of intervention when considering the Economy criterion as there are significant differences in cost depending on the level of intervention.

As noted above the Blue Option Corridor represents the Management Option which comprises the maximum reuse of the existing infrastructure. All the remaining option corridors include a portion of new infrastructure. Two design scenarios were developed to inform the assessment of what is the appropriate level of intervention required to provide the optimum transport solution. These design scenarios were developed using a single carriageway and a dual carriageway cross-section. These two design scenarios were assessed under the Economy criteria only. The Environmental assessment was undertaken using the dual carriageway cross-section to ensure that the worst-case impacts are assessed. In the final compilation of the matrix for Stage 1 assessment, the Economy assessment will also present the costs which align with the Environment and Engineering assessments. Figures 7.3.2.0 to 7.3.15.6 show the option corridors with the two design scenarios.

7.2 Findings from Public Consultation No. 2

Public participation is an important part of the development of a project and in particular during the early phases of a project. Public Consultation No. 2 took place between the 19 May 2021 and 25 June 2021 to inform the public of feasible alternatives and options identified and seek their feedback and suggestions on same. This consultation formed part of the option selection process. As this consultation included both Alternative and Options the findings are included in Section 6.2 Findings from Public Consultation No.2 of this report and not repeated here.

7.3 Stage 1 Engineering Assessment of Options

7.3.1 Introduction

As part of the Option Selection Process, an assessment of the engineering methods employed for the preliminary design of each option corridor is required to establish the most preferred option from a purely engineering perspective. A number of criteria have been selected to assess the option corridors based on engineering parameters.

This section details the Stage 1 Assessment of the Option Corridors with respect to the engineering constraints identified in Section 4 Engineering of this report. Section 7.3.2 outlines the methodology that was used to carry out the study and Section 7.3.3 details the options assessment. A summary of the assessment is presented in Section 7.3.4.

The option corridors are assessed in two sections, west and east of Node J at Drumsna Junction The assessment is mindful that any design scenario could be realigned within its corridor and therefore the overall impact of the option is also assessed to identify possible impacts within the 300m wide corridor.

7.3.2 Methodology

The engineering assessment criteria have been identified under the following headings: Geometry, Trip Length, Junction Strategy, Constructability and Traffic. The various assessment methodologies employed under each of these headings are outlined in Section 7.3.3.

The assessment of each of the option corridors under the above criteria is included in the summary assessment matrix and includes both quantitative and qualitative assessments. Each criterion shall be scored based on the seven-point scale and an integer shall be assigned according to the impact levels listed in Table 7.3.1 below:

Table 7.3.1 TII PAG Unit 7.0 Multi Criteria Analysis Seven Point Scale

Assessment Score	Description
7	Major or Highly Positive
6	Moderately Positive
5	Minor or Slightly Positive
4	Not Significant or Neutral
3	Minor or Slightly Negative
2	Moderately Negative
1	Major or Highly Negative

A ranking was then given as Preferred, Intermediate, or Least Preferred.

A number of option corridors with the potential for road based solutions have been taken forward to the Stage 1 Preliminary Options. Six option corridors are to the west of Node J at Drumsna Junction (Cyan, Orange, Purple West, Dark Green, Blue West and Black) and four option corridors are to the east of Node J (Purple East, Green, Yellow and Blue East). Each option corridor converges at Node J, therefore, the assessment will score, rank and compare the Cyan, Orange, Purple West, Dark Green and Blue West Option Corridors to the west of Node J at Drumsna Junction, and east of Node J at Drumsna junction the assessment will score, rank and compare the Purple East, Green, Yellow and Blue East Option Corridors.

7.3.3 Stage 1 - Engineering Assessment of Options

7.3.3.1 Geometry

The geometric assessment comprises the calculation of the percentage of the length of each option corridor that achieves at least desirable minimum curvature, both horizontally and vertically to ensure that what is designed is safe.

Each option corridor has been assessed on its horizontal and vertical components and was scored on the worst-case scenario. Where an option achieves at least desirable minimum horizontal and vertical curvature, a score of 7 was given. An alignment achieving between 95% and 100% desirable curvature received a score of 6, and so on in decreasing increments of 5% until any alignment, horizontal or vertical, below 75% would receive a score of 1.

Stage 1 Geometric Assessment of Option Corridors West of Drumsna Junction (Node J)

The Black Option Corridor has been assessed separately as a standalone assessment. The Black Corridor achieves 100% desirable curvature and is given a score of 7.

Table 7.3.2 Geometric Assessment of the Option Corridors West of Node J at Drumsna Junction

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Geometry							
% Horizontal Des. Min. Curvature	100%	100%	100%	100%	81%		100%
% Vertical Des. Min. Curvature	100%	100%	100%	100%	98%		100%
Scoring							
PAG Score	**7**	**7**	**7**	**7**	**3**		7
Preference	**Preferred**	**Preferred**	**Preferred**	**Preferred**	**Least Preferred**		N/A

The Cyan, Orange, Purple West and Dark Green Option Corridors achieve 100% desirable minimum curvature both horizontally and vertically. Therefore, these options ranked equally as Preferred. The Blue West Option Corridor, which represents the existing mainline, consists of a horizontal geometry achieving less than 85% desirable curvature. Scoring only 3, the Blue West Option Corridor is ranked Least Preferred.

Stage 1 Geometric Assessment of Option Corridors East of Drumsna Junction (Node J)

Table 7.3.3 Geometric Assessment of the Option Corridors East of Node J at Drumsna Junction

Option Corridor	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Geometry				
% Horizontal Des. Min. Curvature	100%	100%	100%	84.9%
% Vertical Des. Min. Curvature	100%	100%	100%	90.1%
Scoring				
PAG Score	**7**	**7**	**7**	**3**
Preference	**Preferred**	**Preferred**	**Preferred**	**Least Preferred**

7.3.3.2 Trip Length

Methodology

The Trip Length parameter does not measure the length of new construction of an option, it is a measure of the travel distance from a common start point to a common end point. For West of Drumsna Junction, the measure is from Node O (most westerly point on all of the option corridors) to Node J (Drumsna Junction) and East of Drumsna Junction the measure is from Node J to Node H (most easterly point on all option corridors) with respect to each of the option corridors.

The trip lengths of each option corridor are tabulated and assessed in Table 7.3.4 and Table 7.3.5. Scores were based around the existing trip length (Blue Option Corridor) west and east of Node J at Drumsna Junction respectively. The existing trip length is given a score of 4 (neutral). A trip length within ±10% of the existing situation received a score of 3 or 5 respectively. A trip length between ±10% and ±20% of the existing situation received a score of 2 or 6 respectively. A score of 1 or 7 was given to an option having a trip length more than ±20% of the existing situation.

Stage 1 Trip Length Assessment of Option Corridors West of Drumsna Junction (Node J)

The Blue West Option Corridor offers the shortest trip length west of Node J at Drumsna Junction. However, this option would see traffic continue to travel through Carrick-on-Shannon. By their nature, each of the option corridors bypassing Carrick-on-Shannon would result in a greater trip length; although, none of which exceed 10% longer than the existing situation.

The Black Option Corridor was not scored under this assessment criteria as it does not pass through Nodes O or J. If the Black Corridor alone was to be implemented, the existing N4 mainline and trip length through Carrick-on-Shannon would remain as it is currently.

Table 7.3.4 Trip Length Assessment of the Option Corridors West of Node J at Drumsna Junction

Option Corridor	**CYAN OPTION CORRIDOR**	**ORANGE OPTION CORRIDOR**	**PURPLE WEST OPTION CORRIDOR**	**DARK GREEN OPTION CORRIDOR**	**BLUE WEST OPTION CORRIDOR**
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**
Trip Length					
Trip Length (O-J) (m)	12,416	12,534	13,344	13,215	12,376
Scoring					
PAG Score	**3**	**3**	**3**	**3**	**4**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Intermediate**	**Preferred**

Stage 1 Trip Length Assessment of Option Corridors East of Drumsna Junction (Node J)

Although the Yellow Option Corridor offers the shortest trip length, in reality, the negligible differences of only -2m to +12m make the Green, Yellow and Blue East Option Corridors indistinguishable under this assessment, and so are all ranked Preferred. The Purple East Option Corridor is ranked Least Preferred, with a trip length approximately 106m longer than the existing, but perhaps has the greatest potential to improve safety along the national primary route by bypassing the village of Aghamore.

Table 7.3.5 Trip Length Assessment of the Option Corridors East of Node J at Drumsna Junction

Option Corridor	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Trip Length				
Trip Length (J-H) (m)	7,864	7,878	7,982	7,876
Scoring				
PAG Score	**5**	**4**	**3**	**4**
Preference	**Preferred**	**Preferred**	**Least Preferred**	**Preferred**

7.3.3.3 Junction Strategy

Methodology

This assessment was separated into two parts: 1) an at-grade assessment and 2) a grade separated assessment. The assessments consider the number of junctions along each of the option corridors. It is TII policy, and an aim of each option corridor, to rationalise the number of junctions along the national primary route where possible to minimise conflict points. This is important to improve road safety and may assist in providing consistent junction layouts. At-grade junctions will cause delays on the mainline, with the delay increasing as the number of at-grade junctions increases. At-grade junctions also have the potential to increase delay on the adjoining local road networks. However, it is vital to provide sufficient connectivity between the national primary route to the regional and local networks via junctions. Conversely, a higher number of grade separated junctions provides greater connectivity to the mainline with no significant delay experienced by the mainline traffic.

The number of at-grade junctions were counted along each option corridor and a score of 7 was given where there were no junctions which would cause delay i.e. at-grade junctions. This score would be reduced by 1 for every junction causing delay until a score of 1 would be given to an option corridor with six or more at-grade junctions.

Conversely, the number of grade separated junctions were counted along each option corridor and a score of 1 was given where there were no grade separated junctions. In keeping with the at-grade assessment, this score would be increased by 1 for the introduction of every grade separated junction until a score of 7 would be given to an option with six or more grade separated junctions.

Finally, the average score of both sub-assessments would determine the overall score for the Junction Strategy assessment. Summaries of the number of junctions in west and east of Node J at Drumsna Junction for each option corridor, along with the Junction Strategy assessments, are tabulated below.

Stage 1 Junction Strategy Assessment of Option Corridors West of Drumsna Junction (Node J)

Each option corridor aims to reduce the number of junctions onto the national primary route while providing sufficient connectivity to the regional and local network. The Purple West Option Corridor is the Preferred option under this assessment west of Node J at Drumsna Junction. The Cyan, Orange and Dark Green Option Corridors are each ranked Intermediate. The Dark Green Option Corridor would be preferred of these three as this option holds more potential to provide grade separation. It is not envisaged that the Cyan and Orange Option Corridors could cater for grade separated junctions. The Blue West Option Corridor would not reduce the number of at-grade junctions onto the N4 as it retains all existing accesses through Carrick-on-Shannon town. Therefore, it does not sufficiently perform to award it a score greater than 1 and is therefore ranked as the Least Preferred option to the west of Node J at Drumsna Junction.

The Black Option Corridor has been assessed separately as a standalone assessment. The Black Option Corridor would need to provide sufficient junctions to facilitate connectivity between the R280, the Summerhill Road and the Castlecara Road. It is not envisaged that grade separation would be either practical or necessary on this corridor. The table below shows how the Black Option Corridor performs in the Junction Strategy Report.

Table 7.3.6 Junction Strategy Assessment of the Option Corridors West of Node J at Drumsna Junction

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Junction Strategy							
# Signalised Junction / Roundabouts	2	2	2	3	6		3
# Priority Junction / Left In - Left Out	0	0	0	0	19		0
At-Grade Assessment Score	***5***	***5***	***5***	***4***	***1***		***4***
# Grade Separated	0	0	1	0	0		*0*
Grade Separated Assessment Score	***1***	***1***	***2***	***1***	***1***		***1***
Scoring							
PAG Score	**3**	**3**	**4**	**3**	**1**		**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Intermediate**	**Least Preferred**		**N/A**

Stage 1 Junction Strategy Assessment of Option Corridors East of Drumsna Junction (Node J)

The Purple East Option Corridor and Blue Option Corridor are the Preferred and Least Preferred options respectively east of Node J at Drumsna Junction. The Purple East Option Corridor would remove all at grade junctions from the N4 and offers the greatest opportunity to provide grade separated junctions. Although the Green and Yellow Option Corridors would reduce the number of direct junctions onto the national primary route, these options do not provide for additional grade separation. The Blue East Option Corridor would not reduce the number of at-grade junctions onto the N4 significantly but would retain the existing grade separated junction at Drumsna.

Table 7.3.7 Junction Strategy Assessment of the Option Corridors East of Node J at Drumsna Junction

Option Corridor	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**	**BLUE EAST OPTION CORRIDOR**
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Junction Strategy				
# Signalised / Roundabouts	0	0	0	0
# Priority / Left In - Left Out	3	4	0	15
At-Grade Assessment Score	***4***	***3***	***7***	***1***
# Grade Separated	1	1	2	1
Grade Separated Assessment Score	***2***	***2***	***3***	***2***
Scoring				
PAG Score	**3**	**3**	**5**	**2**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Least Preferred**

7.3.3.4 Constructability

Methodology

Constructability of all of the option corridors will be complicated due to the extent of existing residential housing, commercial businesses, farms, local roads and accesses dotted along the length of the corridors. Disruption to residents and local traffic will need to be minimised throughout the construction period.

There are many factors that influence the constructability of an option. This assessment has primarily been broken into four sections; total construction length, undesirable lengths, structures and crossings, and major utility interfaces. The undesirable lengths consist of lengths of on-line construction, cuts and fill larger than 10m, and lengths of construction within a floodplain all of which bring complexity to the construction phase. Structures and crossings comprise watercourse, rail and road infrastructure crossings for example, bridges and culverts. The only major utility network assessed as part of the Stage 1 Assessment is the ESBI Network as there is no Gas Networks Ireland infrastructure within the study area.

Stage 1 Constructability Assessment of Option Corridors West of Drumsna Junction (Node J)

The Blue West Option Corridor is preferred as this option consists only of small-scale interventions which would be relatively simple to construct and cause minimal disruption. Although this option corridor would require some watercourse crossings and would interfere with some utilities, there would be no proposals for on-line mainline construction which could cause significant disruptions.

The Cyan Option Corridor is ranked Least Preferred as this option would require the greatest total length of construction, undesirable construction lengths, including the joint longest section of on-line upgrades, the biggest amount of structures and a high level of interference with existing utilities. Both the Cyan and Orange Option Corridors score negatively under the length of on-line construction due to the section between Correen and Drumsna all being on-line. However, this reuse of existing will score positively for these option corridors under other assessment criteria.

The Orange, Purple West and Dark Green Option Corridors are ranked Intermediate, with the Orange Option Corridor being the Least Preferred of these three options due to the longest section of on-line upgrades, construction within the floodplain, and the highest interference with existing utilities.

The Black Option Corridor has been assessed separately as a standalone assessment. The Black Option Corridor scores well under this assessment with only a short section of new construction, few watercourse crossings and no interaction with known existing utilities. Although it is not envisaged that any cuts or embankments larger than 10m would be necessary, it is noted that this alternative would require some significant earthworks to comply with geometry standards, due to the topography within the corridor.

Table 7.3.8 Constructability Assessment of the Option Corridors West of Node J at Drumsna Junction

Option Corridor	**CYAN OPTION CORRIDOR**	**ORANGE OPTION CORRIDOR**	**PURPLE WEST OPTION CORRIDOR**	**DARK GREEN OPTION CORRIDOR**	**BLUE WEST OPTION CORRIDOR**		**BLACK OPTION CORRIDOR**
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Constructability							
Mainline New Construction Length (m)	***11,177***	***9,304***	***9,972***	***9,843***	***0***		1,120
	Least Preferred	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**
'Undesirable' Length							
Length of On-line Construction (m)	4,815	4,815	1,750	525	0		0
Length Cut > 10m	90	0	340	560	0		0
Length of Fill > 10m	490	340	600	940	0		0
Length of Floodplain Crossings	1,428	1,466	1,202	945	0		40
Total 'Undesirable' Length	***6,823***	***6,621***	***3,892***	***2,970***	***0***		**40**
	Least Preferred	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Structures and Crossings							
# New River Shannon Crossings	1	1	1	1	0		0
# Stream Crossings	15	12	10	10	4		6
# Rail Crossings	0	0	0	0	0		0
# Road Overbridges	2	3	4	3	0		0
# Road Underbridges	1	1	1	2	0		0
Total Structures / Crossings	***19***	***17***	***16***	***16***	***5***		***6***
Main Utility Crossings							
ESB - 38kV (OH)	1	2	1	1	0		0
ESB - 38kV (UG)	1	1	0	0	1		0
ESB - 110kV	4	4	3	3	1		0
ESB - 220kV	0	0	0	0	0		0
Total Main Utility Crossings	***6***	***7***	***4***	***4***	***2***		***0***
	Intermediate	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Management Option		Urban Street
Scoring							
PAG Score	2	3	3	3	4		4
Rank	Least Preferred	Intermediate	Intermediate	Intermediate	Preferred		N/A

Stage 1 Constructability Assessment of Option Corridors East of Drumsna Junction (Node J)

The Blue East Option Corridor is again Preferred east of Node J at Drumsna Junction due the extent and nature of works proposed.

The Purple East, Green and Yellow Option Corridors score equally in terms of structures and utility crossings, therefore the nature of the construction lengths is the defining factor. The Green Option Corridor is ranked Least Preferred as it is a wholly on-line upgrade option and would require the most on-line construction.

Table 7.3.9 Constructability Assessment of the Option Corridors East of Node J at Drumsna Junction

Option Corridor	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**	**BLUE EAST OPTION CORRIDOR**
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Constructability				
Mainline Construction Length (m)	***7,864***	***7,878***	***7,616***	***0***
	Intermediate	**Least Preferred**	**Intermediate**	**Preferred**
'Undesirable' Length				
Length of On-line Construction	6814	7878	5212	0
Length Cut > 10m	0	0	0	0
Length of Fill > 10m	0	0	0	0
Length of Floodplain Crossings	0	0	0	0
Total 'Undesirable' Length	***6,814***	***7,878***	***5,212***	***0***
	Intermediate	**Least Preferred**	**Intermediate**	**Preferred**
Structures and Crossings				
# New River Shannon Crossings	0	0	0	0
# Stream Crossings	2	2	2	3

Option Corridor	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**	**BLUE EAST OPTION CORRIDOR**
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
# Rail Crossings	0	0	0	0
# Road Overbridges	3	3	3	0
# Road Underbridges	0	0	0	0
Total Structures / Crossings	***5***	***5***	***5***	***3***
	Least Preferred	**Least Preferred**	**Least Preferred**	**Preferred**
Main Utility Crossings				
ESB - 38kV (OH)	0	0	0	0
ESB - 38kV (UG)	0	0	0	0
ESB - 110kV	0	0	0	0
ESB - 220kV	1	1	1	1
Total Main Utility Crossings	***1***	***1***	***1***	***1***
	Preferred	**Preferred**	**Preferred**	**Preferred**
Scoring				
PAG Score	**3**	**2**	**3**	**4**
Preference	**Intermediate**	**Least Preferred**	**Intermediate**	**Preferred**

7.3.3.6 Traffic

Methodology

The traffic assessment compares how the Option Corridors perform against the Do-Minimum scenario for the future years of 2030 and 2045. The criteria assessed was the change in AADT over the River Shannon Bridge as this gives a corresponding assessment of the number on the proposed option corridor i.e. a high reduction of traffic numbers on the River Shannon Bridge gives a higher traffic number on the proposed bypass, which in turn then gives a reduction in the congestion and an improvement on journey time. The Do-Minimum scenario (±1%) is given a score of 4 (Neutral). A change in AADT of up to ±10% from this scenario received a score of 3 or 5, depending on whether it is plus 10% or minus 10% respectively, where a reduction in AADT is deemed positive. A change in AADT between ±10% and ±20% from this scenario received a score of 2 or 6. A score of 1 or 7 was given to an option predicting a change in AADT of more than ±20% from this scenario. The final score for the assessment is based on the average change in AADT over the 2030 and 2045 scenarios. The Do-Minimum AADT across the River Shannon Bridge for the years 2030 and 2045 is 16,844 and 17,066 respectively.

Stage 1 Traffic Assessment of Option Corridors West of Drumsna Junction (Node J)

The introduction of any of the option corridors will reduce AADT over the River Shannon Bridge. The Orange Option Corridor is ranked Preferred, providing the greatest reduction. This can be attributed to being the shortest option corridor with tie-in points to the existing N4 closest to Carrick-on-Shannon. The Blue Option Corridor is least preferred as it would offer an insignificant difference.

The selection of an Option Corridor east of Node J will have no impact on AADT over the River Shannon Bridge, and therefore the traffic assessment east of Drumsna Junction is omitted.

As a standalone assessment, the Black Option Corridor would also offer an insignificant difference in AADT over the River Shannon Bridge and is given a score of 4.

Table 7.3.10 Traffic Assessment of the Option Corridors West of Node J at Drumsna Junction

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Traffic (AADT on River Shannon Bridge)							
Year 2030	12,839	12,756	13,862	13,888	16,662		16,793
Change in AADT	*-23.8%*	*-24.3%*	*-17.7%*	*-17.5%*	*-1.1%*		*-0.3%*
Year 2045	13,626	12,884	14,043	14,074	16,962		16,999
Change in AADT	*-20.2%*	*-24.5%*	*-17.7%*	*-17.5%*	*-0.6%*		*-0.4%*
Scoring							
PAG Score	**7**	**7**	**6**	**6**	**4**		**4**
Preference	**Intermediate**	**Preferred**	**Intermediate**	**Intermediate**	**Least Preferred**		**N/A**

7.3.4 Summary

The engineering assessment of the Stage 1 Option Corridors has examined each of the option corridors under the headings Geometry, Trip Length, Junction Strategy, Constructability and Traffic. The methodology used to assess the option corridors under each heading has been detailed throughout Section 7.3.3. The option corridors were scored based on the seven-point scale before a ranking was given as Preferred (P), Intermediate (I) or Least Preferred (LP) under each heading.

7.3.4.1 Summary of Engineering Assessment West of Drumsna Junction (Node J)

Cyan Option Corridor

The Cyan Option Corridor is one of the preferred options in terms of Geometry and comparable to the Orange, Purple and Dark Green Option Corridors under Trip Length and Junction Strategy, although grade separation is not deemed feasible at this stage. However, the Cyan Option Corridor is ranked as the Least Preferred option under Constructability with the most total construction length, joined most on-line upgrade, significant construction within the floodplain and the most structures & stream crossings required of all of the options west of Drumnsa Junction. The Cyan Option Corridor would offer a significant reduction in AADT over the River Shannon Bridge.

Orange Option Corridor

The Orange Option Corridor is one of the preferred options in terms of Geometry and comparable to the Cyan, Purple and Dark Green Option Corridors under Trip Length and Junction Strategy, although grade separation is not deemed feasible at this stage. Although the Orange Option Corridor would require the shortest amount of new off-line construction, this option would require the most construction within the floodplain and contains the most major utility interaction. The Orange Option Corridor is ranked preferred under the traffic assessment as it would offer the greatest reduction in AADT over the River Shannon Bridge.

Purple West Option Corridor

The Purple Option Corridor is one of the preferred options in terms of Geometry and the preferred option alone in terms of Junction Strategy. Both of these criteria may have the greatest influence to improve safety on this section of the national primary route. The Purple Option Corridor is marginally ranked Least Preferred for Trip Length, although it does not exceed 10% longer than the existing route. Moderate constructability impacts are envisaged along this Option Corridor due to a variety of on-line construction, floodplain crossing, deep cuts and large embankments. This option corridor offers an intermediate reduction in AADT over the River Shannon Bridge.

Dark Green Option Corridor

The Dark Green Option Corridor is one of the preferred options in terms of Geometry and may hold the potential to cater for grade separation. Construction of a new roadway within this option corridor would require large sections of deep cuts and high embankments, but a shorter section of floodplain crossing, and only minimal length of on-line construction compared to the Purple West Option Corridor. The Dark Green Option Corridor also offers an intermediate reduction in AADT over the River Shannon Bridge.

Blue West Option Corridor

The Blue West Option Corridor scores well under Trip Length but would see the national primary route continue through Carrick-on-Shannon and over the existing River Shannon Bridge and would not relieve through traffic or improve journey time within the study area. The Blue Option Corridor is the Preferred option under Constructability as this option is expected to have little construction impacts and cause minimal disruptions due to only small-scale interventions. However, the Blue Option Corridor scores poorly under Geometry and Junction Strategy; due to maintaining the existing sub-standard mainline alignment and not adequately reducing the number of junctions onto the national primary route. The Blue West Option Corridor would have an insignificant, if not negligible, effect on reducing AADT over the River Shannon Bridge.

Black Option Corridor

The Black Option Corridor is a short link road which aims to improve connectivity within Carrick-on-Shannon and reduce some of the through traffic the town centre. This corridor alone would have no impact on the existing national primary route outside of the town due to lack of physical intervention. The Black Option Corridor could achieve at least desirable minimum geometry but would require some significant earthworks for a relatively short section of new roadway. This option corridor does not interfere with any known major utility network infrastructure. The Black Option Corridor does not pass through Nodes O or J and was therefore excluded from the Trip Length assessment; but in the event this alternative alone is implemented, the existing trip length, that of the Blue Option Corridor, would remain. Three at-grade junctions would be required as part of this corridor to facilitate connectivity between the R280, the Summerhill Road and the Castlecara Road. At this stage it is deemed grade separation would not be practical nor warranted on this corridor. The Black Option Corridor would have an insignificant, if not negligible, effect on reducing AADT over the River Shannon Bridge.

Table 7.3.11 Engineering Assessment Matrix of Option Corridors - West of Drumsna Junction (Node J)

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Geometry	New off-line route designed to achieve at least desirable minimum curvature. On-line upgrade also designed to achieve at least desirable minimum curvature.	New off-line route designed to achieve at least desirable minimum curvature. On-line upgrade also designed to achieve at least desirable minimum curvature.	New off-line route designed to achieve at least desirable minimum curvature. On-line upgrade also designed to achieve at least desirable minimum curvature.	New off-line route designed to achieve at least desirable minimum curvature. On-line upgrade also designed to achieve at least desirable minimum curvature.	With no off-line route or on-line upgrades, the substandard mainline would remain as existing.		A new link road designed to achieve at least desirable minimum curvature for an urban street.
Trip Length	A bypass route by nature will be longer than the existing. Within 10% longer than the existing route.	A bypass route by nature will be longer than the existing. Within 10% longer than the existing route.	A bypass route by nature will be longer than the existing. Longest, and therefore Least preferred, yet still within 10% of the existing route.	A bypass route by nature will be longer than the existing. Within 10% longer than the existing route.	Assessment criteria considers the existing as the baseline or 'Neutral'.		N/A
Junction Strategy	Would reduce the number of junctions onto the national primary route. Appears grade separation not suitable, therefore limited to at-grade junctions.	Would reduce the number of junctions onto the national primary route. Appears grade separation not suitable, therefore limited to at-grade junctions.	Would reduce the number of direct access and junctions onto the national primary route. Would include grade separation and therefore reduce delay on the national primary route.	Would reduce the number of direct access and junctions onto the national primary route. May hold potential to cater for grade separation.	Would not significantly reduce the number of direct access or junctions onto the national primary route.		Would require 3 at-grade junctions to provide effective connectivity.

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Constructability	Would require the most new off-line construction, joined most on-line upgrade, significant construction within the floodplain and the most structures & crossings of all of the options.	Would require the shortest amount of new off-line construction, but joined longest on-line upgrade, and the longest floodplain crossing. Similar to other options in terms of structures and utility crossings.	Would require some sections of deep cuts and high embankments with some on-line construction and floodplain crossings. Similar to other options in terms of structures and utility crossings.	Would require large sections of deep cuts and high embankments, but a shorter section of floodplain crossing and only minimal length of on-line construction. Similar to other options in terms of structures and utility crossings.	Small scale interventions which would be easy to construct causing minimal disruption.		No on-line works other than to construct junctions. Would require moderately large cuts and embankments.
Traffic	Would offer a significant reduction in AADT over the River Shannon Bridge.	Would offer the greatest reduction in AADT over the River Shannon Bridge.	Would offer an intermediate reduction in AADT over the River Shannon Bridge.	Would offer an intermediate reduction in AADT over the River Shannon Bridge.	Would offer an insignificant / negligible reduction in AADT over the River Shannon Bridge.		Would offer an insignificant / negligible reduction in AADT over the River Shannon Bridge.

Option Corridor	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Cross-section Assessed	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**		**Urban Street**
Scoring							
Qualitative Assessment	One of the preferred options in terms of Geometry and comparable under Trip Length and Junction Strategy, although grade separation is not deemed feasible at this stage. The Least Preferred option under Constructability with the most new off-line construction, joined most on-line upgrade, significant construction within the floodplain and the most structures & crossings of all of the options. Would offer a significant reduction in AADT over the River Shannon Bridge.	One of the preferred options in terms of Geometry and comparable under Trip Length and Junction Strategy, although grade separation is not deemed feasible at this stage. Although requiring the shortest amount of new off-line construction, this option would require the most construction within the floodplain and contains the most utility crossings. Would offer the greatest reduction in AADT over the River Shannon Bridge.	One of the preferred options in terms of Geometry and the preferred option alone in terms of Junction Strategy; both which may have the greatest influence to improve safety. Marginally ranked Least Preferred for Trip Length, although within 10% of the existing route along with the other options. Intermediate constructability impacts due to a variety of on-line construction, floodplain crossing, deep cuts and large embankments. Would offer an intermediate reduction in AADT over the River Shannon Bridge.	One of the preferred options in terms of Geometry and may hold the potential to cater for grade separation. Would require large sections of deep cuts and high embankments, but a shorter section of floodplain crossing and only minimal length of on-line construction. Would offer an intermediate reduction in AADT over the River Shannon Bridge.	Scores well under Trip Length and Constructability. However, this route runs through Carrick-on-Shannon and would not relieve through traffic or improve journey time. Is expected to have little construction impacts due to small scale intervention. Scores poorly under Geometry and Junction Strategy which have significant safety impacts. Would offer an insignificant / negligible reduction in AADT over the River Shannon Bridge.		A short link road to improve connectivity and reduce some of the through traffic in Carrick-on-Shannon. Would have no impact on the existing national primary route outside of the town alone due to lack of physical intervention. Some significant earthworks would be required for a short section of new roadway. Would offer an insignificant / negligible reduction in AADT over the River Shannon Bridge.
PAG Score	3	3	4	3	3		3
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Intermediate**	**Least Preferred**		**N/A**

Table 7.3.12 Summary Engineering Scoring Matrix of Option Corridors to the West of Drumsna Junction (Node J)

Assessment Criteria	**CYAN OPTION CORRIDOR**	**ORANGE OPTION CORRIDOR**	**PURPLE OPTION CORRIDOR**	**DARK GREEN OPTION CORRIDOR**	**BLUE OPTION CORRIDOR**	**BLACK OPTION CORRIDOR**
Cross-section	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Dual Carriageway**	**Management Option**	**Urban Street**
Geometry	7	7	7	7	4	7
Trip Length	3	3	3	3	4	N/A
Junction Strategy	3	3	4	3	1	3
Constructability	2	3	3	3	4	4
Traffic	7	7	6	6	4	4
Scoring						
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Not Significant** or **Neutral**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**4**	**3**	**3**	**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Intermediate**	**Least Preferred**	**N/A**

7.3.4.2 Summary of Engineering Assessment East of Drumsna Junction (Node J)

Purple East Option Corridor

The Purple Option Corridor is one of the preferred options in terms of Geometry and the preferred option alone in terms of Junction Strategy as it holds the most potential to provide grade separation at junctions. It is ranked Least Preferred in terms of Trip Length as it provides a longer route to bypass the village of Aghamore. Providing this off-line bypass would enhance the safety on the national primary route and would also result in less on-line upgrade construction, although significant on-line works would still be required.

Green Option Corridor

Proposals within the Green Option Corridor would see the existing mainline upgraded to achieve current geometric standards as well as reducing the number of junctions onto the national primary route. However, as a wholly on-line option, this would require major on-line works which would likely cause significant delays and disruptions during construction. The existing grade separated Drumsna junction would be maintained but it is envisaged that all other junctions would remain at-grade.

Yellow Option Corridor

The Yellow Option Corridor would also see most of the existing mainline upgraded to achieve current geometric standards as well as reducing the number of junctions onto the national primary route. By providing an off-line section towards the southern end of the study area, the Yellow Option Corridor could accommodate enhanced overtaking sections over the existing situation and Green Option Corridor while reducing the amount of on-line construction required along the corridor. As for the Green Option Corridor the existing grade separated Drumsna Junction would be maintained but it is envisaged that all other junctions would remain at-grade.

Blue East Option Corridor

The Blue Option Corridor would not see any works done on the existing mainline other than maintenance and overlay to existing mainline pavement when required. This would eliminate the significant delays and disruptions envisaged as a result of a complete on-line upgrade construction. A number of junction and access points would be rationalised to reduce the total number of junctions onto the national primary route. The difference in Trip Length that the Blue, Green and Yellow Option Corridors offer is negligible.

Summary

The engineering assessment of the Option Corridors east of Node J at Drumsna Junction is summarised in Table 7.3.13 and below. The Purple East Option Corridor is ranked as the Preferred Option in this section. Due to the provision of a bypass of Aghamore, this option corridor would see less on-line construction than the Green or Yellow Option Corridors, thus causing less disruption during construction.

Although the Blue East Option Corridor would not propose any on-line works, this option would not address the geometric issues associated with the existing mainline. The Purple East Option Corridor also holds greater potential to offer grade separation at junctions, other than the existing Drumsna junction. The additional Trip Length associated with the Purple Option Corridor is not deemed significant.

Table 7.3.13 Engineering Assessment Matrix of Options Corridors to the East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Geometry	On-line upgrade designed to achieve at least desirable minimum curvature.	On-line upgrade designed to achieve at least desirable minimum curvature.	On-line upgrade designed to achieve at least desirable minimum curvature. Provides opportunity to bypass Aghamore.	With no off-line route or on-line upgrades, the substandard exiting mainline remains.
Trip Length	An insignificant improvement on the existing situation (12m).	Complete on-line upgrade - negligibly longer than the existing route (2m).	Creates the longest Trip Length due to the bypass of Aghamore, yet still within 10% of the existing route.	Assessment criteria considers the existing as the baseline or 'Neutral'.
Junction Strategy	Would reduce the number of junctions onto the national primary route while continuing to use the existing Drumsna junction to aid traffic flow.	Would reduce the number of junctions onto the national primary route while continuing to use the existing Drumsna junction to aid traffic flow.	Would reduce the number of direct access and junctions onto the national primary route. Has the most potential for grade separated junction which would cause the least amount of delay.	Would not significantly reduce the number of direct access or junctions onto the national primary route.
Constructability	Similar to other options in terms of structures and diversion but proposes less on-line construction due to on off-line section at Faulties.	Similar to other options in terms of structures and diversions but being a completely on-line route has the most proposed on-line construction which would cause disruptions.	Similar to other options in terms of structures and diversion but proposes the least amount of on-line construction due to the bypass of Aghamore.	Small scale interventions which would be easy to construct causing minimal disruption.

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Scoring				
Qualitative Assessment	One of the preferred options in terms of Geometry. Indistinguishable between Green and Blue in terms of Trip Length. Provides for improvements in junction strategy but also consists of large amounts of on-line upgrade construction. **Not Significant** or **Neutral**	One of the preferred options in terms of Geometry. Indistinguishable between Yellow and Blue in terms of Trip Length. Provides for improvements in junction strategy but would be the most disruptive to construct due to being a wholly on-line option. **Not Significant** or **Neutral**	One of the preferred options in terms of Geometry but is less desirable in terms of Trip Length due to the bypass of Aghamore. Has the most potential to provide grade separated, free flowing junctions, and would consist of the least amount of on-line construction. **Minor** or **Slightly Positive**	Scores well under Constructability as expected. Would have little construction impacts due to small scale intervention. Indistinguishable between Green and Yellow in terms of Trip Length. Scores poorly under Geometry and Junction Strategy which have significant safety impacts. **Minor** or **Slightly Negative**
Score / Impact Level	**4**	**4**	**5**	**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Least Preferred**

Table 7.3.14 Engineering Assessment Matrix East of Drumsna Junction (Node J)

Assessment Criteria	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**	**BLUE EAST OPTION CORRIDOR**
Cross-section Assessed	**Single Carriageway**	**Single Carriageway**	**Dual Carriageway**	**Management Option**
Geometry	7	7	7	4
Trip Length	5	3	3	4
Junction Strategy	3	3	5	2
Constructability	3	2	3	4
Scoring				
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Negative**
Score / Impact Level	**4**	**4**	**5**	**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Least Preferred**

7.4 Stage 1 Road Safety Impact Assessment

A Road Safety Impact Assessment (RSIA) was carried out for the Stage 1 Assessment of the Option Corridors described in Section 7.1.2. A copy of the RSIA is included in Appendix A.6.4.1. The Stage 1 Assessment is a high level assessment and assesses corridors only, it does not consider a particular cross-section. However, the safety assessment is already considered in the Engineering assessment.

This study examined the impact the option corridors would have on the existing road network within the study area west of Node J at Drumsna Junction and east of Drumsna Junction at Node J. The RSIA considers effects on the network and takes account of all road users, including vulnerable road users in order to ensure that the implications on road safety of each option corridor is fully assessed as part of the Option Selection Process. The assessment indicates the road safety considerations which shall inform the selection of the preferred transport solution.

In addition to the Option Corridors, the Do-Nothing and Do-Minimum scenarios are also assessed. The Do-Minimum Scenario is described in detail in Section 5.2.4.2 but briefly, it includes transportation projects and services that are already committed to be completed within the appraisal period of the N4 Project. The impact of each proposed option corridor was assessed and categorised as positive, negative or neutral from a safety perspective. An extract of the option corridor's Safety Ratings is provided in Table 7.4.1 and Table 7.4.2 below.

Table 7.4.1 West of Drumsna: Do-Nothing, Do-Minimum and Option Corridors Safety Ratings

	Do-Nothing	Do-Min	Blue	Black	Dark Green	Purple	Cyan	Orange
Safety Rating	Mod. Negative	Slightly Negative	Slightly Positive	Slightly Positive	Highly Positive	Highly Positive	Highly Positive	Highly Positive

Table 7.4.2 East of Drumsna: Do-Nothing, Do-Minimum and Option Corridors Safety Ratings

	Do-Nothing	Do-Min	Blue	Purple	Green	Yellow
Safety Rating	Moderately Negative	Slightly Negative	Slightly Positive	Highly Positive	Moderately Positive	Moderately Positive

The following issues are the major contributory factors to road safety in the study area:

- Significant congestion exists along the N4 corridor especially across the River Shannon bridge crossing in Carrick-on-Shannon
- Single river crossing is sub-standard in terms of alignment and cross-section
- Journey time unreliability due to uncertain quantum of delay
- Journey time variability throughout the day
- Peak hour traffic delay

The issues above could be addressed to varying degrees by each of the option corridors as outlined in the RSIA. Carrick-on-Shannon town centre is the major conflict with the national primary route traffic within the study area. By providing an off-line bypass of Carrick-on-Shannon, which would offer a second crossing point of the River Shannon, safety would be improved for all road users within the town, including pedestrians and the vulnerable. Journey time reliability and peak hour delays would also improve as a result of removing through traffic from the town centre to an appropriate route designed to cater for the strategic traffic.

7.5 Stage 1 Environmental Assessment of Options

7.5.1 Stage 1 Population and Human Health Option Assessment

7.5.1.1 Introduction

This section details the Stage 1 Population and Human Health assessment of the options.

This is a broad ranging topic which *"covers the existence, activities and health of people, usually considering people as groups or 'populations'"* (EPA 2015)[3] Aspects examined in this section primarily relate to potential impacts on socio-economic activities (settlement patterns, population characteristics, activities, and economic) and social well-being and health of people at a community level.

Criteria relevant to the assessment of socio-economic activities include journey characteristics, journey amenity, general amenity, community severance, and economic effects relating to business, tourism and employment and relate to the constraints identified in Section 4.4. The Population constraints are presented with the Stage 1 Option Corridors in Figures 7.5.1.1.0 to 7.5.1.1.5.

Other aspects relevant to population such as natural amenity, built and natural heritage, ecosystem services, material assets and nuisance are dealt with in the following sections:

- Section 7.5.2, Material Assets Non-Agriculture
- Section 7.5.3, Material Assets Agriculture
- Section 7.5.4, Air Quality
- Section 7.5.5, Climate
- Section 7.5.6, Noise and Vibration
- Section 7.5.7, Archaeological, Architectural and Cultural Heritage
- Section 7.5.8, Landscape and Visual
- Section 7.5.9, Biodiversity
- Section 7.5.10, Hydrology
- Section 7.5.11, Hydrogeology
- Section 7.5.12, Soils and Geology

Human health impacts are primarily considered through an assessment of the environmental pathways by which health can be affected such as air, noise, water or soil. Therefore, the health assessment relies on the assessments in the following sections and draws on the findings as necessary to examine whether the effects

[3] Extracted from the Advice Notes for Preparing Environmental Impact Statements (EPA draft September 2015)

arising from any identified impacts may have a health impact and to ensure that the effects which may have a health impact are fully considered:

- Section 7.5.4, Air Quality to identify the predicted air quality values adjacent to the proposed option corridors
- Section 7.5.6, Noise and Vibration to identify the predicted noise levels at properties adjacent to the proposed option corridors
- Section 7.5.10, Hydrology to identify areas with any potential impacts on surface water and areas of flood risk
- Section 7.5.11, Hydrogeology to identify areas with any potential impacts on groundwater
- Section 7.5.12, Soils and Geology to identify if there are any areas of contaminated soils

The health assessment also considers health improvement and improvement to services. Other aspects, such as changes in traffic flows which are dealt with in Chapter 3, Traffic Assessment and Cross-Section, have also been considered in relation to the assessment of Socio-economic and Health impacts to ensure that the effects of these issues on population and human health have been addressed.

Section 7.5.1.2 outlines the methodology utilised to carry out the assessment, Sections 7.5.1.3 details the options assessment and a summary is presented in Section 7.5.1.4.

7.5.1.2 Methodology

The assessment in relation to Population and Human Health has been split into two aspects, namely socio-economic activities (Population) and local community health (Human Health). The methodology for these two aspects is set out separately below.

Population

An assessment of Population requires that an understanding of the community is built up through background research, site visits, and conversations with local people and community representatives. For the preliminary options report information has been collected by means of:

- Primary data sources (e.g., demographic data from Census 2016[4] and Census 2011[5] produced by the Central Statistics Office)
- Maps of the study area, including Ordnance Survey Ireland (OSi) Discovery Series 1:50,000 Sheet 33[6]

[4] Central Statistics Office, 2017. Census 2016 Reports. Available at: https://www.cso.ie/en/census/census2016reports/
[5] Central Statistics Office, 2012. Census 2011 Reports. Available at: https://www.cso.ie/en/census/census2011reports/
[6] Ordnance Survey Ireland, 2021. OSi 1:50,000 Discovery Series Sheet 33. Available at: https://sites.google.com/site/theirelandwalkingguide/publications/maps/osi-discovery/sheet33

- Spatial data, including Google Maps[7] and Google Streetview, Open Street Map[8], Department of Education school maps, and church and parish location maps, supplemented by site visits
- Relevant environmental data collected by other disciplines during their studies
- A review of relevant planning document including the Leitrim County Development Plan (2015-2021)[9] and the Roscommon County Development Plan (2022-2028)[10] the prevailing Carrick-on-Shannon Local Area Plan (2010-2019)[11] and the Cortober Area Plan (2015)[12]
- A review of secondary sources including the National Planning Framework[13] and the National Development Plan[14] the Regional Spatial and Economic Strategy 2020-2032 (NWRA-RSES)[15]
- A review of previous Environmental Impact Assessments (EIAs), including of the Environmental Impact Assessment Report for the N4 Dromod-Rooskey Bypass (2004) and the Route Corridor Selection Report (2009) prepared by Roughan & O'Donovan which culminated in a preferred route corridor
- Observation of local settlement and travel patterns and identification of community facilities

[7] Google, 2022. Google Maps. Available at: https://www.google.ie/map
[8] OSM, 2022. Open Streetmap. Available at: https://www.openstreetmap.org
[9] Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan/County_Development_Plan_2015-2021 Note the updated Leitrim County Development Plan will come into effect on 21 March 2023, and it does not change this assessment.
[10] Roscommon County Council, 2022. Roscommon County Development Plan 2022-2028. Available at: https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/stage-3-amendments/stage-3-adoption-of-plan
[11] Leitrim Council, 2010. Carrick-on-Shannon Local Area Plan 2010-2019. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Local-Area-Plan/Amendment-2-Carrick-on-Shannon-2010-2019/
[12] Roscommon County Council, 2014. Cortober Area Plan 2014-2020. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/2-Cortober-Area-Plan.pdf
[13] Government of Ireland, 2018. Project Ireland 2040 Notional Planning Framework. Available at: https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf
[14] Government of Ireland, 2018. Project Ireland 2040 National Development Plan 2018-2027. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null
[15] The Northern and Western Regional Assembly, 2020. Regional Spatial and Economic Strategy 2020-2032 (RSES). Available at: https://www.nwra.ie/rses/

- Websites identifying local walks and trails, angling rivers and lakes[16] [17] [18]

Features relevant to the assessment of Population are discussed in detail in the preceding Chapter 4 - Constraints Study. Many of these relate to the community facilities which are concentrated in Carrick-on-Shannon and Cortober. These include shops and retail centres and services such as hairdressers, schools, sports facilities and playing fields, churches and religious facilities, cemeteries, marinas and moorings, hotels and accommodation, parks and areas of amenity. In addition, there are numerous businesses in and outside of the urban areas which are important for the local economy and employment. There are also linear amenities, most notably the River Shannon, part of the Shannon-Erne Blueway, which is used for boating, kayaking, rowing and angling, and also footpaths, Slí na Sláinte routes and cycle routes.

In terms of sensitivity, direct impacts on churches or other religious facilities or sites would be of profound significance, but nearby roads would not necessarily have a significant impact if noise levels were acceptable on standard indices. Noise can also be of significance to visits to cemeteries, although many established cemeteries are located beside major roads.

Schools and nursing homes are also sensitive to noise and to air quality effects while playing fields have a degree of sensitivity to noise and air quality effects. These facilities would also be vulnerable to physical severance, including where there could be a need for at-grade road crossings, even when assisted by signalised pedestrian or cycle lights. Impacts could extend to adjacent roads.

Direct impacts on businesses would have both an economic and employment impact depending on the size and local significance of the business. However, businesses also benefit from improvements in accessibility and reduced traffic congestion.

The Stage 1 Preliminary Options Assessment considers the potential effects that the options could present at a community level, rather than for individuals or identifiable properties; although effects on individual businesses are discussed. Physical effects on individual properties are addressed separately in Section 7.5.2 Material Assets Non-Agriculture, but this assessment does treat the principal communities of Carrick-on-Shannon, Cortober, Jamestown, Drumsna and Aghamore as constraints, along with other named communities or clusters of residential properties. It also takes into account the effect of possible demolitions or acquisitions where these could impact on the wellbeing of the residual community.

[16] Fermanagh Tourist Information Centre, 2021. Kingfisher Cycle Trail. Available at: https://kingfishercycletrail.com/
[16] Waterways Ireland, 2021. Blueways. Available at: https://www.bluewaysireland.org/
[17] Leitrim Tourism, 2021. Walks and Trails. Available at: https://leitrimtourism.com/things-to-do/walks-and-trails/
[18] Inland Fisheries Ireland, 2021. Carrick on Shannon Coarse Angling Centre. Available at: https://fishinginireland.info/coarse/shannon/carrickonshannon/

Population Assessment Criteria

The Population assessment is primarily qualitative, although quantitative data will be taken into account where available or relevant to the stage of the assessment, including traffic volumes, pedestrian and cyclist counts, journey time, accident statistics and property counts. There are five principal assessment criteria for the assessment of Population as below. For the preliminary option corridors, an assessment is made of access to community facilities and workplaces.

- Journey Characteristics and Connectivity

This criterion takes account of journey patterns based on the nature of the transport network and observed or projected journeys to urban destinations, workplaces and community facilities. Sub-criteria include journey time, journey time reliability, accessibility, and journey connectivity (the availability of connections between desired origins and destinations). These sub-criteria depend also on traffic data and are assessed for all road users including private drivers, commercial drivers, public transport users, cyclists and pedestrians.

- Journey Amenity

Relevant effects arise from the proximity to, volume of, or speed of traffic, as it affects the pleasantness, and perceived or actual safety of pedestrians, cyclists, public transport users and drivers. This will also be affected by the facilities available for these road users (e.g. pavement footpaths, cycle paths, crossing facilities, etc), the physical separation of vehicular traffic from pedestrians or cyclists, the nature of any junctions to be negotiated, the proportion of HGVs and the location of public transport stops, including for school buses. For vulnerable road users, age and physical ability are taken into account. Particular issues include the exposure presented by road crossings or junctions, and the legibility of the transport network, i.e. being able to find one's way (including signage).

- General Amenity and Community Facilities

Community facilities may be directly or indirectly impacted. There can also be effects on residential quality of life or community wellbeing, or on amenity and recreation, due to a combination of environmental effects (e.g. noise or visual) for which significance has been identified in respective chapters of the assessment. Impacts may also arise where traffic adversely affects people's perception of community identity and belonging. This effect can arise from proximity to traffic (see also severance), from changes in traffic volumes on connecting local roads, or from changes in neighbourhood interaction. There are links between General Amenity and health, or social inclusion given the importance of access to community facilities used by sensitive receptors.

- Community Severance

This refers to the ability of people to access community facilities, workplaces, friends or neighbours, particularly as it affects sensitive receptors such as older people, children or people with disabilities. Physical severance can take the form of new severance, for example due to the insertion into the landscape of a new transport facility, or of relief from severance, for example from reductions in

vehicle traffic or the provision of crossings facilities. Social severance can also occur where people feel contained without road boundaries causing their social interaction to diminish. Higher or lower traffic volumes can affect both forms of severance.

- Economic

These arise from changes in economic activity affecting local businesses or employment, either directly or indirectly. These effects can occur due to direct impacts on business premises, from changes in accessibility, or from changes in development opportunities for the local economy.

Scoring

The appraisal of impacts for the Population assessment is based on a multi-criteria analysis (MCA) as described in the TII Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 (PE-PAG-02031)[2]. The number and significance of individual effects are assessed and converted to the assessment scores provided in Table 6.5.1.1. Equal importance weighting is applied to the five criteria listed above for the assessment of potential impacts relevant to Population. The options are rated relative to the baseline environment using qualitative as well as quantitative analysis and professional judgement of their significance using the scoring definition listed in Table 7.3.1 of this report.

Human Health

Human health assessment focuses on three main areas: *health protection, health improvement and improving services* and are the sub-criteria used in the human health assessment. For this Stage 1 Assessment, *health improvement and improving services* are combined as a single assessment as there are no distinct differentiating factors between the options corridors in terms of these two criteria.

There is no specific guidance on the assessment of human health; however, a review of current and emerging guidance on assessing health in Environmental Impact Assessments was undertaken and is included in Appendix A.6.5.1 and forms the basis for the methodology set out here. The assessment utilises a standards-based approach. Whilst it is acknowledged that there is stress and anxiety associated with the acquisition of homes and property, the option corridors span the entire study area with associated stress and anxiety across the study area. Therefore, as it is not a differentiator at this Stage 1, the psychological effects are not assessed for each of the option corridors.

For the Stage 1 assessment, the option corridors are assessed in two sections. west of Drumsna (node J) and east of Drumsna (node J).

The assessment of each Option Corridor includes both a quantitative and qualitative assessment. Firstly, each Option Corridor is assessed under the two sub-criteria, namely *health protection and combined health improvement and improving services,* and the level of potential impact and its significance is assigned as per Table 7.3.1. Following this an overall assessment of each Option Corridor is completed and scored based on the seven-point scale listed in the section above.

Each of the Option Corridors are then ranked using professional judgement as Preferred, Intermediate or Least Preferred.

Sub-criterion 1: Health Protection

Health protection impacts are primarily considered through an assessment of the environmental pathways by which health can be affected include:

- Noise and Vibration – for example potential exposure of people to noise emissions from vehicles and construction activities
- Air – for example potential exposure of people to dust and air emissions from vehicles and construction activities
- Water – for example potential exposure of people to changes in water quality (surface and ground water) or changes in water flows – flood risk
- Soils – for example potential exposure of people to contaminated land

The results of technical assessments of noise, air, soil and water and any potential hazard directly attributed to what is proposed by the options on these elements informed the health protection assessment.

These technical assessments use standards[19] (such as air quality standards) in order to identify whether significant impacts will arise or not. It is important to point out that health standards do not only exist to protect robust groups within the population but are primarily intended to protect the vulnerable. The standards are set at levels for which there will be no significant health effects, but do not exclude each and every effect, i.e. slight or moderate health effects are possible even below the levels at which health based standards would apply.

Sub-criterion 2: Health Improvement and Improving Services

Projects that have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance, could contribute to improving the health and wellbeing of socio-economically deprived communities.

The assessment of human health for the project, in terms of health improvement, includes an assessment on how the project would impact on the socio-economics of the community.

Improving access to services such as hospitals or recreational facilities will have an impact on the health of a community. Therefore, the assessment of human health for the project includes an assessment on whether or not the project will improve access to these services.

Opportunities for health improvements and improved access to services due to the option corridors were identified and each option corridor scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes

[19] The term standards in this instance covers guidelines for example noise guidelines as such standard are not currently available.

- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents
- Potential for improved public transport and an improved environment for cycling and walking within Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in the health benefits

Significance of Human Health Impacts

There is a difficulty in assigning levels of significance to human health impacts. In medicine, as in all science, the concept of statistical significance is used. This involves attaching a value to significance, often expressed as a percentage level of confidence in the data. Confidence measures of 95% or even 99% are often used to measure levels of certainty or changes that are not due to chance alone.

This is a valid approach for the study of the impacts on a *population* but does not absolutely exclude a response on an *individual*. However, it is difficult to assign levels of significance to individual human health impacts without detailed information about that individual. Thus, the significance of health effects are assessed on a group or community basis rather than on an individual basis. There is such a variability in human response that one could never identify all possible individual effects and so, in accordance with the guidance referred to above, it is considered to be more appropriate to assess the significance of health effects at a population level. The significance criteria for the assessment of the health of communities are therefore as outlined in Table 7.5.1.1 below.

Table 7.5.1.1 Significance Criteria Used in the Assessment of Community Health Protection Impacts

Significance Criteria / Degree of Impact	Definition
Major or Highly Negative	The project has the potential to negatively impact on the health status with an associated change in morbidity or impact on the health status of communities or groups of people
Moderately Negative	A moderate negative impact on health status but no change in morbidity or mortality can be attributed to the project
Minor or Slightly Negative	A small negative impact on reported symptoms but no change in health status can be attributed to the project
Not Significant or Neutral	No significant human health impacts are apparent
Minor or Slightly Positive	A small positive impact on reported symptoms but no change in health status can be attributed to the project
Moderately Positive	A moderate positive impact on health status but no change in morbidity or mortality can be attributed to the project
Major or Highly Positive	The project has the potential to positively impact on the health status with an associated change in morbidity or impact on the health status of communities or groups of people

Asthma can be used as an example when using these significance criteria:

- An Imperceptible impact would be one with no measurable effect on asthma
- A Slight impact might be a temporary increase in symptoms but no change in the severity of the underlying condition or treatment required
- A Moderate impact might be an increasing use of inhalers attributable to the proposed road development but no change in underlying condition and no effect on the vast majority of asthmatics
- A Significant effect might be an individual becoming asthmatic or an individual's asthma becoming measurably more severe as a result of the project
- A Very significant effect might be a group of individuals becoming asthmatic or their asthma becoming measurably more severe as a result of the project

A Profound effect might be a measurable increase in the incidence or severity of asthma in a community as a result of the project.

7.5.1.3 Stage 1 Population Options Assessment

Please read this section in conjunction with the Population Impact Summary Tables contained within Appendix A.7.5.1.1

Stage 1 Population Assessment of Options

Black Option Corridor

The Black Option Corridor provides a connection from the L3408 Castlecara Road to the R280 Leitrim Road which would take a proportion of traffic out of the eastern half of the town centre, away from Scoil Mhuire (national school) and locations where congestion regularly occurs, namely at the Carrick Shopping Centre Roundabout, the Relief Road/Dublin Road roundabout, the Dublin Road/Leitrim Road junction and outside Páirc Seán Mac Diarmada during matches.

It is likely to improve access to St Mary's GAA at Cill Tochairt (Kiltoghert) while adding to traffic at the entrance to the pitch. The road here is also part of the Slí na Sláinte walking route. The median line passes through a gap in residential properties in Drummagh, although the corridor includes around seven residential properties. The corridor also includes parts of Oaklands Estate and Ros Airgid on the edge of the Liscara Estate. It would require a junction with the R280 beside one residential property (of three) which offers self-catering accommodation.

Cyan Option Corridor

The Cyan Option Corridor provides a positive impact in terms of journey characteristics as would ensure journey time reliability whilst retaining accessibility and connectivity to the town and onwards to Sligo or Dublin. After the tie-in with the N4, the corridor begins by being quite rural. A guest house is located near the tie-in. Several single properties are located just above the corridor on the L5078 and three further properties fall into corridor, one of which is on the centreline. The

corridor includes lands used by Carrick Quads (and house) for which a significant impact could occur.

The Cyan Option Corridor subsequently follows the railway line, but with the centreline being to the north of the line. The corridor includes McLoughlin Transport Services, CD Carrick Commercials and LVDC Centre, the Bull Field playing fields (including GAA and Carrick Town FC) and the Midland & Western Livestock Market (occasional). The significance of impacts here would depend on the degree to which the playing fields and businesses are physically impacted.

The corridor then follows the railway line to the south. In Cortober, the corridor introduces potential social severance at the R368 Elphin Road on the edge of the community before the railway line and station. To the east, it includes a now disused *eir* depot, the residential estates of Glenpatrick and Sli An Iarainn, with semi-detached properties (on either side of the Elphin Road) and a two property semi-detached house closest to the corridor centreline. To the west, the corridor includes O'Dowd's Fireplaces showroom and a residential property on the R368, as well as Carrick-on-Shannon Railway Station and yard, part of the grounds of an electricity substation, a disused oil depot, and 18 private residential properties on the R370 Frenchpark Road plus the Shannon Gael estate. The corridor also includes the Carrick Poultry business.

The Cyan Option corridor then crosses the River Shannon at Cordrehid in an area that is of high amenity value. Given the open landscape and the proximity of Butler's Marina, this section is well used by boaters, kayakers and anglers; although there is no riverside walking access. Two private moorings have been cut from the river here, one of which serves the Carrick Camping facility which has recently closed (Spring 2020).

On the east bank of the river, the median line of the corridor passes closest to the relatively new Glas na hAbhainn estate where eight properties would front onto the option with a further three being adjacent from the gable end. The corridor then heads east, taking a route just below the residential estates of Cnoc na Sí and Ard na Sí to which environmental effects such as noise and visual would be relevant to residential amenity (see Section 4.9 Noise and 4.10 Landscape & Visual). Two bed and breakfast enterprises are located in these estates along with three more adjacent to the existing N4, although any economic impacts due to the environmental effects of the Cyan Option are likely to be imperceptible. The centreline would impact directly on one residential property just before it meets the existing N4 just before the 50km speed limit and town boundary for Carrick-on-Shannon.

There are two residential properties on the L7426 (south) local road close to the junction with the N4, a farm and one private property on the L7426 (north), another private property backing onto the corridor from the L3656 and approximately 12 more along the N4 (see Section 4.5 Material Assets). The corridor would need to address two existing junctions for Jamestown, of which the L3656 is the principal access. The option corridor continues to follow the existing N4 beside the River Shannon near Jamestown. This section of the river is unnavigable by boats but is popular for kayaking and angling and so a continued impact on amenity would apply, including also during construction. Overall, though, the negative impacts for river use are slight given the level of use and somewhat balanced by positive visual

impacts which the views of the river views provide for the journey amenity of road users of the N4. The corridor to the south includes the Oak Meadows and Grange residential estates in Drumsna which consist of c.25 properties, together with 5 others. At Node J at Drumsna Junction, the Cyan Option Corridor would need to maintain access into Drumsna village and for the R299 to Leitrim Village and Drumshanbo.

In summary, for the Cyan Option Corridor, significant impacts could result given the number of community facilities and businesses, depending on the road design and precise location of the median line selected within the corridor. Most relevant in this regard are the river crossing, the Carrick Town FC pitch and Bull Field changing rooms, Midland and Western Livestock, CD Carrick Commercials and McLoughlin Transport.

Orange Option Corridor

The Orange Option Corridor provides a positive impact in terms of journey characteristics as would ensure journey time reliability whilst retaining accessibility and connectivity to the town and onwards to Sligo or Dublin. In Cortober, the corridor borders the car parking for the Mulvey Centre (retail and entertainment) and is close to a small estate of residential apartments (Hawthorn Crescent). The median line of the corridor falls to the east of the railway line and includes the Midland & Western Livestock Market (occasional), the Bull Field playing fields (including GAA and Carrick Town FC), CD Carrick Commercials and LVDC Centre, McLoughlin Transport Services and the King & Moffat business. The centreline of the corridor would directly impact on the Bull Field playing fields, the Midland & Western Livestock Market and CD Carrick Commercials. Two private properties also fall within the corridor on the west side of the existing N4.

The corridor introduces potential social severance at the R368 Elphin Road on the edge of Cortober at the railway line and station. To the east, the corridor includes an *eir* depot, the residential estates of Glenpatrick and Sli An Iarainn, and, closest to the median line, ten semi-detached properties (on either side of the Elphin Road) and a two-property semi-detached house. To the west, it includes O'Dowd's Fireplaces showroom and a residential property on the R368, as well as Carrick railway station and yard, part of the grounds of an electricity substation, a disused oil depot.

The Orange Option Corridor crosses the River Shannon at Cordrehid in an area that is of high amenity value, and just to the north of the Cyan crossing. Given the open landscape and the proximity of Butler's Marina, this section is well used by boaters and kayakers and is used for some angling, but there is no riverside walking access. Two private moorings have been cut from the river here, one of which serves the Carrick Camping facility, which is located directly on the centreline, but which closed in 2020. The proposed centreline crossing intercepts inlet channels to constructed basins for mooring on both banks making the bridge width much longer. A residential property also falls within the corridor.

On the east bank of the Shannon, the median line of the Orange Option corridor passes closest to the relatively new Glas na hAbhainn estate where eight properties would front onto the option with a further three from the gable end. The corridor takes a route just below the residential estates of Cnoc na Sí and Ard na Sí to which

environmental effects such as noise and visual would be relevant to residential amenity (see Section 7.5.6 Noise and Vibration and Section 7.5.8 Landscape and Visual). Two Bed and Breakfast establishments are located in these estates along with three more beside the N4, although any economic impacts due to the environmental effects of the Orange Option Corridor are likely to be imperceptible. The median line of the corridor impacts directly on one residential property before it meets the existing N4 just before the town boundary. Subsequent potential impacts are as per the Cyan Option Corridor.

Purple West Option Corridor- West of Drumsna Junction/Node J

The Purple West Option Corridor has a significant positive impact in connecting with the R280 to Leitrim village and Drumshanbo, and is also used by some traffic, including HGVs, to access Sligo using the R284. From the tie-in with the existing N4 north of Carrick-on-Shannon, the corridor crosses the River Shannon and would continue above the floodplain of the river to the east. The river here, and more especially the Boyle River and Eidin Lake, is well used for boating, kayaking, and angling. The crossing location at Corryolus is less visible than the alternative crossings to the south in the Orange Option Corridor and Cyan Option Corridor, but a 1km section of the road would be elevated above the river (see Section 7.5.6 Noise and Vibration and Section 7.5.8 Landscape and Visual). There is no riverside access, but a potential significant impact given the visibility of a section of the road combined with the attraction of the undisturbed wetland character of the floodplain. Journey amenity for users of the road would be positive due to views of the river, but comparable to the southern crossing.

At Hartley, 27 residential properties (including one farm) fall within the Purple West Option Corridor. Social severance is likely here along with possible physical severance. Hartley Lodge Guest House is located beside (west) of the corridor. The R280 would likely be connected at a junction beside one residential property and close to the Cartown nightclub (occasional events). No significant issues arise at the L7410.

The L3408 Castlecara Road is crossed at a rather rural location, although the corridor does include four residential properties (one being a farm). Castlecara Road is part of the southern route of the Kingfisher Cycle Trail. The option continues southwards, passing to the rear of a line of 11 residential properties (for an assessment of the environmental effects of Noise and Vibration please see Section 7.5.6 Noise and Vibration). One isolated house is located close to (west of) the median line of the corridor. The corridor also includes farm buildings and a connecting access track to the north. The corridor crosses the L7426 (north) where it includes three residential properties and a farm.

The Purple West Option Corridor presents a potential impact at Jamestown due to proximity of the corridor to the unnavigable section of the River Shannon where there is some kayaking and angling activity. The effect is accentuated in comparison with the Orange Option Corridor by the likelihood of a junction at this location, but partly compensated by the positive effect on journey amenity for users of the N4. Subsequent impacts for the corridor are as for Orange prior to any consideration of design characteristics.

Dark Green Option Corridor

The impacts of the Dark Green Option Corridor, prior to any consideration of design characteristics, are the same as the Purple Option Corridor until after the L3408 Castlecara Road. The L3408 Castlecara Road is crossed at the same rural location as for the Purple Option Corridor, although the corridor includes four residential properties (one being a farm). Castlecara Road forms a section of the Kingfisher Cycle Trail southern route.

The option continues southwards, crossing low intensity grazing land. The Dark Green Option Corridor includes five residential properties (including a farm) on the L7426 and one isolated residential property. The corridor joins the existing N4 just to the north of Node J.

Blue West Option Corridor West of Drumsna Junction/Node J

This Blue West Option Corridor is an on-line option. It provides good connectivity to Sligo, but less so for the R280 which necessitates journeys through the town. The road is also subject to regular congestion which can have a significant impact on journey times at weekends. The option is expected to involve some consolidation of minor road, property and farm accesses with shared access roads to reduce the incidence of single access points onto the N4. In the Western Section, from Node J moving west, property impacts would initially be avoided given the absence of roadside properties. The corridor would continue to follow the unnavigable section of the River Shannon as of now and its proximity would impact slightly on the kayaking and angling activity that occurs along this stretch, although with some compensation due to the visual aspect for drivers and the positive contribution to journey amenity this entails.

Once within the town limits, the Blue West Option would provide a slight positive economic benefit relative to other options by maintaining familiarity with retail outlets beside the road, including the service stations in Cortober and to the south of the town. On entering Cortober, a signalised crossing can be expected at the R368, possibly involving a connection with the Inver Geal apartments. Projected traffic volumes would place pressure on the pinch point that is the existing bridge crossing.

A consolidation of commercial accesses could be expected using shared access road. Signalised junctions with Bridge Street, Dublin Road, the L3412/Carrick Shopping Centre and the L3408 Castlecara Road are proposed and would be necessary to facilitate traffic flow. However, some traffic build up is likely on busy shopping days or during matches at Páirc Seán Mac Diarmada. The maintenance of traffic volumes would have a continued slight negative impact on use of the riverside park due to the environmental effects and physical severance, although the significance of this effect would be greater when comparisons are made to other options for which through traffic would be transferred off-line. This level of traffic could discourage walking and cycling without improvements to existing foot and cycle paths to provide continuity. New crossing facilities for both cyclists and pedestrians would be needed. However, these would be facilitated by the replacement of roundabouts by signalised junctions and would have a positive impact on pedestrian and cyclist journey patterns and amenity. Although there is an existing signalised pedestrian crossing approaching the junction with Bridge Street,

and pedestrian islands elsewhere, physical severance would be exacerbated by growth in traffic volumes unless improved crossing facilities are provided. However, these crossing facilities would also need to have a minimal impact on traffic flow.

Overall, the replacement of roundabout junctions with signalised crossings would have a positive effect on traffic movement and on pedestrian and cyclist journey amenity. The rationalisation of direct entrances to the Blue Option would also assist with traffic flow and reduce collision or accident risk. The design features required for the corridor would need to ensure that traffic movement is maintained or improved if delays are not to occur with consequent negative effects for journey characteristics, journey amenity and the local economy.

There are many private residences along the Blue Option and environmental impacts would be as at present, although trends in traffic flow could worsen these without mitigation (see respective Sections). From the perspective of socio-economics, new impacts would be few relative to other options. However, the town would continue to be traversed by a high volume of traffic and the Blue Option Corridor would need to be combined with many of the interventions being considered for the Active Travel Option. Without this, the Blue Option Corridor would have a negative impact due to continued physical severance from the natural surroundings of the river that has a key role in place making, and on amenity generally, including the town's ability to attract visitors and the economic benefit that is realised.

Table 7.5.1.2 Stage 1 Population Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR	BLACK OPTION CORRIDOR
Journey characteristics	Moderate Positive. Would improve journey amenity over this corridor length PAG Score 6	Moderate Positive. Would improve journey amenity over this corridor length PAG Score 6	Significant Positive. Would connect with the R280 and so with Leitrim village and Drumshanbo, potentially reducing some traffic on the R299 PAG Score 7	Significant Positive. Would connect with the R280 and so with Leitrim village and Drumshanbo, potentially reducing some traffic on the R299 PAG Score 7	Moderate Negative. Continued delays in Carrick-on-Shannon and use of R299 as an alternative PAG Score 2	Provides urban connection between community facilities and optional regional connection with R280 PAG Score 7
Journey amenity	Slightly Positive. Bridge view. River at Jamestown Significant positive avoidance of delay PAG Score 5	Slightly Positive. Bridge view. River at Jamestown Significant positive avoidance of delay PAG Score 5	Slightly Positive bridge view. Significant positive avoidance of delay PAG Score 5	Slightly Positive bridge view. Significant positive avoidance of delay PAG Score 6	Slightly Negative (depends on traffic flow). Slightly positive in places, e.g. Bridge View PAG Score 3	Moderately Positive PAG Score 6
General amenity	Moderately Negative. River crossing. River at Jamestown. Bull Field pitch. Proximity to residential estates PAG Score 2	Moderately Negative. River crossing. Mooring Facilities. River at Jamestown. Bull Field pitch. Proximity to residential estates PAG Score 2	Moderately Negative crossing of River Shannon. Slightly Negative at river Jamestown PAG Score 3	Moderately Negative river crossing PAG Score 3	Significant Negative Riverside in Carrick-on-Shannon and Cortober. Impacts on Carrick-on-Shannon and Cortober communities PAG Score 1	Slightly Positive: connectivity including gaelscoil, but increased traffic on Castelcara Road PAG Score 5
Community Severance	Moderately Negative. Social severance in Cortober PAG Score 2	Moderately Negative social severance in Cortober PAG Score 2	Slight-Moderate Negative social (& possible physical) severance Hartley PAG Score 2	Slight-Moderate Negative social (& possible physical) severance Hartley PAG Score 2	Significant Negative: Carrick-on-Shannon PAG Score 1	Minor or Slightly Negative: Elysian Meadows PAG Score 3
Economic	Slightly Negative. Businesses in Cortober east (5) and	Slightly Negative. Businesses in Cortober east (6) and west (1) of railway line	Neutral. Proximity to Cartown Nightclub PAG Score 4	Slightly Negative (2) Businesses PAG Score 3	Significant Negative Impact also on tourism PAG Score 1	Neutral PAG Score 4

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
	west (2) of railway line PAG Score 3	PAG Score 3					
Scoring							
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**	**Moderately Positive**	**Major** or **Highly Negative**		**Moderately Positive**
Score / Impact Level	**4**	**4**	**5**	**6**	**1**		**6**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**	**Least Preferred**		**N/A**

Stage 1 Population Assessment Option Corridors East of Drumsna Junction – Node J

Green Option Corridor

The Green Option Corridor represents an on-line upgrade of the existing N4 single carriageway and links with the Dromod-Roosky Bypass. The corridor passes beside Drumgilra Lough to the west and Gortconnellan Lough to the east where there is some angling. It bisects an on-road heritage trail east of Drumsna which follows the L7428, L7429 and L7430 around Gortconnellan Lough taking in locations that inspired the writings of author Anthony Trollope who was postmaster in the village in the 1940s. The first of these roads is served by the R299 overbridge. To the south, Annaduff Church of Ireland is located off the former spur of the N4 (L3630), beside a regularly visited memorial to country musician Tom Dunphy who died in a road accident here in 1975.

Only part of the grounds of the Masonite plant are included in the corridor, but this is followed by another five residential properties with a further five to the north. In Drumsna, three properties and parts of the Oak Meadows estate and The Grange estate fall within the corridor. A further 15 residential properties are included in the corridor after the Masonite plant, seven of which are beside the road and four off a parallel access road.

The Green Option Corridor would continue to pass through the village of Aghamore in the wider community of Annaduff. The location is subject to a reduced speed limit and has a crossing island, but the routing of the corridor through the village means that physical severance, at one level or another, would continue to apply due to the presence of community facilities including St. Mary's Church and cemetery and Annaduff National School which is located just 100m to the east on the L3470 just outside the corridor. The village also includes a guest house. The prominent Top of the Hill pub is currently not in operation.

The corridor includes 5 residential properties just to the south of Aghamore, three of which are on a parallel access road. These are followed by a further 4 properties and a farm. Annaduff GAA and Leitrim GAA Centre of Excellence fall within the corridor along with at least four other properties and farm buildings. To the south, the corridor includes part of the premises of a milling business, McDonogh Feeds, beside the N4, and takes in 2 private properties on the L1475.

The corridor includes junctions with the R201 to Mohill and R299 to Drumsna and Leitrim Village.

Yellow Option Corridor

Potential impacts by the Yellow Option Corridor are similar to the Green Option Corridor, except at the southern end of the corridor at Fernaught before the Dromod-Roosky Bypass. At this location, the Yellow Option Corridor diverts from the line of the existing N4 between Nodes G and H slightly to the west. This brings the corridor down the hill from the existing N4 and would deny southbound drivers the current elevated view of the Shannon lakes (see Section 4.11 Landscape & Visual) which would represent a slight negative effect on journey amenity. The Yellow

Option Corridor would, however, minimise any impact on McDonogh Feeds and avoids impacts on residential properties on the L1475.

Purple East Option Corridor East of Drumsna Junction/Node J

The Purple East Option Corridor east of Drumsna Junction follows a similar route to that of the Green Option Corridor, but follows the line of the existing N4 taking in 2 private properties on the L1475 as well as McDonogh Feeds at Node G. The Purple East Option Corridor includes the same properties and community facilities as the former options between here and Aghamore.

Physical severance is avoided in the middle of Aghamore village, providing relief from the severance associated with the current high traffic volumes for the church. However, social severance, and possible physical severance, could apply to Annaduff National School given that the bulk of residences from which many students would live are to the east of the corridor off the L4370. After Aghamore, the corridor sweeps away to the east between Nodes F and J. This takes the corridor away from Leitrim GAA Centre of Excellence (if not the Annaduff GAA building).

Blue East Option Corridor East of Drumsna Junction/Node J

The Blue East Option Corridor follows the alignment of the existing N4 to the south of Drumsna Junction. The minor L7661 from just east of the river bridge in Drumsna would be closed at the N4 and connected with the L3630 through Annaduff to the south. The very lightly used oblique exit to the road to the N4 would also be closed. The corridor would pass through Aghamore as at present.

Table 7.5.1.3 Stage 1 Population Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Journey characteristics	Slightly Positive PAG Score 5	Slightly Positive PAG Score 5	Slight-Moderately Positive PAG Score 5	Slightly Positive PAG Score 5
Journey Amenity	Slightly Negative loss of Shannon view PAG Score 3	Neutral PAG Score 4	Neutral PAG Score 4	Neutral PAG Score 4
General Amenity	Slightly Negative. Impacts on Aghamore and Drumsna. Impacts on Annaduff GAA and Leitrim GAA Centre of Excellence PAG Score 3	Slightly Negative. Impacts on Aghamore and Drumsna. Impacts on Annaduff GAA and Leitrim GAA Centre of Excellence PAG Score 3	Slightly Negative Annaduff GAA PAG Score 3	Annaduff GAA and Leitrim GAA Centre of Excellence included in corridor PAG Score 2
Community Severance	Continued Significant severance in Aghamore PAG Score 1	Continued Significant severance in Aghamore PAG Score 1	Positive relief from severance at Aghamore, but possible new severance at NS PAG Score 5	Continued Significant severance in Aghamore PAG Score 2
Economic	Neutral PAG Score 4	Slightly Negative McDonogh Feeds PAG Score 3	Slightly Negative McDonogh Feeds PAG Score 3	Slightly Negative McDonogh Feeds PAG Score 3
Scoring				
Qualitative assessment	**Moderately Negative**	**Moderately Negative**	**Not Significant** or **Neutral**	**Moderately Negative**
Score / Impact level	**2**	**2**	**4**	**2**
Preference –	**Intermediate**	**Intermediate**	**Preferred**	**Intermediate**

7.5.1.4 Stage 1 Human Health Options Assessment

Sub-criterion 1: Health Protection

The results of the noise and vibration, air quality, soils and water assessments have informed the health assessment as these are the environmental pathways by which health can be affected.

Noise

As detailed in Section 7.5.6 the assessment of potential noise impacts and ranking of option corridors is based primarily upon property counts, a review of the likely requirement for mitigation measures based on the indicative noise footprint for each option corridor and changes in traffic flows. The potential noise and vibration impacts associated with the construction phase of each option corridor will be of a non-permanent duration (i.e., less than 7 years). Whilst there will be varying impacts associated with each, the construction phase will be undertaken using standard road construction techniques and will be controlled by the implementation of construction noise and vibration limits. Therefore, for the purposes of ranking option corridors, the noise assessment focused on longer terms operational impacts only.

In terms of vibration, road traffic along normal well-maintained surfaces, in line with the proposed option corridors, generates very low levels that are normally not perceptible to building occupants. Therefore, it was assumed that all option corridors will have a comparable low vibration impact during their operational phase and vibration was not assessed further nor included in this health assessment.

A summary of the noise assessment for west of Drumnsa Junction (Node J) is included in Table 7.5.1.4 below and for east of Drumsna Junction (Node J) is included in Table 7.5.1.5 .

Air

As detailed in Section 7.5.4, the air quality assessment is based on the number of sensitive receptors in proximity to each option corridor and the projected traffic volumes accessing the corridors during the operational phase. The construction phase is assessed through the consideration of the number of sensitive properties located in proximity to the likely construction works where dust impacts may be experienced. Sensitive receptor locations are defined in the NRA, 2011 Guidelines[20] as residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. In addition, planning applications[21] give an indication to the potential number of future sensitive receptors adjacent to the option corridors.

[20] National Roads Authority NRA, 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes, 2011. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

[21] Department of House, Planning and Local Government,2021. National Planning Applications. Available at: https://data.gov.ie/dataset/national-planning-applications

The number of existing and potential sensitive receptors in proximity to each option corridor determined the air quality impacts. The zone of interest for the assessment is 0-50m from each indicative fenceline within each option corridor. This is an offset from the edge of the indicative fenceline within each option corridor and assumes that properties within the potential fenceline would be acquired and would therefore not be counted as receptors.

A summary of the air quality assessment for west of Drumnsa Junction (Node J) is included in Table 7.5.1.4 below and for east of Drumsna Junction (Node J) is included in Table 7.5.1.5 .

Soils

Potential health impacts due to soils relate to the disturbance of contaminated lands and radon.

Soil Contamination

As detailed in Section 7.5.12, a number of sites of potential areas of contamination have been identified in the study area west of Drumsna Junction (Node J). The results of the soils assessment with respect to contaminated lands are included in Table 7.5.1.4. The soils assessment does not apply to East of Drumsna Junction (Node J) of the option corridors.

Radon

The area of Roscommon and Leitrim within the study area is in a less than 1 per cent area. It is only when radon builds up in buildings that are inhabited by human beings that the health risk occurs. During construction, there will be excavation activities. This will have the potential to cause some release of radon. However, this will almost instantaneously be dissipated and will be harmless. Radon escape from rock will take the path of least resistance. Radon is escaping all the time but when it escapes to the open air there are no health effects.

Water

Potential health impacts due to water relate to water quality and flooding.

Water quality

In terms of surface water, as detailed in Section 7.5.11, the Irish Water Carrick-on-Shannon Public Water Supply abstraction is located in the River Shannon circa 1 km upstream of N4 Carrick-on-Shannon Bridge. This is a large abstraction that supplies well over 50% of Leitrim's water supply and is considered to be of regional importance and its attribute importance is therefore very high.

In terms of groundwater, as detailed in Section 7.5.11, there are no discharge and emissions licensed facilities identified within any of the option corridors. A number of abandoned and historical quarries and pits have been identified within the option corridors west of Drumsna Junction (Node J), however, the potential for the contamination of groundwater from these quarries is expected to be insignificant and therefore with regard to groundwater contamination all the option corridors are considered 'not Significant or Neutral'.

Therefore, the health assessment in relation to the potential to impact on flooding only considered the hydrolgical assessment as the hydrogeological assessment was not significant or neutral.

Flooding

In terms of groundwater flooding, there are no areas of historic groundwater flooding within any of the option corridors. Therefore, with regard to groundwater flooding all the option corridors are considered not significant or neutral.

Floodplains and flood risk areas were assessed in the hydrological assessment detailed in Section 7.5.11 and are included in this human health assessment.

Based on the above, the health assessment in relation to the potential to impact on water quality only considered the hydrological assessment as the hydrogeological assessment was not significant or neutral.

Sub-criterion 2: Health Improvement and Improving Services

The option corridors have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance, could contribute to improving the health and wellbeing of socio-economically deprived communities. They can facilitate transport of goods and people in a timely, reliable and efficient manner. The full economic benefit will be realised once the full extents of the preferred transport solution is completed. Accessibility to businesses and community facilities in Carrick-on-Shannon, Cortober and the wider study area along with the Business Parks in both towns will be better facilitated by the project and the resulting reduction in congestion. It will also bring with it benefits to business and public facilities in Carrick-on-Shannon town centre by reducing noise and air pollution. This all translates into an increased potential for economic prosperity for the Western Region, which in turn will play a part in reviving the Irish economy.

The human health assessment presented in Table 7.5.1.4 and Table 7.5.1.5 includes an assessment on how the option corridors would impact on the socio-economics of the community and improve access to services such as hospitals or recreational facilities as this will have an impact on the health of a community.

Opportunities for health improvements and improved access to services due to the option corridors were identified and each option corridor scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes
- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents
- Potential for improved public transport and an improved environment for cycling and walking within Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in the health benefits

Table 7.5.1.4 Stage 1 Human Health Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Sub-criterion 1: Protection of Health Assessment							
Noise	Moderately Negative	Moderately Negative	Minor or Slightly Negative	Minor or Slightly Negative	Not Significant or Neutral		Moderately Negative
Air	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors	Moderately Negative due to the traffic volumes in proximity to sensitive receptors		Minor Slightly Negative due to a decrease in air quality at sensitive receptors
Soils	Moderately Negative	Moderately Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
Water Supply	Minor to Moderate Negative	Minor Negative	Highly Negative	Highly Negative	Not Significant or Neutral		Not Significant or Neutral
Flood risk	Moderate to Major Negative	Moderate to Major Negative	Moderate Negative	Moderately Negative	Not Significant or Neutral		Minor to Moderate Negative
Sub-criterion 1: Summary of Overall Protection of Health Assessment							
Overall Protection of Health Assessment	Moderately Negative	Moderately Negative	Major or Highly Negative	Major or Highly Negative	Moderately Negative		Minor or Slightly Negative
Sub-criterion 2: Summary of Overall Health Improvement and Improving Services Assessment							
Health improvement and improving services	Moderately Positive	Moderately Positive	Minor or Slightly Positive	Minor or Slightly Positive	Moderately Negative		Minor or Slightly Positive

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Scoring							
Overall Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Moderately Negative**		**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**3**	**3**	**2**		**4**
Preference - Professional Judgement	**Preferred**	**Preferred**	**Intermediate**	**Intermediate**	**Least Preferred**		**N/A**

Table 7.5.1.5 Stage 1 Human Health Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Sub-criterion 1: Protection of Health Assessment				
Noise	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Not Significant or Neutral
Air	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors	Moderately Negative due to the traffic volumes in proximity to sensitive receptors	Moderately Negative due to the traffic volumes in proximity to sensitive receptors	Moderately Negative due to the traffic volumes in proximity to sensitive receptors
Soils	N/A	N/A	N/A	N/A
Water Supply	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Flood risk	Minor or Slightly Negative	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Sub-criterion 1: Summary of Overall Protection of Health Assessment				
Overall Protection of Health Assessment	Minor or Slightly Negative	Moderately Negative	Moderately Negative	Moderately Negative
Sub-criterion 2: Summary of Overall Health Improvement and Improving Services Assessment				
Health improvement and improving services	Minor or Slightly Positive	Minor or Slightly Positive	Minor or Slightly Positive	Minor or Slightly Positive
Scoring				
Overall Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**	**4**
Preference - Professional Judgement	**Preferred**	**Intermediate**	**Intermediate**	**Intermediate**

7.5.1.5 Summary

Summary Population Assessment of Stage 1 Options

The Black Option Corridor has a positive impact by improving connectivity, including for the Gaelscoil, and across the eastern half of Carrick and between the Leitrim Road and the N4. It introduces some severance at Elysian Meadows to the west of the Beeches estate.

The Dark Green Option and Purple West Options are preferred West of Drumsna Junction, but the distinction with the other options, with the exception of Blue West, is slight, as positive and negative effects apply to each. The Cyan and Orange Option Corridors have potential impacts on community facilities and businesses in Cortober, although there are opportunities to avoid or mitigate these. The Cyan Option Corridor extends slightly further north and includes an additional business impact. The River Shannon crossing is prominent but could be mitigated by a bridge design of high standard. However, the Cyan and Orange Option Corridors do approach the bridge by passing beside residential estates with possible environmental effects which are addressed in other sections of this assessment.

By comparison, the Purple West and Dark Green Option Corridors cut through a larger area of countryside, although they are located away from minor roads, minimising amenity impacts. Both options introduce potential community severance in Hartley, but the wider location is relatively rural compared with the more urban location represented by Cortober in the case of Cyan and Orange Option Corridors. The River Shannon crossing is less prominent than for the Cyan and Orange Option Corridors, but the approach is potentially more visible from other sections of the river to the north, presenting potential impacts in terms of amenity and tourism.

The Blue West Option Corridor maintains through traffic flow in Carrick-on-Shannon and Cortober and therefore maintains existing severance between the riverside and the town and at other locations. This also has impacts on amenity and tourism. On the other hand, it contains features including signalised crossings which would facilitate traffic flow and also provide some relief from the severance experienced by pedestrians and cyclists at the numerous roundabout junctions. If the Blue West Option is combined with the proposals for Active Travel and public transport contained in the respective option, then there is potential for cumulative positive impacts, although the severance at the river would remain.

The options east of Drumsna Junction are mainly on-line but differ only with respect to the southern-most alignment and at Aghamore. The Purple East Option Corridor bypasses the centre of Aghamore providing relief from severance, particularly of the church. However, in doing so it raises the possibility of new severance between the church and school with the more numerous residential properties to the east.

Summary Human Health Assessment of Stage 1 Options

In summary, health protection covers the health effects of the option corridors arising from noise, vibration, air emissions, water and soil contamination and psychological issues. Opportunities for health improvements and improved access

to services due to the option corridors were identified and each option corridor was scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes
- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents
- Potential for improved public transport and an improved environment for cycling and walking within the Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in the health benefits

The summary of the health assessment is as provided in Table 7.5.1.4 and Table 7.5.1.5 above.

7.5.2 Stage 1 Material Assets Non-Agriculture Option Assessment

7.5.2.1 Introduction

This section details the Stage 1 Assessment of the Option Corridors with respect to the Material Assets Non-Agriculture constraints identified in Section 4.5 Material Assets Non-Agriculture of this report. The Stage 1 Option Corridors as described in Section 7.2 with the Material Assets Non-Agriculture constraints are presented in Figures 7.5.2.1.0 to 7.5.2.14.1.

Section 7.5.2.2 outlines the methodology utilised to carry out the assessment, Sections 7.5.2.3 details the options assessment and a summary is presented in Section 7.5.2.4.

There are ten Option Corridors, six of which are to the west of Node J at Drumsna Junction (Purple West, Dark Green, Black, Orange, Cyan and Blue West) and four which are to the east of Node J (Purple East, Green, Yellow and Blue East).

7.5.2.2 Methodology

The assessment of Material Assets Non-Agriculture is conducted in the context of the constraints identified in Section 4.5 of this report.

For the Stage 1 assessment, the option corridors are assessed in two sections; one west of Drumsna (Node J) and the second is east of Drumsna (Node J). The cross-section of a potential road-based solution within these corridors has not yet been determined. However, a fenceline has been developed for each option corridor within which a road design could sit. This fenceline represents the expected 'worst-case' scenario with respect to landtake.

For this assessment, the potential impacts on the following were assessed:

- The following property types:
    - Residential properties
    - Commercial and industrial properties
    - Amenity Spaces (Recreation, Tourism and Leisure)
    - Proposed developments
- The infrastructure for both public and private utilities/service providers

The assessment of each option corridor includes both a quantitative and qualitative assessment. Firstly, each potential impact on Material Assets Non-Agriculture is quantified and then the level of impact and its significance assigned for each impact as per Table 7.5.2.1. Following this an overall assessment of the cumulative impacts for each option corridor is completed and scored based on the seven-point scale listed in Table 7.3.1 of this report.

Assessment Methodology for Material Assets Excluding Utilities and Services

For the purposes of assessing direct impacts on properties, the indicative fenceline developed for each option corridor was regarded to include all lands required for the construction and operation of new road infrastructure. This included a potential design and a buffer of 10m from the edge of the earthworks associated with the mainline, and a buffer of 3m from the edge of the earthworks associated with the sideroads. Properties within the corridors were also identified as the cross-section is undetermined and the design is fluid and could move anywhere within the corridor.

Level of Impact

The potential impact of the option corridors on non-agricultural properties was assessed according to the significance criteria detailed in Table 7.5.2.1.

Table 7.5.2.1 Criteria for Assessing the Significance of Impact on Non-agricultural Properties

Significance Level / Degree of Impact	Definition
Major or Highly Negative Profound	A non-agricultural property of national or regional importance is fully within the fenceline and will be removed by the proposed option
Moderately Negative	A non-agricultural property or other material asset is fully within the fenceline and may result in the demolition or acquisition of a dwelling or, where acquisition of a property results in loss of employment and total or partial loss of the business
Minor or Slightly Negative	Part of a non-agricultural property or other material asset is within the fenceline
Not Significant or Neutral	An impact on a property which is currently occupied by a public right-of-way, e.g. a road or the non-agricultural property or other material asset is within the Option Corridor but outside the indicative fenceline

The level of impacts for residential, commercial/industrial and amenity properties have been considered under three categories:

- All properties fully within the fenceline are considered as full acquisitions and are major or highly negative or moderately negative impacts depending on the significance of the asset
- Any property holding partially within the fenceline is considered to require partial landtake. Depending on the extent of the landtake these impacts vary from minor or slightly negative to not significant or neutral
- An impact on a property which is currently occupied by a public right-of-way, e.g. a road or the non-agricultural property and all properties that lie within the corridor but outside the fenceline were also included in this assessment as the cross-section is undetermined and the design may need to be realigned within the corridor and in that event, could potentially have a direct impact on these properties. These impacts are considered to be not significant or neutral

This assessment has been carried out and the number of affected properties and a synopsis of the impacts are presented in Section 7.5.2.3.

Assessment Methodology for Utilities and Services Infrastructure

The locations of existing utilities were requested from the relevant utility service providers. At this stage of the assessment of option corridors, it is difficult to consider all utilities that are impacted by all the options.

There are considerable numbers of low voltage ESB lines, servicing every home and business in the study area. These services were not assessed as part of this assessment, as they are required for each of the options and are considered to be a minor constraint and could be readily diverted where necessary. The ESB services that have been assessed (see bullet list below) are considered to be the major utilities for this service provider and pose more significant constraints for the Project.

Similarly, there are numerous small diameter foul, combined and surface water sewers and watermains throughout the Study Area that have not been considered as part of this assessment, as they are located throughout each of the option corridors. Moreover, they are considered to be a minor constraint and could be readily diverted where necessary. The assessment has been carried out based on the larger diameter, more critical services, as detailed in the bulleted list below, as these pose more significant constraints for the Project.

In summary, as a preliminary assessment of the option corridors, impacts on larger utilities and services were assessed. The following utilities and services were considered where they crossed the indicative fenceline for the assessment:

- ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)
- ESB High Voltage Underground Lines (HV UG)
- ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)
- ESB Substations
- Irish Water watermains with pipe diameter greater than 300mm
- Irish Water foul or combined sewers with pipe diameters greater than 300mm
- Water/wastewater treatment plants
- Telecoms Antennas
- Eir underground services
- E-Net services
- BT services – BT were contacted however it is their policy to not provide electronic data for large swathes of areas however, they did confirm that there are BT fibre optic cables within the N4 study area. BT services are present within the N4 study area at the following locations:
    - Leitrim Leisure Centre
    - Rosebank Retail Park
    - Along the railway line
    - At the train station

In addition, the existing waste facilities within the study area have been identified in Section 4.5 Material Assets Non-Agriculture. The methodology described above for Material Assets Non-Agriculture excluding utilities and services assessment was also used for the waste assessment. The footprint of each option corridor was examined against these constraints identified and any waste facility within this footprint was assessed as an impact.

Level of Impact

The potential impact of the option corridors on non-agricultural properties was assessed according to the significance criteria detailed in Table 7.5.2.2.

Table 7.5.2.2 Criteria for Assessing the Significance of Impact on Non-Agricultural Properties

Significance Level / Degree of Impact	Definition
Major or Highly Negative Profound	Removal of a service or utility that is of national or regional importance
Moderately Negative	Major diversion of High Voltage ESB lines (38kV, 110kV or 220kV) or fibre optic telecoms
Minor or Slightly Negative	Minor diversion of High Voltage ESB lines (38kV, 110kV or 220kV) or fibre optic telecoms
Not Significant or Neutral	The diversion of low and medium voltage ESB network, telecommunications or water supply or foul sewer services

This assessment has been carried out and the assessment and is presented in Section 7.5.2.3.

7.5.2.3 Option Corridors Assessment

Material Assets Non-Agriculture, Excluding Utilities and Services West of Drumsna Junction (Node J)

The impacts on properties are quantified for each option corridor West of Drumsna Junction (Node J) in Table 7.5.2.3. An indicative fenceline is contained with the option corridors in order to aid the assessments. Both an assessment of the properties within the indicative fenceline and properties within the corridors is provided as a design could still move within the corridors.

Table 7.5.2.3 Identification of Property Impacts West of Drumsna Junction (Node J)

Assessment Criteria	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Blue West Option Corridor		Black Option Corridor
Residential Acquisitions	16	11	3	0	0		0
Residential Partial Landtake	14	28	18	15	15		3
Residential Properties within the Corridor*	114	102	27	27	290		20
Commercial / Industrial Acquisitions	3	2	0	0	0		0
Commercial / Industrial Partial Landtake	2	4	0	0	2		0
Commercial / Industrial Properties within the Corridor*	1	1	0	0	37		0
Amenity Acquisitions	1	0	0	0	0		0
Amenity Partial Landtake	4	0	0	0	0		0
Amenity within the Corridor*	1	1	1	1	2		0
Proposed Development Full Impact	1	1	0	0	0		0
Proposed Development Partial Impact	2	1	0	0	3		0

**These are properties (all types) outside of the footprint of the potential design but within the option corridor.*

Cyan Option Corridor

The Cyan Option Corridor has the greatest number of full residential property acquisitions at 16, none of these properties are of national or regional importance and therefore these impacts are moderately negative. This option corridor requires a further possible partial landtake from 14 residential properties and these impacts are minor or slightly negative. There are 114 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires the full acquisition of 3 commercial/industrial properties (moderately negative), partial landtake from 2 commercial/industrial

property (minor or slightly negative) and there is 1 additional commercial/industrial property within the corridor but outside the fenceline (minor or slightly negative). There is 1 amenity within the fenceline but there is possible landtake from 4 amenities (minor or slightly negative) and there is one amenity within the corridor but outside the fenceline (minor or slightly negative).

There is one planning application fully within the fenceline (moderately negative) and two planning applications partially within the fenceline (minor or slightly negative).

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Least Preferred.

Orange Option Corridor

The Orange Option corridor is similar to that of the Cyan Option Corridor. It has the second greatest number of full residential property acquisitions at 11, none of these properties are of national or regional importance and therefore these impacts are moderately negative. It has a further partial landtake from 28 residential properties (minor or slightly negative). There are 102 additional residential properties within the corridor but outside the Fenceline (not significant or neutral). This option corridor would require the full acquisition of two commercial/industrial properties (moderately negative), partial landtake from four commercial/industrial properties (minor or slightly negative) and there is one additional commercial/industrial property within the corridor but outside the fenceline (not significant or neutral). There are no amenities within the fenceline and no partial landtake. There is one amenity within the corridor but outside the fenceline (not significant or neutral).

There is one planning application fully within the fenceline (moderately negative) and one planning application partially within the fenceline (minor or slightly negative).

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Least Preferred.

Purple West Option Corridor

There are no impacts on commercial/industrial properties or planning applications, to the west of Drumsna Junction, on the Purple West Option Corridor. It requires the full acquisition of 3 residential properties, neither of these properties are of national or regional importance and therefore these impacts are moderately negative. There is partial landtake from 18 residential properties (minor or slightly negative) and there are 27 additional residential properties within the corridor but outside the fenceline (not significant or neutral). There are no amenities within the fenceline nor the possible landtake from an amenity. There is one amenity within the corridor but outside the fenceline (not significant or neutral).

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as Intermediate.

Dark Green Option Corridor

The Dark Green Option Corridor also has no impacts on commercial/industrial properties or planning applications. It does not require the full acquisition of any residential property and therefore the impact is not significant or neutral. There is partial landtake from 15 residential properties (minor or slightly negative) and there are 27 additional residential properties within the corridor but outside the fenceline (not significant or neutral). There are no amenities within the fenceline nor the possible landtake from an amenity. There is one amenity within the corridor but outside the fenceline (not significant or neutral).

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as Intermediate.

Blue West Option Corridor

The Blue West Option Corridor is the management ('on-line') option; therefore, it has the fewest direct impacts to residential properties as this option seeks to reutilise the existing N4 and requires no full acquisition of a property. It requires a partial landtake from 15 residential properties (minor or slightly negative) and there are 290 residential properties within the corridor but outside the fenceline (not significant or neutral). There are no full acquisitions or commercial/industrial properties but there is partial landtake from two commercial/industrial (minor or slightly negative) and there are 37 commercial/industrial within the corridor but outside the fenceline (not significant or neutral).

There are no amenities within the fenceline nor the possible landtake from an amenity. There are two amenities within the corridor but outside the fenceline (not significant or neutral). There are no planning applications directly impacted by the Blue West Option Corridor.

As a result, this option corridor is considered to be minor or slightly negative (3) and is ranked as Preferred as it has no moderately negative impacts associated with it, unlike the Purple and Dark Green Option Corridors which are also scored as being Minor or Slightly Negative (3) which have two and one moderate negative impacts respectively.

Black Option Corridor

The Black option corridor is the link to the north of Carrick-on-Shannon. It has no impacts on commercial/industrial properties, planning applications or amenities and requires no full acquisition of a residential property. It does require partial landtake from three residential properties (minor or slightly negative) and there are 20 residential properties within the corridor but outside the fenceline (not significant or neutral).

As a result, this option corridor is considered to be Minor or Slightly Negative (3). This option corridor is not compared to the other option corridors and as such has not been ranked.

The assessment matrix of these impacts for each option corridor is presented in Table 7.5.2.4 below.

Table 7.5.2.4 Assessment Matrix of Material Assets Non-Agriculture, excluding Utilities and Services – West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Residential	There are 16 moderately negative, 14 minor or slightly negative and 114 not significant or neutral impacts associated with this option corridor	There are 11 moderately negative, 28 minor or slightly negative and 102 not significant or neutral impacts associated with this option corridor	There are 3 moderately negative, 18 minor or slightly negative and 27 not significant or neutral impacts associated with this option corridor	There are 15 minor or slightly negative and 27 not significant or neutral impacts associated with this option corridor	There are 15 minor or slightly negative and 290 not significant or neutral impacts associated with this option corridor		There are 3 minor or slightly negative and 20 not significant or neutral impacts associated with this option corridor
Commercial / Industrial	There are 3 moderately negative, 2 minor or slightly negative and 1 not significant or neutral impact associated with this option corridor	There are 2 moderately negative, 4 minor or slightly negative and 1 not significant or neutral impacts associated with this option corridor	There are 0 commercial / industrial impacts associated with this option corridor	There are 0 commercial / industrial impacts associated with this option corridor	There are 2 minor or slightly negative and 37 not significant or neutral impacts associated with this option corridor		There are 0 commercial / industrial impacts associated with this option corridor
Amenity	There are 4 minor or slightly negative and 1 not significant or neutral impacts associated with this option corridor	There is 1 not significant or neutral impacts associated with this option corridor	There is 1 not significant or neutral impact associated with this option corridor	There is 1 not significant or neutral impacts associated with this option corridor	There are 2 not significant or neutral impacts associated with this option corridor		There are 0 amenity property impacts associated with this option corridor
Proposed Development	There are 1 moderately negative and 2 minor or slightly negative impacts associated with this option corridor	There is 1 moderately negative and 1 minor or slightly negative impact associated with this option corridor	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor	There are 3 minor or slightly negative impacts associated with this option corridor		There are 0 proposed development impacts associated with this option corridor

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Overall Assessment	There are 20 moderately negative, 22 minor or slightly negative and 118 not significant or neutral impacts associated with this option corridor	There are 14 moderately negative, 33 minor or slightly negative and 104 not significant or neutral impacts associated with this option corridor	There are 3 moderately negative, 18 minor or slightly negative and 27 not significant or neutral impacts associated with this option corridor	There are 15 minor or slightly negative and 28 not significant or neutral impacts associated with this option corridor	There are 20 minor or slightly negative and 329 not significant or neutral impacts associated with this option corridor		There are 3 minor or slightly negative and 20 not significant or neutral impacts associated with this option corridor
Scoring							
Overall Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**3**	**3**	**3**		**3**
Preference - Professional Judgement**	**Least Preferred**	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

**These are properties (all types) outside of the footprint of the potential design but within the option corridor*

Utilities and Services West of Drumsna Junction (Node J)

The assessment for the number of conflicts with utilities and services for each Option Corridor West of Drumsna Junction (Node J) is presented in Table 7.5.2.5 below. These impacts range from crossing of the option corridor to diversions of kilometres of service ducts and pipelines.

Table 7.5.2.5 Number of Utilities and Services Conflicts - West of Drumsna Junction (Node J)

Assessment Criteria	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Blue West Option Corridor	Black Option Corridor
ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH) [crossings of the indicative fenceline]	6 No.	7 No.	4 No.	4 No.	3 No.	0 No.
ESB High Voltage Underground Lines (HV UG) [crossings of the indicative fenceline]	1 No.	1 No.	0 No.	0 No.	1 No.	0 No.
ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH) [crossings of the indicative fenceline]	2 No.	2 No.	2 No.	2 No.	1 No.	0 No.
ESB Substations	None	None	None	None	None	None
Irish Water watermains with pipe diameter greater than 300mm	0m length	0m length	766m length	444m length	0m length	80m length
Irish Water foul or combined sewers with pipe diameters greater than 300mm	0m length	0m length	0m length	0m length	215m length	0m length
Water / wastewater treatment plants	None	None	None	None	None	None
Licenced waste facilities	None	None	None	None	None	None
Telecoms Antenna	None	None	None	None	None	None
Eir underground services	5790m length	5696m length	3003m length	1905m length	29025m length	99.7m length
ENet	126m length	107.4m length	0m length	0m length	3744m length	0m length
BT services	*At the time of writing BT have not provided electronic location data however the generalised descriptive locations provided indicated that the locations where they do occur coincides with the locations of similar sized underground utilities. It is determined that the impacts on BT underground utilities would not be considerable enough to influence the comparative assessment.*					

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Cyan Option Corridor

The Cyan Option Corridor has six conflicts with High Voltage Overhead lines two of which are long skewed crossings. In addition, there is one conflict with one High Voltage Underground line. These are considered to be moderately negative in significance.

Furthermore, there are two conflicts with medium voltage ESB lines and one conflict with a relatively short length of Eir Underground services and as such these impacts are considered to be not significant or neutral.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the long skewed ESB crossings.

Orange Option Corridor

The Orange Option Corridor has seven conflicts with High Voltage Overhead Line crossings, two of which are long skewed crossings. In addition, there is one conflict with a High Voltage Underground line, these are considered to be moderately negative in significance.

There are two conflicts with medium voltage ESB lines and one conflict with a relatively short length of Eir Underground services and as such these impacts are also considered to be not significant or neutral.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the long skewed ESB crossings.

Purple West Option Corridor

The Purple West Option Corridor has four conflicts with High Voltage Overhead Line crossings. This includes an angle tower near the centreline of the Purple West Option Corridor. These are considered to be moderately negative in significance.

There are two conflicts with medium voltage ESB lines and one conflict with a relatively short length of Irish Water watermains with pipe diameter greater than 300mm and one conflict with Eir Underground services and as such these impacts are also considered to be minor or slightly negative.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the change in direction of one of the High Voltage Overhead crossings.

Dark Green Option Corridor

The Dark Green Option Corridor has four conflicts with High Voltage Overhead Line crossings. This includes an angle tower near the centreline of the Dark Green Corridor. These are considered to be moderately negative in significance.

There are two conflicts with medium voltage ESB lines and one conflict with a relatively short length of Irish Water watermains with pipe diameter greater than 300mm and one conflict with Eir Underground services and as such these impacts are also considered to be minor or slightly negative.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the change in direction of one of the High Voltage Overhead crossings.

Blue West Option Corridor

The Blue West Option Corridor has four conflicts with High Voltage Overhead Line crossings and one conflict with one High Voltage Underground line, these are considered to be Moderately Negative in significance.

There is one conflict with medium voltage ESB lines and one conflict with a relatively short length of Irish Water watermains with pipe diameter greater than 300mm as such these impacts are also considered to be not significant or neutral.

There is an extensive length of Eir Underground services, circa 29km in conflict with the Blue Option Corridor and this impact is considered to be moderately negative.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Preferred.

Black Option Corridor

The Black Option Corridor is a standalone option which will have little to no impact on the surrounding area's utilities. This option corridor has no conflicts with the ESB network but does have a conflict with a relatively short length of Irish Water watermains with pipe diameter greater than 300mm and one conflict with Eir Underground services and as such these impacts are also considered to be not significant or neutral.

As a result, this option corridor is considered to be Not Significant or Neutral (4). This option corridor is not compared to the other option corridors and as such has not been ranked.

Table 7.5.2.6 Assessment Matrix of Utilities and Services – Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Utilities and Services	There are 7 Moderately Negative and 3 Not Significant or Neutral impacts associated with this option corridor	There are 8 Moderately Negative and 3 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative and 4 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative and 4 Not Significant or Neutral impacts associated with this option corridor	There 5 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor		There are 2 Not Significant or Neutral impacts associated with this option corridor
Licenced Waste Facilities	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor		There are 0 Licenced waste facilities impacts associated with this option corridor
Scoring							
Qualitative Assessment	Includes two long skewed ESB crossings **Moderately Negative**	Includes two long skewed ESB crossings **Moderately Negative**	Includes an angle tower / change in direction of HV line **Moderately Negative**	Includes an angle tower / change in direction of HV line **Moderately Negative**	**Moderately Negative**		**Not Significant** or **Neutral**
Score / Impact Level	**2**	**2**	**2**	**2**	**2**		**4**
Preference - Professional Judgement	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

Overview - West of Drumsna Junction (Node J)

In the overall ranking of the option corridors for West of Drumsna Junction (Node J) in terms of Material Assets Non-Agriculture the number of property acquisitions were weighted more heavily than conflicts with utilities as these utilities can be diverted as part of the works. Table 7.5.2.7 summarises the order of ranking for the option corridors in West of Drumsna Junction (Node J).

Table 7.5.2.7 Summary Material Assets-Non-Agriculture Assessment Matrix of Option Corridors West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Properties	There are 20 Moderately Negative, 22 Minor or Slightly Negative and 118 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 33 Minor or Slightly Negative and 104 Not Significant or Neutral impacts associated with this option corridor	There are 3 Moderately Negative, 18 Minor or Slightly Negative and 27 Not Significant or Neutral impacts associated with this option corridor	There are no Moderately Negative, 15 Minor or Slightly Negative and 28 Not Significant or Neutral impacts associated with this option corridor	There are no Moderately Negative, 20 Minor or Slightly Negative and 329 Not Significant or Neutral impacts associated with this option corridor		There are no Moderately Negative, 3 Minor or Slightly Negative and 20 Not Significant or Neutral impacts associated with this option corridor
Services and Utilities	There are 7 Moderately Negative and 3 Not Significant or Neutral impacts associated with this option corridor	There are 8 Moderately Negative and 3 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative and 4 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative and 4 Not Significant or Neutral impacts associated with this option corridor	There 5 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor		There are 2 Not Significant or Neutral impacts
Scoring							
Overall Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**3**	**3**	**3**		**3**
Preference - Professional Judgement	**Least Preferred**	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

Material Assets Non-Agriculture, Excluding Utilities and Services - East of Drumsna Junction (Node J)

The impacts on properties are quantified for each option corridor in East of Drumsna Junction (Node J) in Table 7.5.2.8.

Table 7.5.2.8 Identification of Property Impacts – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Residential Acquisitions	16	14	13	0
Residential Partial Landtake	24	22	30	3
Residential Properties within the Corridor*	47	52	46	86
Commercial / Industrial Acquisitions	0	0	1	0
Commercial / Industrial Partial Landtake	0	3	3	2
Commercial / Industrial Properties within the Corridor*	1	0	0	1
Amenity Acquisitions	0	0	0	0
Amenity Partial Landtake	1	1	0	1
Amenity within the Corridor*	0	0	2	0
Proposed Development Full Impact	0	0	0	0
Proposed Development Partial Impact	0	0	0	0

**These are properties (all types) outside of the footprint of the potential design but within the option corridor.*

Yellow Option Corridor

The Yellow Option Corridor requires the full acquisition of 16 residential properties, none of these properties are of national or regional importance and as such these impacts are moderately negative. This option corridor requires a further possible partial landtake from 24 residential properties and these impacts are minor or slightly negative. There are 47 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor does not require full acquisition of a commercial/industrial property, but requires partial landtake from one commercial/industrial property (minor or slightly negative) and there is one additional commercial/industrial property within the corridor but outside the fenceline (not significant or neutral).

There are no amenities within the fenceline but there is possible landtake from one amenity (minor or slightly negative). There are no amenities within the corridor but outside the fenceline. There are no planning applications directly impacted by the Yellow Option Corridor.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Least Preferred.

Green Option Corridor

The Green Option Corridor requires the full acquisition of 14 residential properties, none of these properties are of national or regional importance and as such these impacts are moderately negative. This option corridor requires a further possible partial landtake from 22 residential properties and these impacts are minor or slightly negative. There are 52 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires no full acquisition of a commercial/industrial property but does require partial landtake from three commercial/industrial properties (minor or slightly negative) and there are no additional commercial/industrial properties within the corridor but outside the fenceline (not significant or neutral).

There are no amenities within the fenceline but there is possible landtake from one amenity (minor or slightly negative). There are no amenities within the corridor but outside the fenceline. There are no planning applications directly impacted by the Green Option Corridor.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate.

Purple East Option Corridor

The Purple East Option Corridor requires the full acquisition of 13 residential properties, none of these properties are of national or regional importance and as such these impacts are moderately negative. This option corridor requires a further possible partial landtake from 30 residential properties and these impacts are minor or slightly negative. There are 46 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires the full acquisition of one commercial/industrial property (moderately negative), partial landtake from three commercial/industrial property (minor or slightly negative) and there are no additional commercial/industrial properties within the corridor but outside the fenceline.

There are no amenities within the fenceline or possible landtake from an amenity and there are two amenities within the corridor but outside the fenceline (not significant or neutral). There are no planning applications directly impacted by the Purple East Option Corridor.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate.

Blue East Option Corridor

The Blue East Option Corridor requires no full acquisition of a residential property. This option corridor requires possible partial landtake from three residential properties and these impacts are minor or slightly negative. There are 86 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires no full acquisition of a commercial/industrial property but does require partial landtake from two commercial/industrial property (minor or slightly negative) and there is one additional commercial/industrial property within the corridor but outside the fenceline (not significant or neutral).

There are no amenities within the fenceline but there is possible landtake from one amenity (minor or slightly negative). There are no amenities within the corridor but outside the fenceline. There are no planning applications directly impacted by the Blue East Option Corridor.

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as Preferred.

The assessment matrix of these impacts for each option corridor is presented in Table 7.5.2.9 below.

Table 7.5.2.9 Assessment Matrix of Material Assets Non-Agriculture excluding Utilities and Services – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Residential	There are 16 Moderately Negative, 24 Minor or Slightly Negative and 47 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 22 Minor or Slightly Negative and 52 Not Significant or Neutral impacts associated with this option corridor	There are 13 Moderately Negative, 30 Minor or Slightly Negative and 46 Not Significant or Neutral impacts associated with this option corridor	There are 3 Minor or Slightly Negative and 86 Not Significant or Neutral impacts associated with this option corridor
Commercial / Industrial	There is 1 Not Significant or Neutral impacts associated with this option corridor	There are 3 Minor or Slightly Negative impacts associated with this option corridor	There is 1 Moderately Negative and 3 Minor or Slightly Negative impacts associated with this option corridor	There are 2 Minor or Slightly Negative and 1 Not Significant or Neutral impacts associated with this option corridor
Amenity	There are 1 Minor or Slightly Negative impacts associated with this option corridor	There are 1 Minor or Slightly Negative impacts associated with this option corridor	There are 2 Not Significant or Neutral impacts associated with this option corridor	There are 1 Minor or Slightly Negative impacts associated with this option corridor
Proposed Development	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor
Overall Assessment	There are 16 Moderately Negative, 25 Minor or Slightly Negative and 48 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 26 Minor or Slightly Negative and 52 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 33 Minor or Slightly Negative and 48 Not Significant or Neutral impacts associated with this option corridor	There are 0 Moderately Negative, 6 Minor or Slightly Negative and 87 Not Significant or Neutral impacts associated with this option corridor
Scoring				
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**2**	**3**
Preference - Professional Judgement	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**

Utilities and Services - East of Drumsna Junction (Node J)

The assessment for the number of conflicts with utilities and services for each Option Corridor East of Drumsna Junction (Node J) is presented in Table 7.5.2.10 below. These impacts range from crossing of the option corridor to diversions of kilometres of service ducts and pipelines.

Table 7.5.2.10 No. of Utilities and Services Conflicts – East of Drumsna Junction (Node J)

Option Corridor	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH) [crossings of the indicative fenceline]	1 No.	1 No.	1 No.	1 No.
ESB High Voltage Underground Lines (HV UG) [crossings of the indicative fenceline]	None	None	None	None
ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH) [crossings of the indicative fenceline]	None	None	None	None
ESB Substations	None	None	None	None
Irish Water water mains with pipe diameter greater than 300mm	5023m length	5659m length	3391m length	7398m length
Irish Water foul or combined sewers with pipe diameters greater than 300mm	None	None	None	None
Water / wastewater treatment plants	None	None	None	None
Licenced waste facilities	None	None	None	None
Telecoms Antenna	None	None	None	None
Eir underground services	9100m length	10781m length	11061m length	14675m length
ENet	None	None	None	None
BT services	*At the time of writing BT have not provide electronic location data however the generalised descriptive locations provided indicated that the locations where they do occur coincides with the locations of similar sized underground utilities. It is determined that the impacts on BT underground utilities would not be considerable enough to influence the comparative assessment.*			

The Purple East, Green, Yellow and Blue East Option Corridors are in conflict with the following services and utilities:

- High Voltage Overhead Line crossings, which are considered to be moderately negative impacts particularly as there is a 220kV Overhead crossing of all the options near Aghamore
- Irish Water watermains with pipe diameter greater than 300mm which are considered to be not significant or neutral impacts. The lengths of each conflict are relatively similar ranging from circa 3.4km to 7.4km
- Eir Underground services which are considered to be not significant or neutral impacts. The lengths of each conflict are relatively similar ranging from circa 9.1km to 14.7km

Based on the assessment of utilities and services and licenced waste facilities there is no distinguishable difference among the options west of Drumsna Junction (Node J) and so they are all deemed Intermediate.

Table 7.5.2.11 Assessment Matrix of Utilities and Services – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Utilities and Services	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor
Licenced waste facilities	There are 0 licenced waste facility impacts associated with this option corridor	There are 0 licenced waste facility impacts associated with this option corridor	There are 0 licenced waste facility impacts associated with this option corridor	There are 0 licenced waste facility impacts associated with this option corridor
Scoring				
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**
Score / Impact Level	**2**	**2**	**2**	**2**
Preference - Professional Judgement	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**

Overview East of Drumsna Junction (Node J)

In the overall ranking of the option corridors for East of Drumsna Junction (Node J) in terms of Material Assets Non-Agriculture the number of property acquisitions are weighted more heavily than conflicts with utilities as utilities can be diverted as part of the works.

Table 7.5.2.12 below summarises the order of ranking for the route options in East of Drumsna Junction (Node J).

Table 7.5.2.12 Summary Material Assets-Non-Agriculture Assessment Matrix of Option Corridors – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Properties	There are 17 Moderately Negative, 25 Minor or Slightly Negative and 48 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 26 Minor or Slightly Negative and 52 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 33 Minor or Slightly Negative and 48 Not Significant or Neutral impacts associated with this option corridor	There are 0 Moderately Negative, 6 Minor or Slightly Negative and 87 Not Significant or Neutral impacts associated with this option corridor
Services and utilities	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor	There are 1 Moderately Negative and 2 Not Significant or Neutral impacts associated with this option corridor
Scoring				
Overall Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**2**	**3**
Preference - Professional Judgement	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**

7.5.2.4 Summary

The overall ranking preferences for the option corridors west and east of Drumsna Junction (Node J), in terms of material assets non-agriculture are shown in Table 7.5.2.7 and Table 7.5.2.12 respectively.

It has been determined that the Preferred Option Corridor west of Drumsna Junction (Node J) is the Blue West Option Corridor in relation to Material Assets Non-Agricultural. The Purple West and Dark Green Option Corridors are both Intermediate and the Cyan and Orange Option Corridors are Least Preferred from a Material Assets Non-Agricultural perspective.

East of Drumsna Junction (Node J) the Blue East Option Corridor is also the Preferred Option Corridor. The Purple East and Green Option Corridors are Intermediate, and the Yellow Option Corridors is Least Preferred.

7.5.3 Stage 1 Material Assets-Agriculture Option Assessment

7.5.3.1 Introduction

This section details the Stage 1 Assessment of the Options in the context of the agricultural constraints identified in Section 4.6 Material Assets – Agriculture of this report.

The Material Assets- Agriculture constraints are presented with the Stage 1 Option Corridors in Figures 7.5.3.1.0 to 7.5.3.3.5.

Section 7.5.3.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment criteria is presented in Section 7.5.3.3 and the assessment in 7.5.3.4, with Section 7.5.3.5 outlining the general summary of the Stage 1 Material Assets- Agriculture assessment of the options.

7.5.3.2 Methodology

The options included in this assessment fall under the following headings:

- Do-Minimum Option (Planned and Committed Projects)
- Management Option (interventions on the existing infrastructure to address the identified transport problems as described in Section 7.1 of this document)
- Do-Something Road Based Options

A total of ten option corridors have been taken forward to the preliminary options as described in Section 7.1 of this report. There are six option corridors to the west of Node J at Drumsna Junction (Purple West, Dark Green, Black, Orange, Cyan and Blue East) and four option corridors to the east of Node J at Drumsna Junction (Purple East, Green, Yellow and Blue East). Please see Figures 7.5.3.1.0 to 7.5.3.3.5 for locations.

The following guidelines and legislation were referred to when undertaking this Stage 1 Material Assets- Agriculture assessment of options:

- European Union (2018) (Planning and Development) (Environmental Impact Assessment) Regulations. (SI 296 of 2018)[22]
- Environmental Protection Agency (EPA) (August 2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports[33]
- Transport Infrastructure Ireland (TII) (2016) Project Appraisal Guidelines Unit 7.0 - Multi Criteria Analysis, PE-PAG-02031[2]

This assessment is a combination of a desktop assessment of available data sources combined with the on-site survey conducted in August 2020 as part of the Constraints Study. The desktop study considered the following sources of information:

[22] European Union, 2018. Regulations SI 296 of 2018, Planning and Development, Environmental Impact Assessment. Available at: https://www.irishstatutebook.ie/eli/2018/si/296/made/en/print

- Aerial mapping/photography
- Property Registration Authority of Ireland (PRAI) database
- Soil mapping data from the Teagasc Irish Soil Information System
- Data regarding agriculture in Counties Roscommon and Leitrim from the Central Statistics Office (CSO)

Information regarding the location and types of farm yards, farm types, land use/cropping and land quality was obtained from the site survey and examination of the afore mentioned desktop sources of information. The information in Table 4.6.1 of Section 4.6.2.3, Material Assets – Agriculture Constraints Study is used to categorise the sensitivity of farms. The following features along each option corridor have been identified from desktop research and site survey:

- Farm size and type was determined by referencing the CSO data for the study area and farm types were also recorded from the field survey
- Yards and farm facilities were identified using aerial photography[23] and site survey
- Dairy, equine farms, horticultural and other highly sensitive enterprises were identified from aerial photography23 and site survey. Their folios were identified using the PRAI[24] data
- Good and poor quality land and areas of woodland/scrub/forestry were initially identified by using the Teagasc Irish Soils Information System[25], aerial photography23 and verified during the site survey.

Scoring procedure

Quantitative and qualitative assessments of impacts were undertaken for this assessment using the PAG Unit 72 scoring method. The PAG seven point scale descriptions are listed in Table 7.3.1 of this report.

In the first instance, individual assessments are carried out on each criterion followed by an overall assessment. A score was assigned to each option corridor based on the TII PAG seven point scale, and the overall preference for each option corridor of Preferred, Intermediate, or Least Preferred was assigned using a combination of the assessment criteria results and professional judgement.

7.5.3.3 Assessment Criteria

A 300m wide corridor is assessed for each of the option corridors except the 150m wide Black Option Corridor which underwent a stand-alone assessment rather than a comparative assessment. The assessment criteria as set out in Section 3.1.5 of the PAG Unit 72 Guidelines were used to conduct this assessment:

[23] Google Aerial Mapping, 2021. Available at: https://www.google.com/maps
[24] Property Registration Authority, 2021. Available at: https://www.landdirect.ie/index
[25] Teagasc, 2022. Irish Soil Information System. Available at: http://gis.teagasc.ie/soils/

- Farm size (25ha) was assumed identical along all corridors based on the CSO data for the relevant electoral divisions (see Section 4.6.3.3 and Tables 4.6.4 and 4.6.5 of the Constraints Study)
- Farm type was assessed, with reference to the CSO data (see Section 4.6.3.3 and Tables 4.6.4 and 4.6.5 of the Constraints Study) and the site survey
- Landtake and removal of buildings (impacts on farm yards) and/or facilities was assessed by examining the sub-criteria total landtake, landtake of agricultural land (Corine data), quality of landtake (i.e. area of poor quality alluvial and peat soils), length on-line/off-line and number of impacts on farm yards and facilities along each corridor. On-line sections are assumed to have 50% of the landtake of off-line sections
- The degree of severance in this assessment is determined by the length of each corridor which is off-line.
- Farm viability describes the capacity of a farm to survive, grow and develop. High viability is associated with large farm size, good land quality and intensive land-use. Farm viability is in the low – medium range along all the corridors. This is assessed with reference to farm size, enterprise types and soil types (see Sections 4.6.3.2 and 4.6.3.3 of the Constraints Study). The viability of high sensitivity land parcels (dairy and equine) is assumed to be higher than medium enterprises (beef and sheep).

7.5.3.4 Stage 1 Material Assets- Agriculture Option Corridor Assessment

Assessment of Option Corridors West of Node J

The Do-Minimum Option as described in Section 7.1 of this document will have minimal impacts on agriculture. The impact from this option is assessed as Neutral (i.e., 4 on the PAG seven point scale).

The Black Option Corridor is the shortest corridor having the lowest landtake and overall impact levels. It is 0.6km off-line and has an agricultural landtake of 14ha. In addition to the Black Option Corridor there are two option corridors which follow an alignment north of Carrick-on-Shannon (Purple West and Dark Green).

The Purple West Option Corridor is 10.8km long and is on-line for 2kms. It has the second highest landtake of agricultural land when adjusted for on-line sections. The area of agricultural land within the corridor is 236ha and 214ha when adjusted for the on-line section. There are 63ha within the corridor classified as ‘Lands principally occupied by agriculture, with significant areas of natural vegetation’. The area of poor-quality land (peats and alluvial soils) is 71ha. There are no highly sensitive enterprises and five farm yards within the corridor (none of the farm yards are highly sensitive).

The Dark Green Option Corridor is 10.6km long and is off-line for its entirety. It has the highest landtake of agricultural land. The area of agricultural land within the corridor is 239ha. There are 93ha within the corridor classified as ‘Lands principally occupied by agriculture, with significant areas of natural vegetation’. The area of poor quality land (peats and alluvial soils) is 119ha. There are no highly

sensitive enterprises and six farm yards within the option corridor (none of the farm yards are highly sensitive).

The Blue West Option (Management Option as described in Section 7.1 of this document) is on-line and crosses through Carrick-on-Shannon. This option will have minimal impacts on agriculture, requiring very little landtake to allow for on-line improvements and traffic management. The Blue West Option Corridor is the longest overall (12.2km). The area of agricultural land within the corridor is 218ha, however when adjusted by 50% to allow for a lower expected landtake on the on-line sections the landtake is 109ha. There is 29ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor quality land (peats and alluvial soils) is 128ha. This corridor impacts on one high sensitivity enterprise. There are six farm yards within the corridor, none of which are high sensitivity.

There are two option corridors west of Node J which follow an alignment south of Carrick-on-Shannon (Cyan and Orange).

The Cyan Option Corridor is the second longest overall (11.9km), however it is on-line for 5.3km. The area of agricultural land within the corridor is 267ha, however the landtake along the on-line section (5.3km) is discounted by 50% to allow for a lower expected landtake and therefore the adjusted landtake is 208ha. There are 50ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor quality land (peats and alluvial soils) is 105ha. This option corridor impacts on two highly sensitive enterprises. There are eight farm yards within the corridor, three of which are high sensitivity.

The Orange Option Corridor is the shortest (9.3km). It is on-line for 4.8km. The area of agricultural land within the corridor is 200ha, and when adjusted by 50% to allow for a lower expected landtake on the on-line sections the landtake is 148ha. There are 48ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor-quality land (peats and alluvial soils) is 85ha. It affects one high sensitivity enterprise and there are six farm yards within the corridor, one of which is high sensitivity.

Table 7.5.3.1 Stage 1 Material Assets- Agriculture Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Quantitative Assessment							
Assessment criteria 1 – Farm Size	25ha (compared to the national average of 32.7ha) PAG Score 2	25ha (compared to the national average of 32.7ha) PAG Score 2	25ha (compared to the national average of 32.7ha) PAG Score 2	25ha (compared to the national average of 32.7ha) PAG Score 2	25ha (compared to the national average of 32.7ha) PAG Score 2		25ha (compared to the national average of 32.7ha) PAG Score 2
Assessment criteria 2 – Farm Type	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total[26]). Some high sensitivity farms[27] at western end of the corridor PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total[26]). Some high sensitivity farms at western end of the corridor PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total[26]). PAG Score 4	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total[26]). PAG Score 4	Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total[26]). Some high sensitivity farms at western end of the corridor PAG Score 3		Low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total[26]). PAG Score 4
Assessment criteria 3 – Landtake Sub-criteria – Landtake	267ha of agri land adjusted to 208ha for on-line sections	200ha of agri land adjusted to 148ha for on-line sections	236ha of agri land adjusted to 214ha for on-line sections	239ha of agri land adjusted to 239ha for on-line sections	218ha of agri land adjusted to 109ha for on-line sections		14ha of agri land
Assessment criteria 3 – Landtake Sub-criteria – Length on-line / off-line	5.3km (44%) of entire length (6.6km off-line)	4.8km (52%) of entire length (4.5km off-line)	2km (19%) of entire length (8.8km off-line)	0km (0%) of entire length (10.6km off-line)	12.2km (100%) of entire length is on-line		0.0 km (0% - 1.2 km off-line)

[26] Table 2 of 2010 Census of Agriculture, data for Co Roscommon and Co Leitrim, CSO Electoral Division Data and site survey

[27] 1 Dairy Farm and 1 Agri-Tourism Farm

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Assessment criteria 3 – Landtake Sub-criteria – Impacts On farm yards	8 farm yards / facilities within corridor (3 of which are high sensitivity)	6 farm yards / facilities within corridor (including severance of a highly sensitive entrance lane)	5 farm yards / facilities within corridor (no high sensitivity yards)	6 farm yards / facilities within corridor (no high sensitivity yards)	6 farm yards / facilities within corridor (no high sensitivity yards)		None
Assessment criteria 3 – Landtake Sub-criteria – Quality of landtake	105ha of poor quality land (39%). 50ha of land with significant areas of natural vegetation (19%)[28] PAG Score 2	85ha of poor quality land (43%). 48ha of land with significant areas of natural vegetation (24%)[28] PAG Score 3	71ha of poor quality land (30%). 63ha of land with significant areas of natural vegetation (27%)[28] PAG Score 2	119ha of poor quality land (50%). 93ha of land with significant areas of natural vegetation (39%)[28] PAG Score 2	128ha of poor quality land (59%). 29ha of land with significant areas of natural vegetation (13%)[28] PAG Score 4		9ha of poor quality land (56%). No significant areas of natural vegetation[28] PAG Score 4
Assessment criteria 4 – Severance (length off-line)	6.6km off-line PAG Score 2	4.5km off-line PAG Score 3	8.8km off-line PAG Score 2	10.6km off-line PAG Score 2	0km off-line PAG Score 4		1.2km off-line PAG Score 4
Assessment criteria 5 – Viability	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly higher along southern options PAG Score 3	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly higher along southern options PAG Score 3	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly lower along northern options PAG Score 4	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly lower along northern options PAG Score 4	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability similar to Cyan and Orange PAG Score 3		Expected overall impact is likely to be slight adverse or Neutral. Baseline level is low - medium viability. PAG Score 4

[28] With reference to Corine 2018 data and Teagasc Soils Data. Poor quality land = soil series 05RIV (alluvial soils) and soil series 1xx peats

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Scoring							
Qualitative Assessment	Minor adverse (with effects which are tending towards moderate adverse) Higher expected impact on highly sensitive enterprises – but number of these is very low. Higher quantity of alluvial wet soils south of Carrick-on-Shannon – but overall soil quality is medium. Second highest landtake. Highest impacts on yards. **Minor** or **Slightly Negative**	Higher expected impact on highly sensitive enterprises – but number of these is very low. Higher quantity of alluvial wet soils south of Carrick-on-Shannon – but overall soil quality is medium. Lowest landtake and preferred of the off-line options. **Minor** or **Slightly Negative**	Minor adverse (with effects which are tending towards moderate adverse) No impact on highly sensitive enterprises. Overall soil quality is low – medium. Similar landtake to Cyan – second highest. Site visit would indicate lower viability farming north of Carrick-on-Shannon. **Minor** or **Slightly Negative**	Minor adverse (with effects which are tending towards moderate adverse) No impact on highly sensitive enterprises. Overall soil quality is low - medium. Highest landtake – but also highest area of poor quality soils. Site visit would indicate lower viability farming north of Carrick-on-Shannon. **Minor** or **Slightly Negative**	Neutral (with effects which are tending towards minor adverse) On-line options will have lower predicted impacts on agriculture. **Not Significant** or **Neutral**		Neutral No impact on highly sensitive enterprises. Overall soil quality is low - medium. Lowest landtake. Site visit would indicate lower viability farming north of Carrick-on-Shannon. **Not Significant** or **Neutral**
Score / Impact Level	**3**	**3**	**3**	**3**	**4**		**4**
Preference	**Intermediate**	**Intermediate**	**Intermediate**	**Least preferred**	**Preferred**		**N/A**

Assessment of Option Corridors East of Node J

There are four option corridors east of Node J.

The Purple East Option Corridor is 8km long and it is on-line for 6.2km. There are ten farm yards within the corridor, none of which are high sensitivity. The landtake of the corridor is 148ha after discounting the on-line section by 50%. There is 52ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor quality land (peats and alluvial soils) is 39ha.

The Green Option Corridor is 7.9km long and all of this is on-line. There are 11 farm yards within the corridor, none of which are high sensitivity. The landtake of the corridor is 117ha after discounting the on-line sections by 50% because it is all on-line. There is 51ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor quality land (peats and alluvial soils) is 41ha.

The Yellow Option Corridor is 7.9km long and it is on-line for 6.9km. There are 11 farm yards within the corridor, none of which are high sensitivity. The landtake of the corridor is 132ha after discounting the on-line section by 50%. There is 51ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor quality land (peats and alluvial soils) is 41ha.

The Blue East Option Corridor "Management Option" is 7.9km long and all of this is on-line. There are 11 farm yards within the corridor, none of which are high sensitivity. The landtake of the corridor is 117ha after discounting the on-line sections by 50% because it is all on-line. There is 51ha within the corridor classified as 'Lands principally occupied by agriculture, with significant areas of natural vegetation'. The area of poor quality land (peats and alluvial soils) is 41ha.

Table 7.5.3.2 Stage 1 Material Assets- Agriculture Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Quantitative Assessment				
Assessment criteria 1 – Farm Size	25 ha (compared to the national average of 32.7ha) PAG Score 2	25 ha (compared to the national average of 32.7ha) PAG Score 2	25 ha (compared to the national average of 32.7ha) PAG Score 2	25 ha (compared to the national average of 32.7ha) PAG Score 2
Assessment criteria 2 – Farm Type	Low – medium sensitivity – mainly beef / sheep farms (98% of total) PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (98% of total) PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (98% of total) PAG Score 3	Low – medium sensitivity – mainly beef / sheep farms (98% of total) PAG Score 3
Assessment criteria 3 – Landtake Sub-criteria – Landtake	234ha of agri land adjusted to 132ha for on-line sections	234ha of agri land adjusted to 117ha for on-line sections	243ha of agri land adjusted to 148ha for on-line sections.	234ha of agri land adjusted to 117ha for on-line sections
Assessment criteria 3 – Landtake Sub-criteria – Length on-line / off-line	6.9km (87%) of entire length (1km off-line)	7.9km (100%) of entire length	6.2km (78%) of entire length (1.75km off-line)	7.9km (100%) of entire length
Assessment criteria 3 – Landtake Sub-criteria – Impacts on farm yards	11 farm yards / facilities within corridor	11 farm yards / facilities within corridor	10 farm yards / facilities within corridor	11 farm yards / facilities within corridor
Assessment criteria 3 – Landtake Sub-criteria – Quality of landtake	41ha of poor quality land (17%). 51ha (22%) of land with significant areas of natural vegetation PAG Score 3	41ha of poor quality land (18%). 51ha (22%) of land with significant areas of natural vegetation PAG Score 3	39ha of poor quality land (16%). 52ha (21%) of land with significant areas of natural vegetation PAG Score 3	41ha of poor quality land (18%). 51ha (22%) of land with significant areas of natural vegetation PAG Score 3
Assessment criteria 4 – Severance (length off-line)	1km off-line PAG Score 4	0km off-line PAG Score 4	1.75km off-line PAG Score 4	0km off-line PAG Score 4

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Assessment criteria 5 – Viability	Baseline level is low - medium viability PAG Score 4	Baseline level is low - medium viability PAG Score 4	Baseline level is low - medium viability PAG Score 4	Baseline level is low - medium viability PAG Score 4
Scoring				
Qualitative Assessment	Minor Adverse Mainly on-line (except for 1km) and therefore impacts are low. Compared to other options it will have second highest predicted landtake. (Ranked 3) **Minor** or **Slightly Negative**	Minor Adverse (tending towards Neutral) Mainly on-line and therefore impacts are low. Compared to other options It will have a similar landtake to Blue East Option Corridor i.e. the second lowest predicted landtake (Ranked 2) **Minor** or **Slightly Negative**	Minor Adverse Mainly on-line and therefore impacts are low. However, compared to other options it is a dual carriageway, is off-line for longest distance and will have highest predicted landtake. (Ranked 4) **Minor** or **Slightly Negative**	Minor Adverse (tending towards Neutral) On-line and therefore impacts are low. Compared to other options it will have lowest predicted landtake. (Ranked 1) **Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**3**	**3**
Preference	**Intermediate**	**Preferred**	**Least Preferred**	**Preferred**

7.5.3.5 Summary

The preferred options are:

- West of Node J the Blue West Option Corridor (Management Option); and
- East of Node J the Blue East Option Corridor (Management Option) and the Green Option Corridor.

West of Node J the effects of the Black Option Corridor will be neutral (PAG Score 4) because this option is very short.

West of Node J the effects of the Blue West Option Corridor will have adverse effects which are low due to the on-line nature of the option and therefore the overall PAG Score is 4 (neutral). Hence the Blue West Option Corridor is the preferred Option Corridor West of Node J.

West of Node J the Orange, Cyan and Purple Option Corridors with PAG scores of 3 have a lower preference than the Blue West Option Corridor and a higher preference than the Dark Green Option Corridor.

West of Node J the Dark Green Option Corridor is least preferred with a PAG score of 3.

East of Node J, there is little to differentiate the predicted significance levels and all options have a PAG Score of 3. These have all been assessed as slight adverse – Neutral because the options are predominantly on-line. Based on the qualitative and quantitative assessments the Green and Blue East Option Corridors will have the lowest impact and are preferred because they are entirely on-line. The Purple East Option Corridor east of Node J is assigned the lowest preference because it has the longest length off-line.

7.5.4 Stage 1 Air Quality Option Assessment

7.5.4.1 Introduction

This section details the Stage 1 Air Quality assessment of the options with respect to the Air Quality constraints identified in Section 4.7 Air Quality of this report.

The constraints relating to Air Quality are identified among various other Environmental constraints. These are presented with the Stage 1 Options in the following figures:

- Sensitive Receptor Locations: Population Stage 1 Figures 7.5.1.1.0 to 7.5.1.1.5
- Designated Sites: Biodiversity Stage 1 Figures 7.5.9.1.0 to 7.5.9.1.5
- Integrated Pollution Control (IPC) or Waste Licences: Soils and Geology Stage 1 Figures 4.5.12.1.1 to 4.5.12.1.5

Section 7.5.4.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 7.5.4.3 with Section 7.5.4.4 outlining the general summary of the Stage 1 Air Quality assessment of the options.

7.5.4.2 Methodology

The multi-criteria air assessment was undertaken with reference to the TII Project Appraisal Guidelines for National Roads Unit – 7.0 – Multi Criteria Analysis. The assessment includes both a quantitative and qualitative element. Each impact is scored qualitatively based on the PAG seven-point scale and an integer is assigned according to the impact levels as listed in Table 7.3.1.

Using a combination of the impact scores and professional judgement a determination is made as to whether each option corridor assessed is Preferred, Intermediate or Least Preferred. The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[29] were also referred to when undertaking this assessment, particularly Table 3.3 in determining the significance of the impact.

The Air Quality assessment has been prepared in accordance with the National Roads Authority (NRA) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes[30] and in accordance with the requirements of the TII Project Management Guidelines 2019[31], and the TII Project

[29] Environmental Protection Agency (EPA), 2017. Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available at: http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf
[30] NRA, 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf
[31] Transport Infrastructure Ireland, 2019. Project Management Guidelines PE-PMG-02041. Available at: https://www.tiipublications.ie/library/PE-PMG-02041-02.pdf

Manager's Manual, 2019 and the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 2016[2].

In December 2022, TII published PE-ENV-01107: Air Quality Assessment of Proposed National Roads – Standard to supersede the 2011 TII Air Quality Guidelines. Section 1.9 of PE-ENV-01107 states that '*where projects requiring approval under Section 51, Section 177AE or Part 8 have, at the date of publication of this SD, commenced planning and design, and in particular, where technical advisor contracts have been executed, this SD should be:*

· *treated as advice and guidance;*

· *employed to the greatest extent reasonably practicable; and*

· *applied in a proportionate manner, having regard to the characteristics and location of the project/maintenance works and the type and characteristics of potential impacts*.'

As this air quality assessment was undertaken well in advance of the publication of the new guidance, the assessment relied on the 2011 guidance.

7.5.4.3 Assessment Criteria

The air quality assessment is based on the number of sensitive receptors in proximity to each option corridor and the projected traffic volumes accessing the corridors during the operational phase. The construction phase is assessed through the consideration of the number of sensitive properties located in proximity to the likely construction works where dust impacts may be experienced.

Section 2.3, Route Selection Process Stage 1 Preliminary Options Assessment, of the NRA, 2011 Guidelines[30] includes the initial steps to assess air quality within a study area as follows:

"The specific objectives of the air quality input to the Stage 1 Preliminary Options Assessment of the Route Selection Process are to characterise the existing and ambient air quality in the study area and to initially identify all sensitive receptor locations within the study area likely to be impacted by the proposed scheme before feasible route options are identified. Once feasible route options are identified, and in order to undertake the preliminary options assessment, the total number of sensitive receptors (e.g. residential properties) within 50m of the carriageway of each feasible route option should be recorded with a view to eliminating those routes with the greater number of sensitive receptors likely to be impacted by the proposed scheme."

The existing and ambient air quality and the initial identification of sensitive receptor locations within the study area are included in the Air Quality Constraints Section 4.7. The air quality conditions for this assessment are in line with the baseline conditions set out in Section 4.7.

The scope of the air quality assessment is described in Section 2.3 of the NRA, 2011 Guidelines as follows:

"Identify and record all sensitive receptor locations within the study area and all sensitive receptors within 50 m of the carriageway of each feasible route option that are, or have the potential to be, significantly affected by a proposed scheme"

In line with the NRA, 2011 Guidelines, a quantitative assessment of potential air quality impacts on existing and potential sensitive receptors was undertaken.

Sensitive receptor locations are defined in the NRA, 2011 Guidelines as residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. In addition, planning applications[32] give an indication to the potential number of future sensitive receptors adjacent to corridors.

Traffic data is provided for the base year (2020) for each option. This data is considered in the assessment of options.

7.5.4.4 Stage 1 Air Quality Option Corridor Assessment

The number of existing and potential sensitive receptors in proximity to each option corridor determines air quality impacts. The zone of interest for the assessment is 0-50m from each indicative road fenceline within each option corridor. This is an offset from the edge of the indicative road fenceline within each option corridor and assumes that properties within the potential fenceline would be acquired and would therefore not be counted as receptors.

Stage 1 Air Quality Assessment – Options West of Node J at Drumsna Junction

The numbers of sensitive receptors in proximity to each option corridor and the air quality assessment determinations are outlined in Table 7.5.4.1 for the options west of Node J.

The number of sensitive receptors is relatively similar among the Cyan, Orange, Purple West and Dark Green Option Corridors, with the Blue West Option corridor having a great deal more receptors, followed by the Cyan Option corridor and the Orange Option corridor respectively.

The Cyan Option Corridor is an off-line proposal, south of the existing N4 which deviates from the existing N4 at Cloongownagh at Node A. It continues eastwards and rejoins the existing N4 at Lissenghan at Node D. The existing N4 between Lissenghan at Node D and Node J at Drumsna Junction will be subject to an on-line upgrade. The Cyan Option Corridor passes through two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 0-50m distance.

The Orange Option Corridor commences at Node B where it deviates from the existing N4 at Meera. It continues east and rejoins the existing N4 at Lissenghan at

Node D before following the existing N4 to the Drumsna Junction at Node J. An on-line upgrade is proposed for the existing N4 between Lissenghan at Node D and Drumsna Junction at Node J. The Orange Option Corridor also passes through two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 0-50m distance. As outlined in Table 7.5.4.1, the Orange Corridor has a slightly higher number of both existing and potential receptors in proximity.

The Purple West Option Corridor is located north of the existing N4 and deviates from the N4 at Tumna at Node B. It continues north-eastwards, with a junction to the R280 at Cartown. It continues south-eastwards and rejoins the existing N4 at Tully at Node E. It then continues with an on-line upgrade of the existing N4 to the Drumsna Junction at Node J. As outlined in Table 7.5.4.1, compared with the other options the Purple West Option Corridor has a lower number of both existing and potential receptors in proximity.

The Dark Green Option Corridor deviates from the existing N4 at Tumna at Node B. It continues north-eastwards, crossing the River Shannon at Corryolus, and meets the R280 at Cartown. It continues south-eastwards and rejoins the existing N4 at the Drumsna Junction at Node J. As outlined in Table 7.5.4.1, the Dark Green Corridor has the lowest number of both existing and potential receptors in proximity.

The Blue West Option Corridor comprises the Management Option which considers interventions on the existing infrastructure to address the identified transport problems. It commences at Node O at Usna and follows the existing N4 to Node J at Drumsna Junction. The Blue West Option Corridor passes directly through Carrick-on-Shannon which makes up a large majority of the properties counted within the 0-50m distance. As outlined in Table 7.5.4.1, the Blue Option Corridor (West) has the highest number of both existing and potential receptors in proximity.

An impact level of minor or slightly negative was assigned to the Cyan, Orange, Purple West and Dark Green Option Corridors. All four options attract relatively low traffic volumes which are unlikely to generate a significant air quality impact. Nonetheless, the by-pass options are increasing traffic volumes in proximity to new sensitive receptors, thus potentially decreasing air quality. The Blue West Option Corridor has higher traffic volumes in comparison to the other options and has been given an impact level of moderately negative. It should be noted that this on-line option will not introduce new sensitive receptors as it does not deviate from the existing N4.

The Purple West and Dark Green Option Corridors have been rated as Preferred as these options have a slightly lower number of sensitive receptors. The Orange and Cyan Option Corridors are only marginally worse and are rated as Intermediate. The Blue West Option Corridor has been rated as the Least Preferred with the highest sensitive receptors in proximity and AADTs.

<u>Stage 1 Air Quality Assessment of the Black Option Corridor</u>

The Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon. The option provides connectivity by interconnecting the R280 to the Summerhill Road and on to the Castlecara Road with the development of a new link road. The link road crosses agricultural land and in proximity to residential dwellings both side of the carriageway. Using the same methodologies discussed above, the sensitive receptors 0-50m from the road fenceline and the traffic volumes were analysed for the route. The results are summarised in Table 7.5.4.1

The Black Option Corridor is predicted to result in an increase in road traffic at properties located in proximity to its alignment, therefore decreasing air quality at new sensitive receptor locations. However, the relative number of sensitive receptors and the projected AADTs is not significant from an air quality perspective, therefore the impact is minor or slightly negative.

Table 7.5.4.1 Stage 1 Air Quality Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION OPTION CORRIDOR	ORANGE OPTION OPTION CORRIDOR	PURPLE WEST OPTION OPTION CORRIDOR	DARK GREEN OPTION OPTION CORRIDOR	BLUE WEST OPTION OPTION CORRIDOR		BLACK OPTION CORRIDOR
Property Counts - Existing Sensitive Receptors 0 – 50m (from fenceline)	64	68	60	54	116		10
Property Counts - Granted Planning Applications for Sensitive Receptor Developments 0 – 50m (from fenceline)	5	5	3	3	3		3
Total Number of Sensitive Receptors within 0-50m of fenceline	69	73	63	57	119		13
AADTs (2030)	6,652	6,030	5,518	5,492	10,433		4,966
Scoring							
Qualitative Assessment	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors **Minor** or **Slightly Negative**	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors **Minor** or **Slightly Negative**	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors **Minor** or **Slightly Negative**	Minor or Slightly Negative due to the traffic volumes in proximity to sensitive receptors **Minor** or **Slightly Negative**	Moderately Negative due to the traffic volumes in proximity to sensitive receptors **Moderately Negative**		Minor or Slightly Negative due to a decrease in air quality at sensitive receptors **Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**3**	**3**	**2**		**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**	**Least Preferred**		**N/A**

Stage 1 Air Quality Assessment – Options East of Node J at Drumsna Junction

The numbers of sensitive receptors in proximity to each option corridor, AADTs and the air quality assessment determinations are outlined in Table 7.5.4.2 for the options east of Node J at Drumsna Junction.

The Green Option Corridor comprises an on-line upgrade of the existing single carriageway between Lissenghan at Node J and Faulties at Node H. The Yellow Option Corridor comprises an on-line upgrade of the existing N4 between Lissenghan at Node J and Fernaught, with a short off-line section proposed between Fernaught at Node G and Faulties. As outlined in Table 7.5.4.2 the Green Option Corridor has a marginally higher number of sensitive receptors in proximity than the Yellow Option corridor.

The Purple Option Corridor comprises an on-line upgrade of the existing N4 between Drumsna Junction at Node J and Drumgildra at Node F. A short off-line deviation to the east of Aghamore is proposed between Nodes F and G with the remaining N4 upgraded between Aghamore at Node G and Faulties at Node H. The Purple Option corridor has the lowest number of sensitive receptors within the 0-50m distance compared to the other options in the eastern section. This is due to the lower property counts in the off-line section of this corridor. On this basis the Purple East Option corridor would result in marginally lower potential air quality impacts.

The Blue East Option Corridor comprises the Management Option which considers interventions on the existing infrastructure to address the identified transport problems. It follows the existing N4 between Node J at Drumsna Junction and Faulties at Node H. As outlined in Table 7.5.4.2 the Blue East Option Corridor and the Green Option Corridor have the highest number of existing and potential receptors in proximity.

An impact level of Moderately Negative was assigned to all options. All options result in relatively low traffic volumes which are unlikely to generate significant air quality impacts. Nonetheless, the by-pass options are increasing traffic volumes in proximity to new sensitive receptors, and thus potentially decreasing air quality.

Although the Purple East Option Corridor has slightly higher traffic volumes relative to the other options, it also has the lowest number of sensitive receptors. This has been rated as the Preferred option corridor on the basis of the low sensitive receptors. There is very little difference in projected traffic volumes on the Yellow, Green and Blue East Option corridors.

Table 7.5.4.2 Stage 1 Air Quality Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Property counts - existing sensitive receptors				
0 – 50m	108	116	60	116
Property counts - granted planning applications for sensitive receptor developments				
0 – 50m	5	3	3	3
Total sensitive receptors				
Total No. of Receptors within 0 – 50m	113	119	63	119
AADTs – average across routes				
AADTs (2030)	7,494	7,510	8,631	7,566
Scoring				
Qualitative Assessment	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors
Score / Impact Level	**2**	**2**	**2**	**2**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Intermediate**

7.5.4.5 Summary

The results from the Stage 1 Air Quality Assessment of the Option Corridors conclude that the Purple West Option Corridor and Dark Green Option Corridors are the Preferred Options on west of Node J at Drumsna Junction and the Purple East Option Corridor is the Preferred option east of Node J at Drumsna Junction. This determination is based on the consideration of the numbers of sensitive receptors and traffic volumes associated with each option. The impact of the Black Option Corridor was found to be minor or slightly negative.

7.5.5 Stage 1 Climate Option Assessment

7.5.5.1 Introduction

This section details the Stage 1 Assessment of the Options with respect to the Climate constraints identified in Section 4.8 Climate of this report.

Section 7.5.5.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 7.5.5.3 with Section 7.5.5.4 outlining the general summary of the Stage 1 Climate assessment of the options.

7.5.5.2 Methodology

The multi-criteria climate assessment was undertaken with reference to the TII Project Appraisal Guidelines for National Roads Unit – 7.0 – Multi Criteria Analysis[1]. The assessment includes both a quantitative and qualitative element. Each impact is scored qualitatively based on the seven-point scale listed in Table 7.3.1of this report and an integer is assigned according to the impact level.

Using a combination of the impact scores and professional judgement a determination was made as to whether each option corridor assessed is Preferred, Intermediate or Least Preferred. The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[33] were also referred to when undertaking this assessment, particularly Table 3.3 in determining the significance of the impact.

The Climate assessment has been prepared in accordance with the requirements of the TII Project Management Guidelines 201931, and the TII Project Manager's Manual, 201934 and the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 20162.

7.5.5.3 Assessment Criteria

The climate assessment evaluates potential carbon emissions from road traffic during the operational phase while also considering potential embodied carbon from the construction phase of each corridor. In addition, the traffic data provided for each option is considered in the assessment.

7.5.5.4 Stage 1 Climate Option Corridor Assessment

From a climate perspective, greater corridor lengths have the potential to increase carbon emissions from road traffic during the operational phase due to an increase in vehicle kilometres travelled. In addition, the more materials required to construct

[33] Environmental Protection Agency, 2017. Guidelines on the Information to be contained in Environmental Impact Assessment Reports. Available at: http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf
[34] Transport Infrastructure Ireland (TII), 2019. Project Manger's Manual for Major National Road Projects PE-PMG-02042. Available at: https://www.tiipublications.ie/library/PE-PMG-02042-01.pdf

an option corridor, the greater the embodied carbon generated for the construction phase.

Stage 1 Climate Assessment – Options West of Node J at Drumsna Junction

The corridor lengths, AADTs, vehicle kilometres travelled, and the estimated embodied carbon associated with each option are listed followed by the climate assessment determination in Table 7.5.5.1 for the section west of Node J at Drumsna Junction.

As outlined in Table 7.5.5.1 all off-line options were rated as Major or Highly Negative as the embodied carbon in the materials required to construct the new road infrastructure have the potential to result in a significant negative impact on carbon emissions and thereby climate. The works will require the use of materials which generate carbon, for example concrete, bitumen and aggregates.

The Blue Option corridor (West) is the Preferred option as it follows a mainly on-line route, resulting in the lowest vehicle kilometres travelled and thus lower operational carbon during the operational phase and the least embodied carbon associated with the construction phase relative to the other options.

The Orange, Dark Green and Cyan Option corridors (West) are slightly longer than the Blue Corridor respectively, deviating relatively further from the on-line corridor. This will result in marginally higher carbon emissions at both the construction and operational phases, in comparison to the Blue Option corridor.

The Purple Option corridor (West) requires the longest off-line route relative to the other options, resulting in the highest vehicle kilometres travelled and generating the most carbon emissions at the construction and operational phases. The Purple Option corridor is the Least Preferred option.

Stage 1 Climate Assessment- Black Option Corridor

Using the same methodologies discussed above, the Black Option corridor was assessed, but not compared to the other options as it was subject to a stand-alone assessment. The results are summarised in Table 7.5.5.1 .

The Black Option corridor is 2.51km in length. The impact is rated as moderately negative as the embodied carbon in the materials required to construct the new road infrastructure have the potential to result in a negative impact on climate due to the use of materials which generate carbon, for example concrete, bitumen and aggregates.

The option will result in a slight overall increase in traffic volumes in comparison to the do-nothing scenario, which contributes to an increase in carbon emissions, and thus has a negative impact on climate.

It is worthy to note, although a comparative assessment is not being conducted on the Black Option Corridor, the corridor length is significantly shorter than the option corridors both west and east of Node J which would result in less vehicle kilometres travelled at an operational phase and generate the least carbon emissions at the construction phase relative to the other options.

Table 7.5.5.1 Stage 1 Climate Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Operational Carbon kgCO2eq	47,617,580	47,524,052	47,885,871	47,925,244	47,328,758		47,317,562
Embodied Carbon kgCO2eq	14,333,913	12,716,968	16,917,740	15,800,963	4,359,259		890,676
Scoring							
Qualitative Assessment	**Major** or **Highly Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Major** or **Highly Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Major** or **Highly Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Major** or **Highly Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Moderately Negative** due to the additional vehicle kilometres travelled and the embodied carbon		**Moderately Negative** as the embodied carbon in the materials required to construct the new road infrastructure have the potential to result in a negative impact on climate
Score / Impact Level	**1**	**1**	**1**	**1**	**2**		**2**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

Stage 1 Climate Assessment – Options East of Node J at Drumsna Junction

The corridor lengths, AADTs, vehicle kilometres travelled, and the estimated embodied carbon associated with each option are listed followed by the climate assessment determination in Table 7.5.5.2 for the section east of Node J at Drumsna Junction.

As outlined in Table 7.5.5.2 , all off-line options were rated major or highly negative as the embodied carbon in the materials required to construct new road infrastructure have the potential to result in a significant negative impact on carbon emissions and thereby, climate. The works will require the use of materials which generate carbon, for example concrete, bitumen and aggregates.

The Purple East Option Corridor requires the longest off-line route relative to the other options, resulting in the highest vehicle kilometres travelled and generating the most carbon emissions at both construction and operational phases. Consequently, the Purple East Option Corridor is the Least Preferred option of the options west of Node J at Drumsna Junction.

The Blue East Option Corridor is the Preferred option as it is projected to have the lowest vehicle kilometres travelled at an operational phase. The preference for the Blue East Option Corridor is marginal from a climate perspective.

Table 7.5.5.2 Stage 1 Climate Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Operational carbon kgCO2eq	47,935,919	47,473,001	47,885,871	47,328,758
Embodied carbon kgCO2eq	5,228,183	4,363,122	7,759,091	806,221
Scoring				
Qualitative Assessment	**Moderately Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Moderately Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Major** or **Highly Negative** due to the additional vehicle kilometres travelled and the embodied carbon	**Moderately Negative** due to the additional vehicle kilometres travelled and the embodied carbon
Score / Impact Level	**2**	**2**	**1**	**2**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Preferred**

7.5.5.5 Summary

The Blue West Option Corridor and Blue East Option Corridors were found to be the Preferred options from a climate perspective. These preferences were determined from an assessment of overall corridor length and assumed scale of construction works generating embodied carbon. The preference is marginal over the other options.

The Black Option Corridor was found to have a moderately negative impact to climate due the embodied carbon associated with the new road infrastructure and an increase in operational carbon emissions.

7.5.6 Stage 1 Noise and Vibration Option Assessment

7.5.6.1 Introduction

This section details the Stage 1 Assessment of the Option Corridors with respect to the Noise and Vibration constraints identified in Section 4.9 Noise and Vibration of this report.

The Noise and Vibration constraints are presented with the Stage 1 Option Corridors in Figures 7.5.6.1.0 to 7.5.6.2.5.

Section 7.5.6.2 describes the methodology and lists the assessment criteria used to assess and rank the option corridors. The assessment criteria are presented in Section 7.5.6.3. The Stage 1 Noise and Vibration assessment of the options is conducted in Section 0. Finally, a summary is presented in Section 7.5.6.5.

7.5.6.2 Methodology

The option corridors are described in Section 7.1.2. In summary, a total of ten option corridors have been taken forward to the preliminary options (Stage 1). Six of the option corridors are to the west of Node J at Drumsna Junction (Purple West, Dark Green, Orange, Cyan, Blue West and Black) and four option corridors are to the east of Node J (Purple East, Green, Yellow and Blue East).

This assessment has ranked the corridors in order of preference, except for the Black Option Corridor west of Node J which is given a stand-alone assessment. The assessment considers the potential impacts of each option corridor with respect to noise and vibration on the surrounding environment through which they pass. An indicative dual carriageway design (worst case scenario) was used to conduct the assessment.

The noise impact assessment is conducted in accordance with the relevant guidance provided in Section 5.0 of the National Roads Authority (NRA), 2004 Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII Noise Guidelines 2004)[35], within Section 2 of the 2014 Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII Noise Guidelines 2014)[36], in accordance with the requirements of the TII Project Management Guidelines 201931, and the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 20162 and Design Manual for Roads and Bridges (DMRB) (UKHA, 2020)[37].

[35] NRA, 2004. Guidelines for the Treatment of Noise and Vibration in National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Treatment_of_Noise_and_Vibration_in_National_Road_Schemes.pdf

[36] Transport Infrastructure Ireland, 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Good_Practice_Guidance_for_the_Treatment_of_Noise_during_the_Planning_of_National_Road_Schemes.pdf

[37] Design Manual for Roads and Bridges (DMRB) (UKHA, 2020). Available at: https://www.standardsforhighways.co.uk/dmrb/

In terms of operational noise, the NRA 2004 Noise and Vibration Guidelines and TII Noise Guidelines 2014 consider it appropriate to set the design goal for road traffic noise for new national roads in Ireland as follows:

- Day-evening-night 60 dB L_{den} (free field)

Both the NRA 2004 and TII 2014 noise documents acknowledge that it may not always be sustainable to achieve this design goal. In such circumstances, a structured approach should be taken in order to ameliorate as far as practicable road traffic noise through the consideration of measures such as alignment changes, barrier type (e.g., earth mounds) or low noise road surfaces.

Impact Rating Score

Based on the quantitative and qualitative analysis undertaken for each option corridor, all options have been assessed against the following scoring system based on the TII Project Appraisal Guidelines for National Roads Multi Criteria Analysis as listed in Table 7.3.1 of this report.

All option corridors have the potential to generate a negative noise impact at noise sensitive properties impacted by the new and existing alignments.

7.5.6.3 Assessment Criteria

The assessment of potential noise impacts and ranking of option corridors is based primarily upon property counts, a review of the likely requirement for mitigation measures based on the indicative noise footprint for each option, and changes in traffic flows. The following has been conducted to assess the impact rating of each of the option corridors under consideration:

- Property counts have been conducted within four bands from the centreline of each option corridor, i.e., 0 to 50m, 50 to 100m, 100 to 200m and 200 to 300m, in accordance with Section 5.2 of the NRA 2004[35] document. Using this information, the Potential Impact Rating (PIR) for each option corridor was established
- The potential noise footprint of the indicative carriageway design for each option was then established taking into account the vertical alignments for varying sections of each option, projected future traffic flows and traffic speed
- An assessment of the potential number of properties likely to be exposed to traffic noise levels at or above 60 dB $L_{den,}$ and consequently require noise mitigation was determined using a noise 'footprint' assessment
- A high-level review of changes in traffic noise levels on the existing road network was undertaken based on a comparison between Do Minimum traffic data and the Do Something traffic data for the year 2045, for each route option.
- In terms of vibration, road traffic along normal well-maintained surfaces, in line with this proposed development, generates very low levels that are normally not perceptible to building occupants. For the purposes of this assessment, therefore, it is assumed that all routes will have a comparable low

vibration impact during their operational phase and vibration is not assessed further.

The potential noise and vibration impacts associated with the construction phase of each route will be of an impermanent duration (i.e., less than 7 years). Whilst there will be varying impacts associated with each, the construction phase will be undertaken using standard road construction techniques and will be controlled by the implementation of construction noise and vibration limits. For the purposes of ranking options, this assessment has focused on longer terms operational impacts only.

The ranking of option corridors during their operational phase is focused on the potential operational phase noise impacts which will vary among option corridors.

Stage 1 Assessment Methodology for the Assessment of Potential Impact Rating (PIR)

An assessment of Potential Impact Rating (PIR) based upon the number of noise sensitive receptors (NSRs) within specified distance bands from each of the option corridors is set out in the following section.

The number of properties potentially sensitive to noise and/or vibration within 300m of each of the proposed option corridors has been identified.

Property counts have been undertaken for four bands from the centreline of each option corridor, i.e., 0 to 50m, 50 to 100m, 100 to 200m and 200 to 300m. A weighting value for each distance band has been applied with a weighting factor of 4 for the closest distance band (0 to 50m) down to 1 for the furthest distance band (200 to 300m). For the PIR assessment, the calculated weighted value for each distance band is summed to obtain a total PIR value. The option corridor with the lowest PIR has the lowest potential impact for this assessment criterion.

Stage 1 Assessment Methodology for the Assessment of Noise Footprint and Potential Requirement for Noise Mitigation

It should be noted that the approach used for Stage 1 is a high-level screening assessment and is not used to calculate specific noise levels at individual properties or groups of properties or used to determine the extent of noise mitigation. The procedure used at this stage of the preliminary options assessment is to provide an objective methodology for ranking the potential noise impacts associated with each option on a comparative basis.

Option corridors with the highest number of noise sensitive properties, and therefore with the highest requirement for noise mitigation based on the conditions noted above, are ranked least favourably.

To assess the indicative noise impacts associated with each option, a review of the indicative carriageway design within each corridor has been undertaken. The preliminary indicative dual carriageway design provided for each option was used to determine the likely noise ‘footprint’ of each and the likely requirement for mitigation at a given receiver. The noise ‘footprint’ of each carriageway design was determined using the following methodology.

- Each dual carriageway design was overlaid on OS and aerial mapping. The proposed vertical alignment of each route was then reviewed to determine areas of grade, cuttings and embankments along each option corridor
- Using guidance from the TII Noise Guidelines 2014[2], the approximate distance to a 60 dB L_{den} contour was established using the noise footprint graphs set out in Chapter 5 of the Guidance document
- The noise footprint was determined for individual sections of each dual carriageway design option, taking into account the vertical alignment of the carriageway design, the Annual Average Daily Traffic flows (AADT), traffic speed, and the road surface
- An operational speed of 100km/hr and a standard hot rolled asphalt road surface was assumed along all dual carriageway design options and assuming the following traffic flows based on the 2045 traffic model outputs listed in Table 7.5.6.1 .

Table 7.5.6.1 Traffic Flows Based on the 2045 Traffic Model Outputs

Option Corridor	Section Between Nodes	Traffic Flow (2045 AADT)
West of Drumsna Junction (Node J)		
Black	R280 to Summerhilll Road	6,068
	Summerhill Road to Castlecara Road	3,855
Orange	Node B – Node J	5,047
Cyan	Node A – Node J	6,016
Purple West	Node B – R280 Road	4,727
	R280 Road – Node J	3,709
Dark Green	Node B – R280 Road	4,727
	R280 Road – Node J	3,709
Blue West	Node 0 – West of R368	8,648
	N4 – R368 to L3408	16,962
	N4 – L3408 to Node J	9,180
Do-Minimum	N4 – West of R368	8,676
	N4 – R368 to L3408	17,066
	N4 – L3408 to Node J	9,878
East of Drumsna Junction (Node J)		
Purple East	Node J – Node H	9,345
Green	Node J – Node H	9,345
Yellow	Node J – Node H	8,582
Blue East	Node J – Node F	7,869
	Node F – Node H	6,341

Option Corridor	Section Between Nodes	Traffic Flow (2045 AADT)
Do-Minimum	Node J – Node F	8,029

- The number of noise sensitive properties within the 60 dB L_{den} contour for each section of carriageway was counted and a total number between each section was established
- With respect to NRSs along either off-line or on-line option corridors, the following three conditions must be satisfied under the NRA 200435 and TII 201436 noise guidelines for noise mitigation to be provided:
    - The combined expected maximum traffic noise level, i.e., the relevant noise level, from the proposed road development together with other traffic in the vicinity is greater than the design goal of 60 dB Lden
    - The relevant noise level is at least 1 dB more than the expected traffic noise level without the proposed road development in place
    - The contribution to the increase in the relevant noise level from the proposed road development is at least 1 dB

Stage 1 Assessment Methodology Change in Traffic Noise Level

Traffic flow data for the year 2045 has been reviewed to provide an analysis on the expected change in noise level associated with the implementation of the various proposed options along the existing N4. For off-line options, traffic along the existing N4 will be diverted to the new proposed alignments.

In the absence of any Irish guidelines or standards relating to the assessment of the effects associated with changes in road traffic noise levels, reference is made to the UK's DMRB. This document provides suggested magnitude rating tables relating to changes in noise levels associated with road traffic noise.

The calculated road traffic noise levels used in this study relate to the design year of 2045, hence in line with the DMRB guidance, the following magnitude of change is applied for the long-term period (design year) as reproduced in Table 7.5.6.2 .

Table 7.5.6.2 Classification of Magnitude of Traffic Noise Impacts in Long-term (DMRB 2020)

Long-term Magnitude	Long-term Noise Change, dB
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3 to 4.9
Negligible	Less than 3.0

7.5.6.4 Stage 1 Option Corridor Assessment

Stage 1 PIR Assessment of Option Corridors West of Node J at Drumsna Junction

Table 7.5.6.3 summarises the PIR values calculated for the option corridors west of Node J at Drumsna Junction using the weighting values for each distance band discussed above and taking account of existing properties within the 300m band.

Table 7.5.6.3 PIR Assessment Table for Option Corridors West of Drumsna Junction (Node J)

Option Corridor	PIR 0-50m Band	PIR 50-100m Band	PIR 100-200m Band	PIR 200-300m Band	Total PIR
Cyan Option Corridor	64	180	300	238	782
Orange Option Corridor	68	138	300	203	709
Purple West Option Corridor	60	42	70	47	219
Dark Green Option Corridor	64	30	68	43	205
Blue West Option Corridor	404	336	390	266	1,396
Black Option Corridor	40	54	308	136	538

The highest PIR value is associated with the Blue West Option Corridor (1,396). This is the Management Option that follows the existing N4 from Node O to Node J at Drumsna. As this option is fully on-line, it includes the highest number of noise sensitive locations within each distance band as is typically associated with an existing national road in proximity to and through an urban setting.

The next highest PIR value is associated with the Cyan Option Corridor (782) which follows an off-line corridor south of Carrick-on-Shannon between Nodes A and D and joins the existing N4 at Lissenghan (Node D) to follow an on-line corridor to Node J. This option corridor passes in proximity to two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 50 to 300m distance bands.

The Orange Option (709) has a marginally lower PIR value compared to the Cyan Option Corridor but has a higher PIR value compared to the Purple and Dark Green Option Corridors. The Orange Option Corridor follows an off-line route south of Carrick-on-Shannon, but commences at Node B, north of the Cyan Option Corridor, as far as Node C. The Orange Option Corridor follows a similar corridor to the Cyan Option Corridor between Nodes C and D with a deviation north of the Cyan Option Corridor west of the River Shannon. Both option corridors follow the same on-line corridor between Nodes D and J. This option corridor also passes in proximity to

two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 50 to 300m distance bands.

In addition to the noise sensitive buildings along each corridor, both the Cyan and Orange Option Corridors cross the River Shannon south of Carrick-on-Shannon along a section of the river that has a high amenity value used for a mixture of outdoor amenities and boat mooring areas. The noise environment would be increased in the vicinity of a new bridge crossing and the surrounding amenity area for both these options.

The Purple West Option Corridor yields the second lowest overall PIR (219) in the western comparative assessment. This option follows an off-line corridor north of Carrick-on-Shannon between Nodes B and J. The corridor passes through more rural areas compared to the southern option corridors with an associated lower density of noise sensitive buildings. This corridor crosses the River Shannon north of Carrick-on-Shannon which will also increase the ambient noise environment at any amenity areas along the River crossing. The presence of specific amenity areas is however, less frequent in this section of the River Shannon compared to those south of Carrick-on-Shannon.

The Dark Green Option Corridor has the lowest overall PIR (205) in the comparative assessment. This option also follows an off-line corridor through rural areas, following the Purple West Option Corridor but instead of turning south it continues further east before re-joining the existing N4 at Node J. This option corridor also crosses the River Shannon north of Carrick-on-Shannon which, as noted above, will also increase the ambient noise environment at any amenity areas along the river crossing.

The Black Option Corridor has an overall PIR of 538. This is a relatively high score for a short option corridor, and is driven by the proximity to the Oaklands residential housing estate to the south. The majority of NSRs that make up the total PIR are located in the outer distance bands of 100 – 200m and 200 – 300m. The number of NSRs in the 0 – 50m and 50 – 100m bands, i.e. the receptors most exposed to traffic noise, are relatively low by comparison to the outer distance bands.

On the basis of the PIR analysis in isolation, in terms of the comparative assessment, the Blue West Option Corridor has the highest potential noise impact due to the number and distribution of noise sensitive properties in proximity to the on-line route and the Dark Green Option Corridor would result in the lowest potential noise impacts.

Stage 1 PIR Assessment of Option Corridors East of Node J at Drumsna Junction

Table 7.5.6.4 summarises the PIR values calculated for the option corridors east of Node J at Drumsna Junction using the weighting values for each distance band discussed above and taking account of existing properties within the 300m band.

Table 7.5.6.4 PIR Assessment Table for Option Corridors East of Drumsna Junction (Node J)

Option Corridor	PIR 0-50m Band	PIR 50-100m Band	PIR 100-200m Band	PIR 200-300m Band	Total PIR
Purple East Option Corridor	60	81	130	29	300
Green Option Corridor	116	81	100	18	315
Yellow Option Corridor	108	81	100	18	307
Blue East Option Corridor	116	81	100	18	315

The resultant PIR values are all broadly similar among the option corridors east of Node J, with the Green Option Corridor and Blue East Option Corridor having a marginally higher value (315) followed by the Yellow Option Corridor (307). These options follow the same on-line corridor with the exception of the section between Nodes G to H where the Yellow Option follows an off-line path west of the existing N4.

The Purple East Option Corridor follows the same on-line corridor as the Green Option Corridor but deviates between Nodes F and G where it follows an off-line corridor to the east of Aghamore. The Purple East Option Corridor has the lowest PIR (300) compared to the other three options in the eastern section due to the lower property counts in the off-line section of this corridor. On this basis the Purple East Option would result in a marginally lower potential noise impact.

Whilst the PIR assessment provides information on the number of noise sensitive properties in the vicinity of each option corridor, the NRA 2004 and TII 2014 Noise Guidelines acknowledge that the PIR process only provides an initial high-level screening for option ranking.

In addition to property counts, other factors which also dictate the potential noise impact from an option corridor relate to its vertical alignment (cuttings, embankments, at grade, tunnels etc.), road traffic flows and potential for noise mitigation.

Stage 1 Assessment of Noise Footprint and Potential Requirement for Noise Mitigation - West of Node J at Drumsna Junction

In general, sections of road alignments in cut have the smallest noise footprint compared to those associated with high embankments. West of Node J at Drumsna Junction, for traffic flows up to 5,000 AADT, noise footprints extend to distances of 60m from the road edge for high embankments and 25 to 30m from the road edge for sections of cut. The section between Node D and Node E was determined to have a marginally larger footprint (70m) due to a higher traffic AADT and an at-grade alignment for the majority.

Table 7.5.6.5 summaries the number of counted properties likely requiring noise mitigation based on the noise 'footprint' for the section west of Node J at Drumsna Junction for the six option corridors.

Table 7.5.6.5 Number of Properties Likely Requiring Noise Mitigation – West of Drumsna Junction (Node J)

Option Corridor	Design Description	Indicative No. of Properties Likely requiring noise mitigation
West of Node J		
Cyan Option Corridor	Cyan Dual Carriageway Design	15
Orange Option Corridor	Orange Dual Carriageway Design	19
Purple West Option Corridor	Purple Dual Carriageway Design	3
Dark Green Option Corridor	Dark Green Dual Carriageway Design	1
Blue West Option Corridor	Blue West Dual Carriageway Design	0
Black Option Corridor	Black Single Carriageway Design	11

For west of Node J at Drumsna Junction, the highest number of properties likely to trigger the requirement for noise mitigation were counted along the Cyan and Orange Option Corridors. The majority of these properties are located between Node C and Node D, within two housing estates north of the option corridor and to the east of the River Shannon. Overall, a marginally higher number of properties were counted along the Orange carriageway.

A low number of properties were counted for the Dark Green (1) and Purple West Options (3) due to the routes passing through rural areas, making these favourable options.

The Blue West (Management) Option is determined to have no properties likely to require mitigation due to the neutral change in noise levels compared to the Do-Minimum scenario.

With respect to the Black Option Corridor, noise mitigation would be required along the northern length of the alignment between Summerhill Road and Leitrim Road as a minimum.

The assessment has concluded therefore that the Cyan, Orange and Black Option Corridors are those likely to generate the greatest noise footprint and require the greatest extent of noise mitigation measures to reduce noise levels to within the TII traffic design goal of 60 dB $L_{den.}$ On this basis, these option corridors are less preferred compared to the Blue West, Purple West, and Dark Green options.

Based on the assessment of the likely requirement for noise mitigation, the Blue West, Purple West and Dark Green options result in the lowest potential noise impacts.

Stage 1 Assessment of Noise Footprint and Potential Requirement for Noise Mitigation - East of Node J at Drumsna Junction

For the section east of Node J at Drumsna Junction, similar footprint distances were calculated to those discussed in the section West of Node J at Drumsna Junction, due to similar traffic flows, particularly between Nodes F and H.

For east of Node J at Drumsna Junction, given three of the options in this section follow an on-line corridor over the majority of their alignments, the noise footprint will be the same as the existing N4. Review of the traffic model outputs confirm no significant change in traffic volumes between the Do-Minimum and Do-Something scenarios along the N4 that would trigger a notable increase in noise levels. The only likely requirement for noise mitigation will therefore be associated with off-line sections, along widened sections of the on-line alignment and/or along parallel roads, new junctions and other ancillary works which have the potential to increase traffic noise levels above 60 dB Lden or the prevailing traffic noise level.

For the eastern section of the assessment study area, the 60 dB L_{den} noise footprint and likely requirement for noise mitigation were determined based on a review of the projected future traffic flows and the vertical alignments.

Table 7.5.6.6 summaries the number of properties likely to trigger the requirement for noise mitigation based on their 'footprint' within the eastern section for the four carriageway design options.

Due to the fact that the options in this section follow the on-line corridor for the majority of their alignments with no notable difference in traffic noise levels between the Do-Something and Do-Minimum scenarios, the likely requirement for mitigation is driven by the proximity of NSRs to new parallel roads or junctions which have the potential to result in increased traffic noise levels above 60 dB L_{den}. The assessment is based on indicative layout plans.

Table 7.5.6.6 Number of Properties Likely Requiring Noise Mitigation – East of Drumsna Junction (Node J)

Option Corridor	Design Description	Indicative No. of Properties Likely requiring noise mitigation
East of Node J		
Purple East Option Corridor	Purple East Dual Carriageway Design	7
Green Option Corridor	Green Dual Carriageway Design	13
Yellow Option Corridor	Yellow Dual Carriageway Design	13
Blue East Option Corridor	Blue East Dual Carriageway Design	0

Within the section east of Node J, the highest number of properties likely to trigger the requirement for noise mitigation were counted along the Yellow and Green

carriageways. These properties are located in proximity to new parallel roads and new junctions.

The Purple East option results in a lower number of properties likely to require noise mitigation compared to the Yellow and Green options. The identified properties are located in proximity to new parallel roads and new junctions.

There are no properties identified along the Blue East carriageway that will likely trigger the requirement for noise mitigation due to the absence of parallel roads or any significant new junctions and the similar or marginally lower volume of traffic compared to the Do Minimum scenario.

On the basis of the above analysis, the Purple East and Blue East Option Corridors result in the lowest potential noise impacts compared to the Yellow and Green Option Corridors.

Stage 1 Assessment of Change in Traffic Noise Level -West of Node J at Drumsna Junction

During the operational phase of the Purple West, Dark Green and Blue West Options, traffic noise levels along the existing N4 are reduced by approximately 1 dB or result in a neutral change. With reference to the Design Manual for Roads and Bridges (DMRB) the predicted change in noise level along the existing N4 is categorised as neutral to negligible.

For the Orange Option, traffic noise levels along the existing N4 between Node A and the N4 – junction with R368 are reduced by up to 3 dB and between the N4 – R368 and Node J are reduced by up to 2 dB. Overall, a negligible change in noise level is calculated along the existing N4 with the Orange Option in place.

For the Cyan Option, traffic noise levels along the existing N4 between Node A and the N4 junction with R368 are reduced by up to 4 dB which is categorised as a minor change. Between the N4 junction with R368 and Node J, traffic noise levels are calculated to reduce by approximately 2 dB, defined as a negligible change.

For the Black Option, traffic noise levels along the existing N4 are predicted to be unchanged with the exception of the section of the existing N4 road east of Carrick-on-Shannon and Node J. Along this section, a negligible increase in noise level is predicted as a result of small changes in traffic flow numbers.

In summary, traffic flow data indicates that whilst all options remove an element of traffic out of Carrick-on-Shannon, there is not expected to be a significant reduction in noise levels associated with the residual traffic passing through the town. The highest reductions are achieved with the off-line option corridors to the south, i.e., Cyan and Orange.

Plate 7.5.6.1 shows the assessment break points along the existing N4 west of Node J for the change in nose levels assessment contained in Table 7.5.6.7.

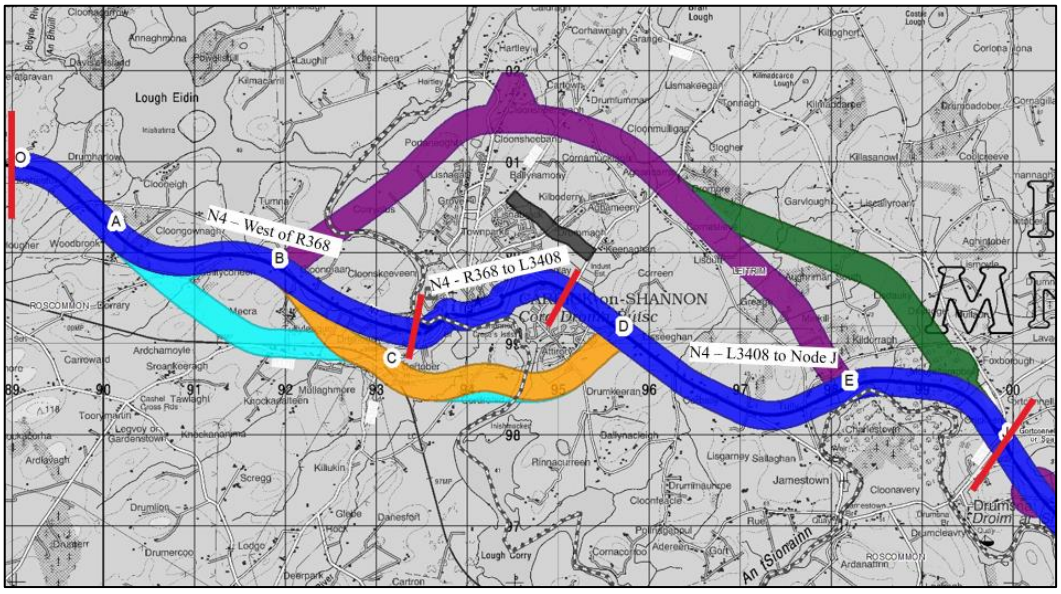

Plate 7.5.6.1 Estimated Change in Noise Levels Assessment Break Points Options West of Node J

Table 7.5.6.7 Estimated Change in Noise Level along Existing N4 West of Drumsna Junction (Node J)

Option Name & Colour	Existing N4 Road Sections West of Node J	Do Minimum AADT (2045)	Do Something AADT (2045)	Change in Noise Level (dB)	DMRB categorisation
West of Drumsna / Node J					
Black Option Corridor	N4 – West of R368	8,676	8,611	+0.0	Negligible
	N4 – R368 to L3408	17,066	16,999	+0.0	Negligible
	N4 – L3408 to Node J	9,878	11,207	+0.5	Negative Negligible
Cyan Option Corridor	N4 – West of R368	8,676	3,424	-4.0	Positive Minor
	N4 – R368 to L3408	17,066	11,926	-1.6	Positive Negligible
	N4 – L3408 to Node J	9,878	12,840	+1.1	Negative Negligible
Orange Option Corridor	N4 – West of R368	8,676	5,170	-2.2	Positive Negligible
	N4 – R368 to L3408	17,066	12,882	-1.2	
	N4 – L3408 to Node J	9,878	11,280	+0.6	Negative Negligible
Purple West Option Corridor	N4 – West of R368	8,676	7,505	-0.6	Positive Negligible
	N4 – R368 to L3408	17,066	13,852	-0.9	
	N4 – L3408 to Node J	9,878	8,031	-0.9	

Option Name & Colour	Existing N4 Road Sections West of Node J	Do Minimum AADT (2045)	Do Something AADT (2045)	Change in Noise Level (dB)	DMRB categorisation
West of Drumsna / Node J					
Dark Green Option Corridor	N4 – West of R368	8,676	7,505	-0.6	Neutral / Positive Negligible
	N4 – R368 to L3408	17,066	13,852	-0.9	
	N4 – L3408 to Node J	9,878	8,031	-0.9	
Blue West Option Corridor	N4 – West of R368	8,676	8,648	0.0	Neutral / Positive Negligible
	N4 – R368 to L3408	17,066	16,962	0.0	
	N4 – L3408 to Node J	9,878	9,180	-0.3	

Stage 1 Assessment of Change in Traffic Noise Level - East of Node J at Drumsna Junction

East of Node J, due to the on-line alignments of the four options, traffic noise levels will remain similar to those in the Do-Minimum scenario, depending on the final alignment design. For the Green, Yellow and Blue East Options, a neutral change in traffic noise levels is expected for the majority of NSRs along the N4 between Nodes J to H. The Purple East Option will result in a reduction in traffic volumes and associated reduction in traffic noise levels along the N4 through Aghamore.

Table 7.5.6.8 Stage 1 Noise and Vibration Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Potential Impact Rating (PIR)	782	709	219	205	1,396		538
No. of properties likely to require noise mitigation	15	19	3	1	0		11
Predicted Change in Noise Level (dB) along existing N4 (DMRB Long-term rating)	Minor Positive to Negative Negligible	Positive Negligible to Negative Negligible	Positive Negligible	Neutral to Positive Negligible	Neutral to Positive Negligible		N/A
Scoring							
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Not Significant** or **Neutral**		**Moderately Negative**
Score / Impact Level	**2**	**2**	**3**	**3**	**4**		**2**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**	**Preferred**		**N/A**

Table 7.5.6.9 Stage 1 Noise and Vibration Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Potential Impact Rating (PIR)	307	315	300	315
No. of properties likely to require noise mitigation	13	13	7	0
Predicted Change in Noise Level (dB) along existing N4 (DMRB Long-term rating)	Neutral	Neutral	Neutral to Positive Negligible	Neutral
Scoring				
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Not Significant** or **Neutral**
Score / Impact Level	**3**	**3**	**3**	**4**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**

7.5.6.5 Summary

Summary Assessment of Option Corridors West of Node J at Drumsna Junction

Taking account of the assessments set out above, the PIR, the likelihood of required mitigation and associated qualitative assessment for each option corridor within the western section of the study area are summarised in Table 7.5.6.8. With reference to Table 7.5.6.2 the predicted change in noise level associated with each option corridor has been categorised. For example, a minor change in noise level is defined as being a 3 – 4.9 dB change. The change is denoted as positive where a reduction in noise level is predicted and negative in the of a predicted increase in noise level. Taking account of the assessment criteria, the Cyan and Orange Option Corridors are determined to have a moderately negative impact. This is due to the number of properties likely requiring noise mitigation and the PIR values being notably higher compared to the Purple West and Dark Green Option Corridors. Both the Cyan and Orange Option Corridors are also more likely to impact highly sensitive amenity areas along the River Shannon at the river crossing compared to the Purple West Option Corridor. It is noted both the Cyan and Orange Option Corridors provide a marginally greater benefit in terms of traffic noise reduction to noise sensitive properties along the existing N4 through Carrick-on-Shannon.

The Purple West Option Corridor has been determined to have a minor or slightly negative impact due to its low PIR and low number of properties likely to require noise mitigation compared to the Cyan and Orange Option Corridors. Whilst this option will affect a small number of properties along its alignment, it results in a negligible change in noise levels to noise sensitive properties along the existing N4 through Carrick-on-Shannon. This option is preferred alongside the Dark Green and Blue West Option Corridors.

The Dark Green Option Corridor has also been determined to have a minor or slightly negative impact due to its low PIR and low number of properties likely to require noise mitigation compared to the Cyan and Orange Option Corridors. Whilst this option will affect a small number of properties along its alignment, it results in a negligible change in noise levels to noise sensitive properties along the existing N4 through Carrick-on-Shannon. This option is preferred alongside the Purple West and Blue West options.

The Blue West Option Corridor has been determined to have a not significant/neutral impact due to its on-line alignment, whereby properties close to the existing N4 will likely not experience an increase in noise levels due to reduced residual traffic flows, in particular in the town of Carrick-on-Shannon. Therefore, the Blue West Option is Preferred alongside the Purple West and Dark Green options.

On the basis of the above, the Blue West, Dark Green, Purple West Option Corridors are preferred over the Cyan and Orange Option Corridors. Both the Cyan and Orange Option Corridors are ranked as Intermediate on the basis that whilst they have higher potential noise impacts, the impacts could be controlled through further detailed design and noise mitigation at focused locations along the carriageways.

The Black Option Corridor has been determined to have a moderately negative impact. While traffic flow numbers are relatively low, the connector road introduces traffic closer to noise sensitive locations than the existing condition. Once operational, small amounts of traffic will make use of this option resulting in no change and a negligible increase in traffic noise levels on the existing N4 alignment.

Summary Assessment of Option Corridors East of Node J at Drumsna Junction

Taking account of the assessments set out above, the PIR, likelihood of required mitigation and associated qualitative assessment for each option corridor within the eastern section of the study area are summarised in Table 7.5.6.9.

With reference to Table 7.5.6.2 the predicted change in noise level associated with each option corridor has been categorised. For example, a minor change in noise level is defined as being a 3 – 4.9 dB change. The change is denoted as positive where a reduction in noise level is predicted and negative in the case of a predicted increase in noise level.

Taking account of the assessment criteria, the Purple East, Green and Yellow Option Corridors are determined to result in a minor or slightly negative effect. The Blue Option Corridor is determined to result in a not significant or neutral effect.

The Green and Yellow Option Corridors score similarly in terms of PIR and number of properties likely requiring noise mitigation and are ranked Intermediate. This relates to the potential for new impacts at properties adjacent to new junctions or parallel roads. Given the early stage of this assessment, however, these impacts may be further reduced at more detail assessment stages.

The Purple East Option Corridor has the lowest PIR and second lowest number of properties likely requiring noise mitigation. The marginally lower number of affected properties associated with new junction or parallel road layouts coupled with the likely reduction in traffic noise levels along the N4 through Aghamore ranks this route preferred over the Green and Yellow Option Corridors.

The Blue East Option Corridor has no properties likely to require mitigation compared to the other options since the option remains on-line throughout, however traffic flow data indicate that there will be a not significant/neutral impact as noise levels are likely not to increase. Due to its neutral to not significant score, the Blue East Option is therefore preferred alongside the Purple East Option.

7.5.7 Stage 1 Archaeological, Architectural and Cultural Heritage Option Assessment

7.5.7.1 Introduction

This section details the Archaeological, Architectural and Cultural Heritage assessment of the options with respect to the Archaeology, Architectural and Cultural Heritage constraints identified in Section 4.10 Archaeology, Architectural and Cultural Heritage of this report.

The Archaeological, Architectural and Cultural Heritage constraints are presented with the Stage 1 Option Corridors in Figures 7.5.7.1.0 to 7.5.7.1.5. The sites are referenced as per the Leitrim County Development 2015-2021, noting that the Draft Leitrim County Development Plan 2023-2029 will come into effect on 21 March 2023. The proposed additions and deletions to the protected structures listed in the new Plan have been reviewed and this assessment of the Stage 1 Option Corridors remains unchanged.

Section 7.5.7.2 details the methodology that was used to carry out the study and Section 7.5.7.3 outlines the assessment criteria which were used. The Stage 1 Assessment and summary are presented in Section 7.5.7.4.

7.5.7.2 Methodology

For the option corridor assessment, the overall project has been split into two sections, i.e. West of Drumsna Junction (Node J) and East of Drumsna Junction (Node J) and the option corridors assessed are those described in Section 7.1.2.

There are two zones associated with each option corridor referred to in this assessment:

- The potential road "footprint", in this case a 100m wide corridor around the centreline of the potential landtake required to construct or improve the road
- The road "corridor", in this case a 250m buffer either side of the "footprint". The "footprint" sits inside the "corridor"

The Stage 1 Option Corridor Assessment has been carried out with reference to the TII Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes[38] and Assessment of Architectural Heritage Impacts of National Road Schemes[39], although it should be noted that the guidelines themselves predate the establishment of a preliminary options assessment process.

[38] Transport Infrastructure Ireland, 2005. Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Assessment-of-Archaeological-Heritage-Impact-of-National-Road-Schemes.pdf

[39] Transport Infrastructure Ireland, 2005. Guidelines for the Assessment Architectural Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Assessment_of_Architectural_Heritage_Impact_of_National_Road_Schemes.pdf

Within each option corridor, the methodology addressed a 250m buffer either side of a 100m wide corridor around a centreline of a potential road footprint. This enables a meaningful assessment of potential negative direct and indirect impacts upon the archaeological, architectural and cultural heritage resource, whilst allowing for either single or dual-carriageway options.

A direct impact occurs where an asset is within the 100m wide potential road footprint of an option corridor. An indirect impact may occur where the asset is within the 250m wide buffer zone of an option corridor.

Measurements are taken from the edge of the 100m wide potential road footprint to the upstanding remains of a site or structure, or to the edges of features/monuments seen through aerial photography. Where there are no upstanding remains, the measurement is taken from the edge of the potential road footprint to the centre of the site. These measurements are noted as "Distance from Option" in the assessment tables herein.

The area of greenfield land within each potential road footprint and corridor has been calculated to assist in the assessment of the likelihood of impacts to previously unrecorded archaeological remains.

Potential impacts on key constraints have been assessed, including recorded monuments, protected structures, NIAH structures and designed landscapes.

Assessment Criteria

The TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi Criteria Analysis[2] (hereafter referred to as the TII PAG) was used as a basis for the assessment of potential impacts on the archaeological, architectural and cultural heritage resource. Impacts were assessed on a scale of 1 – 7 as listed in Table 7.3.1 of this report.

The assessment was informed by the Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[29]. Specifically, the significance of effects, as detailed in Table 3.3 of that document, have been aligned with those impacts described above as follows:

Table 7.5.7.1 Alignment of TII and EPA Impact Guidelines

TII Guidelines	EPA Guidelines
Not Significant or Neutral	Imperceptible
	Not Significant
Minor or Slightly Negative	Slight
Moderately Negative	Moderate
	Significant
Major or Highly Negative	Very Significant
	Profound

Due to the more condensed nature of the TII scale of negative impacts in comparison with that provided by the EPA, i.e., TII scale has four levels, EPA scale has seven levels, the impact assessment remains high level at this stage.

7.5.7.3 Stage 1 Archaeological, Architectural and Cultural Heritage Option Corridor Assessment

Table 7.5.7.2 to Table 7.5.7.7 detail the potential impacts of each option corridor west of Drumsna Junction (Node J) on the known archaeological, architectural and cultural heritage resources. A summary of the impacts across each corridor is then presented in Table 7.5.7.8 together with an average impact score and ranking of each option from Preferred to Intermediate to Least Preferred.

Table 7.5.7.2 Cyan Option Corridor Assessment

Site Ref.	Name	Does it have Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH1	Barrow - ring-barrow	Proposed RMP	189m WNW	Indirect	Slight
AH2	Fulacht fia	None (excavated)	c. 24m NW	Neutral	N/A
AH3	Burnt mound	None (excavated)	c. 4m SW	Neutral	N/A
AH4	Excavation-miscellaneous (poss corn-drying kiln)	Proposed RMP	0m	Neutral	N/A
AH5	Excavation-miscellaneous (Pit with charred material)	Proposed RMP	0m	Neutral	N/A
AH5	Excavation-miscellaneous	None (excavated)	0m	Neutral	N/A
AH6	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH7	Excavation-miscellaneous	None (excavated)	c. 35m NE	Neutral	N/A
AH8	Excavation-miscellaneous	None (excavated)	c. 61m NE	Neutral	N/A
AH8	Burnt mound	None (excavated)	c. 22m NE	Neutral	N/A
AH9	Redundant record	None (excavated)	c. 109m NE	Neutral	N/A
AH10	House-prehistoric	None (excavated)	c. 33m NE	Neutral	N/A
AH10	Hut site	None (excavated)	c. 76m NE	Neutral	N/A

Site Ref.	Name	Does it have Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH10	Ringfort-rath	Proposed RMP	c. 90m NE	Neutral	N/A
AH10	Enclosure	Proposed RMP	c. 86m NE	Neutral	N/A
AH10	Fulacht fia	None (excavated)	c. 76m NE	Neutral	N/A
AH10	Burnt mound	None (excavated)	c. 132m NE	Neutral	N/A
AH10	Burnt mound	Proposed RMP	c. 116m NW	Indirect	Imperceptible Negative
AH10	Burnt mound	Proposed RMP	c. 114m NW	Indirect	Imperceptible Negative
AH15	Burnt mound	Proposed RMP	0m	Direct	Very Significant Negative
AH14	Ringfort-rath	RMP	c. 50m S	Indirect	Moderate Negative
AH20	Ringfort-rath	Proposed RMP	c. 220m ESE	Indirect	Slight Negative
AH13	Ringfort-rath	RMP	c. 77m NE	Indirect	Slight Negative
AH12	Redundant record	None (SMR)	c. 91m SW	Neutral	N/A
AH16	Redundant record	None (SMR)	c. 112m SW	Neutral	N/A
AH17	Redundant record	None (SMR)	c. 139m NE	Neutral	N/A
AH33	Ringfort-rath	RMP	c. 155m SSW	Indirect	Imperceptible Negative
AH36	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
BH2	Railway Storehouse / warehouse	RPS	0m	Direct	Very Significant Negative
BH2	Railway Goods shed	RPS	0m	Direct	Very Significant Negative
BH2	Water tower	None	0m	Direct	Very Significant Negative

Site Ref.	Name	Does it have Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH2	Signal box	RPS	0m	Direct	Very Significant Negative
BH2	Waiting Room	RPS	0m	Direct	Very Significant Negative
BH2	Carrick-on-Shannon Railway station	RPS	0m	Direct	Very Significant Negative
BH2	Footbridge	RPS	0m	Direct	Very Significant Negative
AH66	Ringfort-rath	Proposed RMP	c. 19m N	Indirect	Moderately Negative
AH67	Ringfort-rath	Proposed RMP	c. 105m N	Indirect	Slight Negative
AH68	Ringfort-rath	Proposed RMP	c. 121m N	Indirect	Slight Negative
AH65	Ringfort-rath	RMP	c. 200m N	Neutral	N/A
AH142	Bullaun stone	None (SMR)	c. 130m NW	Indirect	Slight Negative
AH142	Burial Ground	RMP	c. 110m NW	Indirect	Slight Negative
AH142	Ecclesiastical enclosure	Proposed RMP	c. 105m NW	Indirect	Slight Negative
AH142	Church	Proposed RMP	c. 110m NW	Indirect	Slight Negative
AH143	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH144	Ringfort-rath	RMP	c. 217m SW	Indirect	Imperceptible Negative
AH123	Ringfort-rath	RMP	c. 135m NE	Indirect	Imperceptible Negative
AH124	Ringfort-rath	RMP	c. 225m NE	Indirect	Imperceptible Negative
AH151	Fulacht fia	None (SMR)	0m	Neutral	N/A
AH129	Ringfort-rath	RMP	c.216m N	Indirect	Imperceptible Negative
AH132	Enclosure	RMP	c. 135m NNW	Indirect	Slight Negative

Site Ref.	Name	Does it have Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH150	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH139	Redundant record	None (SMR)	c. 201m N	Neutral	N/A
AH152	Mound	Proposed RMP	0m	Direct	Profound Negative
AH133	Crannog	RMP	c. 123m SSE	Indirect	Slight
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A
DL5	Charlestown House demesne	None	c. 92m S	Neutral	N/A
AH156	Ringfort-rath	RMP	c.226m S	Indirect	Imperceptible Negative
AH154	Hut site & Fulacht fia	None (excavated)	0m	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Slight Negative
AH266	Ringfort-rath	Proposed RMP	c.140m N	Indirect	Imperceptible Negative
AH267	Ringfort-rath	Proposed RMP	c. 20m ENE	Indirect	Significant Negative
DL7	Belmont	None	0m	Direct	Slight Negative
AH270	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH269	Ringfort-rath	RMP	c. 61m SW	Indirect	Slight Negative
AH271	Ringfort-rath	RMP	c. 132m NE	Indirect	Imperceptible Negative
BH8	Drumsna National School	None	c. 24m NE	Indirect	Moderate Negative

Table 7.5.7.3 Orange Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH20	Ringfort-rath	Proposed RMP	c. 22m W	Indirect	Imperceptible Negative
AH18	Ringfort-rath	Proposed RMP	c. 223m SW	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH19	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH22	Ringfort-rath	RMP	c. 94m NE	Indirect	Slight Negative
AH23	Ringfort-rath and hut site	Proposed RMP	c.192m NE	Indirect	Imperceptible Negative
AH36	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
BH2	Railway Storehouse / warehouse	RPS	0m	Direct	Very Significant Negative
BH2	Railway Goods shed	RPS	0m	Direct	Very Significant Negative
BH2	Water tower	None (NIAH)	0m	Direct	Very Significant Negative
BH2	Signal box	RPS	0m	Direct	Very Significant Negative
BH2	Waiting Room	RPS	0m	Direct	Very Significant Negative
BH2	Carrick-on-Shannon Railway station	RPS	0m	Direct	Very Significant Negative
BH2	Footbridge	RPS	0m	Direct	Very Significant Negative
AH66	Ringfort-rath	Proposed RMP	c. 19m N	Indirect	Significant Negative
AH67	Ringfort-rath	Proposed RMP	c. 105m N	Indirect	Slight Negative
AH68	Ringfort-rath	Proposed RMP	c. 100m NNW	Indirect	Slight Negative
AH65	Ringfort-rath	RMP	c. 98m N	Indirect	Imperceptible Negative
AH142	Bullaun stone	None (SMR)	c. 130m NW	Indirect	Slight Negative
AH142	Burial Ground	RMP	c. 110m NW	Indirect	Slight Negative
AH142	Ecclesiastical enclosure	Proposed RMP	c. 105m NW	Indirect	Slight Negative
AH142	Church	Proposed RMP	c. 110m NW	Indirect	Slight Negative
AH143	Ringfort-rath	RMP	0m	Direct	Very Significant negative
AH144	Ringfort-rath	RMP	c. 217m SW	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH123	Ringfort-rath	RMP	c. 135m NE	Indirect	Slight Negative
AH124	Ringfort-rath	RMP	c. 225m NE	Indirect	Imperceptible Negative
AH151	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH129	Ringfort-rath	RMP	c. 216m N	Indirect	Imperceptible Negative
AH132	Enclosure	RMP	c. 135m NNW	Indirect	Slight Negative
AH150	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH139	Redundant record	None (SMR)	c. 201m N	Neutral	N/A
AH152	Mound	Proposed RMP	0m	Direct	Profound Negative
AH133	Crannog	RMP	c. 123m SSE	Indirect	Slight Negative
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A
DL5	Charlestown House demesne	None	c. 92m S	Neutral	N/A
AH156	Ringfort-rath	RMP	c. 226m S	Indirect	Imperceptible Negative
AH154	Hut site and Fulacht fia	None (excavated)	0m	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Slight Negative
AH266	Ringfort-rath	RMP	c. 140m N	Indirect	Imperceptible Negative
AH267	Ringfort-rath	Proposed RMP	c. 20m ENE	Indirect	Significant Negative
DL7	Belmont	None	0m	Direct	Slight Negative
AH270	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH269	Ringfort-rath	RMP	c. 61m SW	Indirect	Slight Negative
AH271	Ringfort-rath	RMP	c. 132m NE	Indirect	Imperceptible Negative
BH8	Drumsna National School	None (NIAH)	c. 24m NE	Indirect	Moderately Negative

Table 7.5.7.4 Purple West Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH18	Ringfort-rath	Proposed RMP	c. 210m SW	Indirect	Imperceptible Negative
AH20	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
AH19	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH22	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH21	Ringfort-rath	RMP	c. 101m NW	Indirect	Slight Negative
AH23	Ringfort-rath and hut site	Proposed RMP	c. 98m SE	Indirect	Slight Negative
AH308	Ringfort-rath	RMP	c. 64m NW	Indirect	Slight Negative
AH73	Ringfort-rath	RMP	c. 176m SE	Indirect	Imperceptible Negative
AH74	Ringfort-rath	RMP	c. 239m SE	Indirect	Imperceptible Negative
DL14	Hartley House demesne	None	0m	Direct	Moderately Negative
BH5	House	None	c. 142m SSW	Indirect	Imperceptible Negative
AH85	Ringfort-rath	Proposed RMP	c. 221m SE	Indirect	Imperceptible Negative
AH75	Ringfort-rath	RMP	c. 134m NNW	Indirect	Imperceptible Negative
AH76	Ringfort-rath	RMP	c. 220m NE	Indirect	Imperceptible Negative
AH83	Megalithic structure	RMP	c. 61m W	Indirect	Slight Negative
AH80	Ringfort-rath	RMP	c. 63m S	Indirect	Slight Negative
AH81	Ringfort-rath	RMP	c. 56m S	Indirect	Moderately Negative
DL15	Drumlumman	None	0m	Direct	Slight Negative
AH86	Ringfort-rath	RMP	c. 206m E	Indirect	Imperceptible Negative
AH96	Ringfort-rath	RMP	c. 84m NE	Indirect	Slight Negative
AH96	Enclosure	Proposed RMP	c. 90m NE	Indirect	Slight Negative
AH99	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
DL3	Castlecarra	None	c. 27m SW	Indirect	Slight Negative
AH98	Castle - unclassified	Proposed RMP	c. 186m SW	Indirect	Imperceptible Negative
AH101	Ringfort-rath	Proposed RMP	c. 99m NE	Indirect	Slight Negative
AH110	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH111	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH112	Ringfort-rath	RMP	c. 6m SW	Indirect	Significant Negative
AH116	Ringfort-rath	RMP	c. 44m N	Indirect	Slight Negative
AH115	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
AH115	Church	Proposed RMP	0m	Direct	Profound Negative
AH119	Enclosure	Proposed RMP	c. 46m SW	Indirect	Slight Negative
AH118	Ringfort-rath	RMP	c. 177m NE	Indirect	Imperceptible Negative
AH127	Ringfort-rath	RMP	c. 70m NE	Indirect	Moderately Negative
AH125	Ringfort-rath	RMP	c. 188m SW	Indirect	Imperceptible Negative
AH126	Ringfort-rath	RMP	c. 117m SW	Indirect	Slight Negative
AH135	Ringfort-rath	RMP	c. 224m NE	Indirect	Imperceptible Negative
AH134	Ringfort-rath	RMP	c. 122m NE	Indirect	Imperceptible Negative
AH131	Ringfort-rath	RMP	c. 111m SW	Indirect	Slight Negative
AH139	Redundant record	None (SMR)	c. 108m W	Neutral	N/A
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A
AH150	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH152	Mound	Proposed RMP	0m	Direct	Profound Negative
AH133	Crannog	RMP	c. 123m SSE	Indirect	Slight Negative
DL5	Charlestown House demesne	None	c. 92m S	Neutral	N/A
AH156	Ringfort-rath	RMP	c. 245m S	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH154	Hut site and Fulacht fia	None (excavated)	0m	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Slight Negative
AH266	Ringfort-rath	RMP	c. 140m N	Indirect	Imperceptible Negative
AH267	Ringfort-rath	Proposed RMP	c. 20m ENE	Indirect	Significant Negative
DL7	Belmont	None	0m	Direct	Slight Negative
AH270	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH269	Ringfort-rath	RMP	c. 61m SW	Indirect	Moderately Negative
AH271	Ringfort-rath	RMP	c. 132m NE	Indirect	Imperceptible Negative
BH8	Drumsna National School	None (NIAH)	c. 24m NE	Indirect	Moderately Negative

Table 7.5.7.5 Dark Green Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH18	Ringfort-rath	Proposed RMP	c. 210m SW	Indirect	Imperceptible Negative
AH20	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
AH19	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH22	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH21	Ringfort-rath	RMP	c. 101m NW	Indirect	Slight Negative
AH23	Ringfort-rath and hut site	Proposed RMP	c. 98m SE	Indirect	Slight Negative
AH308	Ringfort-rath	RMP	c. 64m NW	Indirect	Slight Negative
DL14	Hartley House demesne	None	0m	Direct	Moderately Negative
BH5	House	None (NIAH)	c. 142m SSW	Indirect	Imperceptible Negative
AH75	Ringfort-rath	RMP	c. 134m NNW	Indirect	Imperceptible Negative
AH76	Ringfort-rath	RMP	c. 220m NE	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH85	Ringfort-rath	RMP	c. 239m S	Indirect	Imperceptible Negative
AH84	Ringfort-rath	RMP	c. 213m W	Indirect	Imperceptible Negative
AH83	Megalithic structure	RMP	c. 37m NW	Indirect	Moderately Negative
AH80	Ringfort-rath	RMP	c. 33m S	Indirect	Moderately Negative
AH81	Ringfort-rath	RMP	c. 69m S	Indirect	Slight Negative
DL15	Drumlumman	None	c. 191m NE	Neutral	N/A
AH96	Ringfort-rath	RMP	c. 74m NE	Indirect	Slight Negative
AH96	Enclosure	Proposed RMP	c. 80m NE	Indirect	Slight Negative
AH99	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
DL3	Castlecarra	None	c. 27m SW	Indirect	Slight Negative
AH98	Castle - unclassified	Proposed RMP	c. 186m SW	Indirect	Imperceptible Negative
AH101	Ringfort-rath	Proposed RMP	c. 66m NE	Indirect	Moderately Negative
AH110	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH111	Ringfort-rath	RMP	c. 83m SSW	Indirect	Slight Negative
AH116	Ringfort-rath	RMP	c. 38m SW	Indirect	Moderately Negative
AH118	Ringfort-rath	RMP	c. 198m SSW	Indirect	Imperceptible Negative
AH117	Ringfort-rath	RMP	c. 54m NNE	Indirect	Slight Negative
AH137	Ringfort-rath	RMP	c. 217m SE	Indirect	Imperceptible Negative
AH261	Ringfort-rath	RMP	c. 105m NE	Indirect	Slight Negative
DL6	Mountcampbell House demesne	None	0m	Direct	Significant Negative
AH266	Ringfort-rath	RMP	c. 73m SW	Indirect	Slight Negative
AH154	Hut site and fulacht fia	None (SMR)	c. 164m W	Neutral	N/A
DL5	Charlestown House demesne	None	c. 204m SSW	Neutral	N/A
AH267	Ringfort-rath	Proposed RMP	c. 20m ENE	Indirect	Significant Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
DL7	Belmont	None	0m	Direct	Slight Negative
AH270	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH269	Ringfort-rath	RMP	c. 61m SW	Indirect	Moderately Negative
AH271	Ringfort-rath	RMP	c. 132m NE	Indirect	Imperceptible Negative
BH8	Drumsna National School	None (NIAH)	c. 24m NE	Indirect	Moderately Negative

Table 7.5.7.6 Blue West Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH1	Woodbrook House	RPS	c. 177m N	Indirect	Slight Negative
DL1	Woodbrook House	Principal structure in RPS	0m	Direct	Moderately Negative
AH1	Barrow - ring-barrow	Proposed RMP	74m SW	Indirect	Slight Negative
AH2	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH3	Burnt mound	None (excavated)	c. 4m SW	Neutral	N/A
AH4	Excavation-miscellaneous (poss corn-drying kiln)	Proposed RMP	0m	Neutral	N/A
AH5	Excavation-miscellaneous (Pit with charred material)	Proposed RMP	c. 9m SW	Neutral	N/A
AH5	Excavation-miscellaneous	None (excavated)	0m	Neutral	N/A
AH6	Ringfort-rath	RMP	c. 36m SW	Indirect	Slight Negative
AH7	Excavation-miscellaneous	None (excavated)	0m	Neutral	N/A
AH8	Excavation-miscellaneous	None (excavated)	0m	Neutral	N/A
AH8	Burnt mound	None (excavated)	0m	Neutral	N/A
AH9	Redundant record	None (excavated)	c. 22m NE	Neutral	N/A
AH10	House-prehistoric	None (excavated)	0m	Neutral	N/A
AH10	Hut site	None (excavated)	0m	Neutral	N/A

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH10	Ringfort-rath	Proposed RMP	0m	Neutral	N/A
AH10	Enclosure	Proposed RMP	0m	Neutral	N/A
AH10	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH10	Burnt mound	None (excavated)	0m	Neutral	N/A
AH10	Burnt mound	Proposed RMP	0m	Direct	Significant Negative
AH10	Burnt mound	Proposed RMP	0m	Direct	Significant Negative
AH13	Ringfort-rath	RMP	c. 200m S	Indirect	Imperceptible Negative
AH15	Burnt mound	Proposed RMP	0m	Direct	Significant Negative
AH14	Ringfort-rath	RMP	c. 50m S	Indirect	Moderately Negative
AH18	Ringfort-rath	Proposed RMP	c. 210m SW	Indirect	Imperceptible Negative
AH20	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
AH19	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH22	Ringfort-rath	RMP	c. 95m NE	Indirect	Slight Negative
AH23	Ringfort-rath and hut site	Proposed RMP	c. 179m NE	Indirect	Imperceptible Negative
AH24	Ringfort-rath	RMP	c. 195m NE	Indirect	Imperceptible Negative
AH27	Ringfort-rath	RMP	c. 158m NE	Indirect	Imperceptible Negative
BH3	Group of houses	RPS	c. 69-188m SSW	Indirect	Imperceptible Negative
AH63	House - 17th century	Proposed RMP	0m	Direct	Profound Negative
BH4	Hollywell House	RPS	c. 51m SW	Indirect	Moderately
BH4	Post Box, Limestone steps, Carrick-on-Shannon Bridge	RPS RPS Proposed RMP	0m	Direct	Very Significant Negative (on-line through town)
AH64	Historic Town (Carrick on Shannon)	RMP	0m	Direct	Significant Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH4	Governor House Leitrim County Council (Gaol) The Lodge Old Court House Hatley Manor College	RPS RPS RPS RPS RPS None	c. 146-186m NW	Indirect	Slight Negative
BH4	Hoist, Quayside	RPS	0m	Direct	Very Significant
BH4	Old Barrel Store / Carrick-on-Shannon Tourist Information	RPS	0m	Direct	Negative
BH4	Remains of Tower	RPS	0m	Direct	Very Significant
BH4	Old Quay Walls, Quayside	RPS	c. 10m NW	Indirect	Significant Negative
BH4	Glasshouse, Hatley Manor	RPS	c. 225m NW	Indirect	Imperceptible Negative
BH4	Stable Folly, Hatley Manor	RPS	c. 185m NW	Indirect	Imperceptible Negative
BH4	Terrace House	RPS	c. 148m NW	Indirect	Imperceptible Negative
BH4	Carrick-on-Shannon Lawn Tennis Club (gates / railings / walls)	None (NIAH)	c. 131m NW	Indirect	Imperceptible Negative
BH4	National Irish Bank	RPS	c. 117m NNW	Indirect	Imperceptible Negative
BH4	Victoria Parochial Hall	None (NIAH)	c. 56m NNW	Indirect	Imperceptible Negative
BH4	Carrick-on-Shannon Post Office	RPS	c. 158m NNW	Indirect	Imperceptible Negative
BH4	Market Yard & Buildings	RPS	c. 116m N	Indirect	Imperceptible Negative
BH4	McCann Memorial Clock	RPS	c. 163m N	Indirect	Imperceptible Negative
BH4	Milestone / milepost	None (NIAH)	c. 150m N	Indirect	Imperceptible Negative
BH4	Armstrong (house)	None (NIAH)	c. 154m N	Indirect	Imperceptible Negative
BH4	Costello Memorial Chapel	RPS	c. 163m N	Indirect	Imperceptible Negative
BH4	Dunne's (house)	None (NIAH)	c. 193m N	Indirect	Imperceptible Negative
BH4	P. Flynn & Co. end of terrace six bay three storey public house	RPS	c. 168m N	Indirect	Imperceptible Negative
BH4	Town Hall	RPS	c. 41m N	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH4	Teagasc	RPS	c. 40m N	Indirect	Slight Negative
BH4	Frances Fashions (house)	None (NIAH)	c. 61m N	Indirect	Slight Negative
BH4	Campbell's Londis Supermarket	None (NIAH)	c. 27m N	Indirect	Slight Negative
BH4	Allied Irish Bank	None (NIAH)	c. 208m N	Indirect	Imperceptible Negative
BH4	Reynold's Butchers / Moonstone Jewellers end of terrace 4 bay, 2 storey house	RPS	c. 203m N	Indirect	Imperceptible Negative
BH4	End of terrace three bay two storey former presbytery	RPS	c. 230m N	Indirect	Imperceptible Negative
BH4	James McGuire end of terrace three bay two storey former presbytery	RPS	c. 245m N	Indirect	Imperceptible Negative
BH4	Raval, end of terrace three bay two storey house	RPS	c. 242m N	Indirect	Imperceptible Negative
BH4	Carrick-on-Shannon Court House	RPS	c. 76m N	Indirect	Slight Negative
DL16	Shannon Lodge	None	0m	Neutral	N/A
BH4	Carrick-on-Shannon Rectory	None (NIAH)	c. 76m NW	Indirect	Slight Negative
AH72	Ringfort - unclassified	RMP	c. 128m NW	Indirect	Imperceptible
AH143	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH144	Ringfort-rath	RMP	c. 217m SW	Indirect	Imperceptible Negative
AH123	Ringfort-rath	RMP	c. 135m NE	Indirect	Imperceptible Negative
AH124	Ringfort-rath	RMP	c. 225m NE	Indirect	Imperceptible Negative
AH151	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH129	Ringfort-rath	RMP	c. 216m N	Indirect	Imperceptible Negative
AH132	Enclosure	RMP	c. 135m NNW	Indirect	Slight Negative
AH150	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH139	Redundant record	None (SMR)	c. 201m N	Neutral	N/A

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH152	Mound	Proposed RMP	0m	Direct	Profound Negative
AH133	Crannog	RMP	c. 123m SSE	Indirect	Slight Negative
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A
DL5	Charlestown House demesne	None	c. 92m S	Neutral	N/A
AH156	Ringfort-rath	RMP	c. 226m S	Indirect	Imperceptible Negative
AH154	Hut site and Fulacht fia	None (SMR)	0m	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Slight Negative
AH266	Ringfort-rath	RMP	c. 140m N	Indirect	Imperceptible Negative
AH267	Ringfort-rath	Proposed RMP	c. 20m ENE	Indirect	Significant Negative
DL7	Belmont	None	0m	Direct	Slight Negative
AH270	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH269	Ringfort-rath	RMP	c. 61m SW	Indirect	Moderately Negative
AH271	Ringfort-rath	RMP	c. 132m NE	Indirect	Imperceptible Negative
BH8	Drumsna National School	None (NIAH)	c. 24m NE	Indirect	Moderately Negative

Table 7.5.7.7 Black Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH82	Ringfort	RMP	143m NNW	Indirect	Imperceptible

Table 7.5.7.8 Stage 1 Archaeological, Architectural and Cultural Heritage Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Impacts to number of sites subject to statutory protection	Major Negative: 12 Moderate Negative: 2 Minor Negative: 5 Not Significant: 8	Major Negative: 9 Moderate Negative: 2 Minor Negative: 6 Not Significant: 10	Major Negative: 1 Moderate Negative: 8 Minor Negative: 9 Not Significant: 12	Major Negative: 2 Moderate Negative: 6 Minor Negative: 8 Not Significant: 7	Major Negative: 10 Moderate Negative: 7 Minor Negative: 16 Not Significant: 30		Major Negative: 0 Moderate Negative: 0 Minor Negative: 0 Not Significant: 1
Impacts to number of sites not subject to statutory protection	Major Negative: 2 Moderate Negative: 3 Minor Negative: 9 Not Significant: 27	Major Negative: 1 Moderate Negative: 3 Minor Negative: 7 Not Significant: 9	Major Negative: 5 Moderate Negative: 3 Minor Negative: 8 Not Significant: 10	Major Negative: 2 Moderate Negative: 5 Minor Negative: 4 Not Significant: 6	Major Negative: 1 Moderate Negative: 4 Minor Negative: 5 Not Significant: 24		Major Negative: 0 Moderate Negative: 0 Minor Negative: 0 Not Significant: 0
Scoring							
Overall Qualitative Assessment	Major impacts to a range of heritage assets including archaeological and built heritage sites. Potential impact to previously unrecorded archaeological remains within greenfield areas. **Major** or **Highly Negative**	Major impacts to a range of heritage assets including archaeological and built heritage sites. Potential impact to previously unrecorded archaeological remains within greenfield areas. **Major** or **Highly Negative**	Moderate impacts to a range of heritage assets including archaeological and built heritage sites. Potential impact to previously unrecorded archaeological remains within greenfield areas. **Moderately Negative**	Moderate impacts to a range of heritage assets including archaeological and built heritage sites. Potential impact to previously unrecorded archaeological remains within greenfield areas. **Moderately Negative**	Major and Moderate impacts to a range of heritage assets including archaeological and built heritage sites. This is an on-line upgrade and as such requires the least greenfield area and it is likely that a modified footprint through the town of Carrick-on-Shannon could be utilised. **Major** or **Highly Negative**		No Major impacts to any statutorily protected heritage assets or to those not subject to protection at this time. Potential impact to previously unrecorded archaeological remains within greenfield areas. **Not Significant** or **Neutral**

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Score / Impact Level	1	1	2	2	1		4
Preference - Professional Judgement	Least Preferred	Least Preferred	Preferred	Preferred	Intermediate		N/A

The Purple West Option and Dark Green Option Corridors are the Preferred options West of Drumsna Junction (Node J) due to the least number of major impacts to statutorily protected heritage assets and sites that have been identified as being of archaeological or built heritage merit, which are not subject to statutory protection.

The Cyan Option and Orange Option Corridors are considered to represent the Least Preferred options. This is due to the high amount of direct negative major impacts on archaeological and built heritage sites that are subject to statutory protection, as well as a number of sites that are of archaeological and built heritage merit, which are not protected.

The Blue West Option is also ranked as having potential major negative impacts on recorded archaeological and built heritage sites. However, this option represents an on-line upgrade through Carrick-on-Shannon Town and as such is highly unlikely to require a footprint of 100m in width. In addition, this option requires the least amount of previously undisturbed greenfield due to it representing an on-line upgrade of the existing road. As such, this option is considered to be of Intermediate preference.

Table 7.5.7.9 to Table 7.5.7.12 detail the potential impacts of each option corridor East of Drumsna Junction (Node J) on the known archaeological, architectural and cultural heritage resource. A summary of the impacts across each corridor is then presented in Table 7.5.7.13, together with an average impact score and ranking of each option from Preferred to Intermediate to Least Preferred.

Table 7.5.7.9 Yellow Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 222m E	Indirect	Imperceptible Negative
BH7	St. Mary's RC Church	RPS	c. 100m SW	Indirect	Slight Negative
AH274	Ringfort-rath and burial ground	RMP	c. 208m SW	Indirect	Imperceptible Negative
AH275	Ringfort-rath	RMP	c. 222m S	Indirect	Imperceptible Negative
AH276	Ringfort-rath	RMP	c. 225m W	Indirect	Imperceptible Negative
AH277	Ringfort-rath	RMP	c. 103m SW	Indirect	Slight Negative
AH290	Fulacht fia	Proposed RMP	0m	Neutral	N/A
AH289	Mound	RMP	c. 62m SW	Indirect	Slight Negative
DL9	Cloonteem Cottage	None	c. 177m SW	Neutral	N/A

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH9	Nesbitt Mausoleum	RPS, proposed RMP	c. 20m SW	Indirect	Significant Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c. 23m SW	Indirect	Significant Negative
BH9	St. Anne's Church	RPS	Immediate SW	Indirect	Significant Negative
AH293	Redundant record	None (SMR)	0m	Neutral	N/A
AH294	Crannog	RMP	c. 60m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 243m SW	Neutral	N/A
AH300	Ringfort-rath	Proposed RMP	c. 73m W	Indirect	Slight Negative
AH297	Ringfort-rath	RMP	c. 20m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 126m NE	Indirect	Slight Negative
AH306	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
BH15	St. Mary's RC Church	RPS	c. 32m ENE	Indirect	Moderately Negative
AH305	Enclosure	RMP	c. 173m NE	Indirect	Imperceptible Negative
AH45	Standing stone	RMP	0m	Direct	Very Significant Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 80m SW	Indirect	Slight Negative
BH16	House	RPS	c. 5m W	Indirect	Significant Negative

Table 7.5.7.10 Green Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 222m E	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH7	St. Mary's RC Church	RPS	c. 100m SW	Indirect	Slight Negative
AH274	Ringfort-rath and burial ground	RMP	c. 208m SW	Indirect	Imperceptible Negative
AH275	Ringfort-rath	RMP	c. 222m S	Indirect	Imperceptible Negative
AH276	Ringfort-rath	RMP	c. 225m W	Indirect	Imperceptible Negative
AH277	Ringfort-rath	RMP	c. 103m SW	Indirect	Slight Negative
AH290	Fulacht fia	Proposed RMP	0m	Neutral	N/A
AH289	Mound	RMP	c. 62m SW	Indirect	Slight Negative
DL9	Cloonteem Cottage	None	c. 177m SW	Neutral	N/A
BH9	Nesbitt Mausoleum	RPS, proposed RMP	c.20m SW	Indirect	Significant Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c.23m SW	Indirect	Significant Negative
BH9	St. Anne's Church	RPS	Immediate SW	Indirect	Significant Negative
AH293	Redundant record	None (SMR)	0m	Neutral	N/A
AH294	Crannog	RMP	c. 60m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 243m SW	Neutral	N/A
AH300	Ringfort-rath	Proposed RMP	c. 73m W	Indirect	Slight Negative
AH297	Ringfort-rath	RMP	c. 20m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 126m NE	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH306	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
BH15	St Mary's RC Church	RPS	c. 32m ENE	Indirect	Moderately Negative
AH305	Enclosure	RMP	c. 173m NE	Indirect	Imperceptible Negative
AH45	Standing stone	RMP	c. 27m SW	Indirect	Slight Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 169m SW	Indirect	Imperceptible Negative
BH16	House	RPS	c. 14m W	Indirect	Significant Negative

Table 7.5.7.11 Purple East Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 222m E	Indirect	Imperceptible Negative
BH7	St. Mary's RC Church	RPS	c. 100m SW	Indirect	Slight Negative
AH274	Ringfort-rath and burial ground	RMP	c. 208m SW	Indirect	Imperceptible Negative
AH275	Ringfort-rath	RMP	c. 222m S	Indirect	Imperceptible Negative
AH276	Ringfort-rath	RMP	c. 225m W	Indirect	Imperceptible Negative
AH277	Ringfort-rath	RMP	c. 103m SW	Indirect	Slight Negative
AH290	Fulacht fia	Proposed RMP	0m	Neutral	N/A
AH289	Mound	RMP	c. 62m SW	Indirect	Slight Negative
DL9	Cloonteem Cottage	None	c. 177m SW	Neutral	N/A
BH9	Nesbitt Mausoleum	RPS, proposed RMP	c. 20m SW	Indirect	Significant Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c. 23m SW	Indirect	Significant Negative

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
BH9	St. Anne's Church	RPS	Immediate SW	Indirect	Significant Negative
AH293	Redundant record	None (SMR)	0m	Neutral	N/A
AH294	Crannog	RMP	c. 60m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 243m SW	Neutral	N/A
AH300	Ringfort-rath	Proposed RMP	c. 73m W	Indirect	Slight Negative
AH297	Ringfort-rath	RMP	c. 20m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 126m NE	Indirect	Slight Negative
AH306	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
BH15	St. Mary's RC Church	RPS	c. 32m ENE	Indirect	Moderately Negative
AH305	Enclosure	RMP	c. 173m NE	Indirect	Imperceptible Negative
AH45	Standing stone	RMP	c. 27m SW	Indirect	Slight Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 169m SW	Indirect	Imperceptible Negative
BH16	House	RPS	c. 14m W	Indirect	Significant Negative

Table 7.5.7.12 Blue East Option Corridor Assessment

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 222m E	Indirect	Imperceptible Negative
BH7	St. Mary's RC Church	RPS	c. 100m SW	Indirect	Slight Negative
AH274	Ringfort-rath and burial ground	RMP	c. 208m SW	Indirect	Imperceptible Negative
AH275	Ringfort-rath	RMP	c. 222m S	Indirect	Imperceptible Negative
AH276	Ringfort-rath	RMP	c. 225m W	Indirect	Imperceptible Negative
AH277	Ringfort-rath	RMP	c. 103m SW	Indirect	Slight Negative
AH290	Fulacht fia	Proposed RMP	0m	Neutral	N/A

Site Ref.	Name	Statutory Protection?	Distance from option	Impact Type	Potential Impact level
AH289	Mound	RMP	c. 62m SW	Indirect	Slight Negative
DL9	Cloonteem Cottage	None	c. 177m SW	Neutral	N/A
BH9	Nesbitt Mausoleum	RPS, proposed RMP	c.20m SW	Indirect	Significant Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c.23m SW	Indirect	Significant Negative
BH9	St. Anne's Church	RPS	Immediate SW	Indirect	Significant Negative
AH293	Redundant record	None (SMR)	0m	Neutral	N/A
AH294	Crannog	RMP	c. 60m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 243m SW	Neutral	N/A
AH300	Ringfort-rath	Proposed RMP	c. 73m W	Indirect	Slight Negative
AH297	Ringfort-rath	RMP	c. 20m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 126m NE	Indirect	Slight Negative
AH299	Ringfort-rath	RMP	c. 225m NE	Indirect	Imperceptible Negative
AH306	Ringfort-rath	Proposed RMP	c. 236m SW	Indirect	Imperceptible Negative
BH15	St. Mary's RC Church	RPS	c. 100m WSW	Indirect	Slight Negative
AH305	Enclosure	RMP	0m	Direct	Profound Negative
AH45	Standing stone	RMP	c. 27m SW	Indirect	Slight Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 169m SW	Indirect	Imperceptible Negative
BH16	House	RPS	c. 14m W	Indirect	Significant Negative

Table 7.5.7.13 Stage 1 Archaeological, Architectural and Cultural Heritage Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Impacts to number of sites subject to statutory protection	Major Negative: 1 Moderate Negative: 6 Minor Negative: 6 Not Significant: 5	Major Negative: 0 Moderate Negative: 6 Minor Negative: 7 Not Significant: 6	Major Negative: 1 Moderate Negative: 5 Minor Negative: 7 Not Significant: 6	Major Negative: 0 Moderate Negative: 6 Minor Negative: 7 Not Significant: 6
Impacts to number of sites not subject to statutory protection	Major Negative: 1 Moderate Negative: 0 Minor Negative: 1 Not Significant: 4	Major Negative: 1 Moderate Negative: 0 Minor Negative: 1 Not Significant: 5	Major Negative: 0 Moderate Negative: 0 Minor Negative: 1 Not Significant: 5	Major Negative: 1 Moderate Negative: 0 Minor Negative: 1 Not Significant: 5
Scoring				
Qualitative Assessment	Major and Moderate impacts to a range of heritage assets including archaeological and built heritage sites. Potential impact to previously unrecorded archaeological remains within section of greenfield area. **Majorly** or **Highly Negative**	Major and Moderate impacts to a range of heritage assets including archaeological and built heritage sites. This option represents the on-line upgrade and as such does not require as much greenfield as the other two options. **Moderately Negative**	Major and Moderate impacts to a range of heritage assets including archaeological and built heritage sites. Potential impact to previously unrecorded archaeological remains within section of greenfield area. **Moderately Negative**	Major and Moderate impacts to a range of heritage assets including archaeological and built heritage sites. This option represents the on-line upgrade and as such does not require as much greenfield as the other two options. **Moderately Negative**
Overall Score / Impact Level	**1**	**2**	**2**	**2**
Preference	**Least Preferred**	**Preferred**	**Intermediate**	**Preferred**

7.5.7.4 Summary

West of Drumnsa Junction (Node J)

The Purple West Option and Dark Green Option Corridors are the Preferred options West of Drumsna Junction (Node J) due to the least number of major impacts to statutorily protected heritage assets and sites that have been identified as being of archaeological or built heritage merit, which are not subject to statutory protection.

The Cyan Option and Orange Option Corridors are considered to represent the Least Preferred route options. This is due to the high amount of direct negative major impacts on archaeological and built heritage sites that are subject to statutory protection, as well as a number of sites that are of archaeological and built heritage merit, which are not protected.

The Blue West Option is also ranked as having potential major negative impacts on recorded archaeological and built heritage sites. However, this option represents an on-line upgrade through Carrick-on-Shannon Town and as such is highly unlikely to require a footprint of 100m in width. In addition, this option requires the least amount of previously undisturbed greenfield due to it representing an on-line upgrade of the existing road. As such, this option is considered to be of Intermediate preference.

The Black Option is considered as a stand along option and is not comparable to the other options. The option will not result in any significant impacts on the known cultural heritage resource.

East of Drumsna Junction (Node J)

The Green Option Corridor is the Preferred option for East of Drumsna Junction (Node J) as this option has no major impacts on sites that are subject to statutory protection. One major impact may occur in relation to an archaeological site that is proposed for inclusion in the next revision of the RMP. This option also represents an on-line upgrade and as such requires the least amount of previously undisturbed greenfield.

The Blue East Option is also ranked as Preferred for East of Drumsna Junction (Node J) as this option has no major impacts on sites that are subject to statutory protection. One major impact may occur in relation to an archaeological site that is proposed for inclusion in the next revision of the RMP. This option also represents an on-line upgrade and as such requires the least amount of previously undisturbed greenfield.

The Purple East Option Corridor is considered to be of Intermediate preference, as this option has one major impact to a site subject to statutory protection, but no major impacts are predicted regarding the archaeological or built heritage resource that is not subject to protection. This option will also traverse a section of greenfield and therefore has more potential to impact previously undiscovered archaeology.

The Yellow Option Corridor is considered to be the Least Preferred option as this option has one major impact to a site subject to statutory protection, and one major impact on an archaeological site that is not subject to protection. This option will also traverse a section of greenfield and therefore has more potential to impact previously undiscovered archaeology.

7.5.8 Stage 1 Landscape and Visual Option Assessment

7.5.8.1 Introduction

This section describes the Stage 1 Assessment of the Option Corridors in the context of the Landscape and Visual constraints identified in Section 4.11 Landscape and Visual of this report. The Stage 1 Option Corridors are described in Section 7.1.2 Description of Option Corridors.

The Landscape and Visual constraints are presented with the Stage 1 Option Corridors in Figures 7.5.8.1.0 to 7.5.8.1.5.

Section 7.5.8.2 outlines the methodology utilised to carry out the Landscape and Visual assessment of the option corridors. The Landscape and Visual assessment of the option corridors is provided in Section 7.5.8.3 with associated summary assessments and scorings presented in Section 7.5.8.4.

7.5.8.2 Methodology

The Landscape and Visual assessment has been carried out in accordance with the following guidelines:

- Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads – Standard December 2020, Transport Infrastructure Ireland, (TII, 2020)[40]
- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft August 2017 Environmental Protection Agency, (EPA, 2017)[41]
- Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013 Landscape Institute & Institute of Environmental Management and Assessment, (GLVIA, 2013)[42]
- Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis, Transport Infrastructure Ireland, (TII, 2016)[2]

The overarching approach to the landscape and visual assessment of the option corridors follows the following key steps:

- The principal landscape and visual receptors within the study area identified in the constraints study

[40] TII, 2020. Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads – Standard December 2020, Transport Infrastructure Ireland
[41] Environmental Protection Agency, 2017. Guidelines on the Information to be contained in Environmental Impact Assessment Reports. Available from: http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf
[42] Landscape Institute, 2013. Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013, Landscape Institute & Institute of Environmental Management and Assessment

- The likely impacts of each of the option corridors on the landscape and visual receptors is identified and assessed, indicating which, if any, of these are likely to be significant
- The impact of each option corridor on the landscape and visual receptors is assessed and is scored on a seven point scale in accordance with the Project Appraisal Guidelines (TII, 2016)[2]. The scale ranges from 7 to 1 as follows listed in Table 7.3.1 of this report

The assessment involved desktop studies and fieldwork comprising professional evaluation by experienced Landscape specialists.

Sources of Information

The assessment is based on understanding the character of the existing landscape and visual environment with specific reference to:

- Leitrim County Development Plan 2015-2021 (LCC, 2015)[9]
- Carrick-on-Shannon Local Area Plan 2010-2019 (LCC, 2010)[11]
- Landscape Assessment of County Leitrim (LCC, 2020)[43]
- Roscommon County Development Plan 2022-2028 (RCC, 2022)[10]
- Cortober Local Area Plan 2008-2014 (RCC, 2008)[12]
- Landscape Character Assessment of County Roscommon (RCC, 2022)[44]
- Site-based reviews of the landscape and visual environment

The following online resources have also been accessed as part of the assessment:

- Ordnance Survey Ireland Geohive (http://map.geohive.ie/mapviewer.html)[45]
- National Monuments Service: Historic Environment Viewer (https://maps.archaeology.ie/HistoricEnvironment/)[46]
- Environmental Protection Agency GIS Mapping (https://gis.epa.ie/EPAMaps/)
- Google Aerial Photography and Mapping (https://www.google.ie/maps)

A review was also undertaken of the Draft Leitrim County Development Plan, the provisions of which will not take effect until it becomes effective on 21 March

[43] Environmental Resources Management, 2002. Comhairle Chontae Liatroma, Landscape Assessment of County Leitrim Reference 17896
[44] MosArt Landscape-Architecture-Research, Macroworks, Judy Osborne et. al., 2008. Landscape Character Assessment of County Roscommon. Available from: https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/stage-3-amendments/stage-3-adoption-of-plan
[45] Ordnance Survey Ireland, 2021. GeoHive Mapping Service. Available from: http://map.geohive.ie/mapviewer.html
[46] National Monuments Service, 2021. Historic Environment Viewer Available from: https://maps.archaeology.ie/HistoricEnvironment/

2023. The outcome of this assessment remains unchanged as a result of the new Plan.

7.5.8.3 Option Corridor Assessment

Stage 1 Landscape and Visual Option Corridors Assessment

Ten option corridors are included in the Stage 1 Landscape and Visual assessment. Five of the options (Blue West, Purple West, Dark Green, Orange and Cyan) are located to the west of Node J at Drumsna Junction.

A sixth option (Black) located to the west of Node J comprises a short 1.1km link to the north of Carrick-on-Shannon town centre that connects the R280 at Ballynamony the Summerhill Road at Drummagh, and the Castlecara Road at Keenaghan.

Four options are located to the east of Node J at Drumsna Junction (Blue West, Purple West, Green and Yellow).

Option Corridors: West of Drumsna (Nodes O / A / B to Node J)

In total there are six option corridors located to the west of Node J at Drumsna Junction (Purple West, Dark Green, Black, Orange, Cyan and Blue West). Of these, four provide bypasses of Carrick-on-Shannon town (i.e. two to the north (Purple West and Dark Green) and two to the south (Orange and Cyan)).

The Blue West Option Corridor is a management option centred on the existing N4 corridor from Usna (Node O) west of Cortober to Drumsna Junction (Node J).

The Black Option Corridor is a short link road located to the north of Carrick-on-Shannon town centre.

Black Option Corridor

South of R280, the Black Option Corridor directly impacts the corridor of a local stream (Ballynamony/Lisnabrack) and its associated semi-natural vegetation/tree-lines north of the residential estates of Lis Cara (Ros Airgid) and Oaklands. The option corridor crosses the Summerhill Road with residential development to either side. The residential properties include the attractive historic property of Summer Hill (c.1840). South of Summerhill Road the option corridor cuts through a series of mature field boundaries on a local ridge at Drummagh before dropping down to the Castlecara Road between North West Business and Technology Park and Carrick-on-Shannon Business and Technology Park.

There are no protected landscape, townscape or visual features, however, the Black Option Corridor includes prominent landscape features such as a local ridgeline, strong field boundaries, a stream corridor with semi-natural plantings and residential properties.

Blue West Option Corridor

The Blue West Option Corridor comprises a Management Option which provides for interventions on the existing road infrastructure to address identified transport difficulties.

It is assumed that interventions along the existing road corridor would be localised in extent and primarily within the existing corridor of the road.

Any negative landscape and/or visual impacts are likely to be localised and of temporary or short-term duration. Significant landscape or visual impacts are not anticipated.

Measures may not fully address traffic congestion issues in Cortober/Carrick-on-Shannon and therefore, continuing traffic delays are likely to negatively impact the overall townscape and visual quality of the N4 streetscape.

Cyan Option Corridor & Orange Option Corridor

The Cyan and Orange Option Corridors both provide for a southern bypass of Carrick-on-Shannon and a southern bridging of the River Shannon. Both option corridors follow the same corridor from east of the Shannon crossing and for the most part both option corridors have a similar impact on landscape character.

In crossing the River Shannon both option corridors lie within the River Corridor Landscape Character Type within County Roscommon and within River Floodplain Landscape Character Type and a designated Area of High Visual Amenity located between Cortober and the existing N4 at Correens (Node D) in County Leitrim.

Both river crossing locations (i.e., Orange is approximately 120m north of Cyan between Cordrehid in Roscommon and Attirory in Leitrim) are perpendicular to the north – south flow of the river where established fishing and boating amenities line the west (Roscommon) bank of the river. Both option corridors also follow the existing N4 through Tully, Minkill and Kildorragh (in part between Node D and J), where there are protected views of the River Shannon from the existing N4 (Views 27 & 28, Map 4.12, LCC 2015).

Both option corridors also give rise to the same landscape and visual impacts east of the River Shannon, south of emerging and existing residential development/estates at Glas na hAbhainn, Ard na Slí and Cnoc na Slí (Attirory) and along the existing N4 from Correen, east of Carrick-on-Shannon (Node D) to Drumsna Junction (Node J), where established roadside vegetation and dispersed residential properties lie to either side of the existing N4 from Correen to Tully (Node E). Both options have the same landscape and visual effects on the River Shannon Corridor and Floodplain Character Areas and on the Area of High Visual Amenity and Protected Views V27 and V28.

West of the River Shannon, the Cyan Option Corridor begins at Cloongownagh (Node A), c. 2.5km west of Cortober, and broadly follows the north side of the rail line through Cortober and across Station Road crossing the Killukin Stream and the River Shannon along a broadly straight corridor alignment. The Cyan Option corridor impacts on the (previously re-aligned) entrance of the historic Cloongownagh House, on the established/historic landscape features of Springfield House, where it severs the commercial amenity landholding of Carrick Quads.

Thereafter, the Cyan Option Corridor follows the corridor of the rail line – where the station house and other buildings are identified as protected structures – and crosses Station Road between Nos. 1 & 2 Station Road (historic properties) and Nos 1 to 6 Station View. The Cyan Option Corridor cuts straight through local ridgelines at Cortober, west of the Killukin River, and Cordrehid, between the Killukin River and River Shannon – and more south of Carrick Camping than the Orange Option Corridor.

West of the River Shannon, the Orange Option Corridor begins at Meera, c. 0.75km west of Cortober (Node B), cuts through the area of Pairc an Gael, follows the north side of the rail line – where the station house and other buildings are identified as protected structures. The Orange Option Corridor crosses Station Road between No.'s 1 & 2 Station Road (historic properties). The Orange Option Corridor cuts straight through local ridgelines at Cortober, west of the Killukin River, and Cordrehid, between the Killukin River and River Shannon but along a more northern (curving) corridor alignment (than the Cyan Option Corridor) and therefore, more directly across the grounds of Carrick Camping.

Purple West Option Corridor & Dark Green Option Corridor

The Purple West and Dark Green Option Corridors both provide for a northern bypass of Carrick-on-Shannon and a northern bridging of the River Shannon. Both option corridors follow the same corridor from Tumna, west of Cortober (Node B) to the Castlecara Road, north of Carrick-on-Shannon and both option corridors have the same landscape and visual impacts, including impact on landscape character, along this section of corridor.

Common landscape impacts between Tumna and Castlecara include impacts on mature field boundaries and semi-natural river edge vegetation between the existing N4 and the crossing of the River Shannon, which also crosses the proposed blueway route which runs along the River Shannon (Leitrim side of river) upstream of Carrick-on-Shannon. West of Carrick-on-Shannon (within County Leitrim) the Purple West and Dark Green Option Corridors follows an existing ridge with mature field boundaries, from where the corridors turn east across lower lying lands, with semi-natural vegetation at Hartley.

In crossing the River Shannon both option corridors lie within the River Corridor Landscape Character Type within County Roscommon and within a River Floodplain Landscape Character Type and a designated Area of High Visual Amenity (in Corryolus and Portnaeoght) west of Carrick-on-Shannon in County Leitrim. Both option corridors also fall within the extremity of Protected View V8 (Roscommon) from Hartley Bridge (for which planning permission is being sought for its removal and replacement – due to its poor condition).

Both option corridors also give rise to the same visual impacts between Tumna and Castlecara, with visual impacts in crossing the River Shannon corridor (from waterway and future blueway) and for properties viewing the crossing location, for properties at crossings of local roads and R280 through Hartley, Cloonsheerrvagh, Cartown and Drumlumman, Cornamucklagh, Cloonmulligan and Dromore (Castlecara Road).

East of the Castlecara Road, the Purple West Option Corridor takes a more south-easterly alignment to re-join the existing N4 at Tully/Minkill (Node E) from where it follows the alignment of the existing N4 to the Drumsna Junction (Node J). The option corridor passes close to properties in Keenaghan, Cornaslieve, Garvlough, Aughriman South, Tully and Minkill. The Purple West Option Corridor follows the existing N4 through Tully, Minkill and Kildorragh (between Node E and J), where there are protected views of the River Shannon from the existing N4 (Views 27 & 28, Map 4.12, LCC 2015).

By contrast the Dark Green Option Corridor continues in a more easterly direction to re-join the existing N4 further east at Mount Campbell close to the Drumsna Junction (Node J) – avoiding the Protected Views*. The Dark Green Option Corridor passes close to properties in Garvlough and Aughriman South.

** It is noted that these views and prospects are recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029 (January 2022)*

Table 7.5.8.1 Stage 1 Landscape and Visual Assessment Matrix of Option Corridors West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR	BLACK OPTION CORRIDOR
Landscape Effects	Impact on local ridgelines (County Roscommon), mature trees, field boundaries, roadside plantings. Impact on sports grounds at Pairc an Gael. Impact on River Shannon Corridor / Floodplain LCA. Impact on Area of High Amenity along River Shannon (County Leitrim).	Impact on local ridgelines (County Roscommon), mature trees, field boundaries, roadside plantings. Impact on River Shannon Corridor / Floodplain LCA – with curving crossing. Impact on Area of High Amenity along River Shannon (County Leitrim).	Impact on local ridgelines (County Leitrim), mature trees, field boundaries, roadside plantings. Impact on River Shannon Corridor / Floodplain LCA. Impact on Area of High Amenity along River Shannon (County Leitrim).	Impact on local ridgelines (County Leitrim), mature trees, field boundaries. Impact on River Shannon Corridor / Floodplain LCA. Impact on Area of High Amenity along River Shannon (County Leitrim).	No significant landscape / Townscape impacts expected. Option will Not Significantly reduce traffic congestion through Carrick-on-Shannon and Cortober, which would maintain the adverse effect of traffic on the townscape character.	Impact on local ridgeline, mature field boundaries, stream corridor and associated semi-natural vegetation
Visual Effects	Impact on Protected Views V27 & V28 (Tully / Minkill). Impact on residential properties west of Cortober, at Station Road, east of Cortober (Carrick-on-Shannon), at Glas na hAbhainn, Ard na Slí, Cnoc na Slí, and along existing N4.	Impact on Protected Views V27 & V28 (Tully / Minkill). Impact on residential properties at Station Road, east of Cortober (Carrick-on-Shannon), at Glas na hAbhainn, Ard na Slí, Cnoc na Slí, and along existing N4.	Impact on Protected Views V8 (Hartley), V27 & V28 (Tully / Minkill). Impact from waterbody of Shannon (and future Blueway along river). Impact on properties in Hartley, Cloonsheerrvagh, Cartown and Drumlumman, Cornamucklagh, Cloonmulligan, Dromore, Keenaghan, Cornaslieve, Garvlough, Aughriman South, Tully and Minkill.	Impact on Protected Views V8 (Hartley). Impact from waterbody of Shannon (and future blueway along river). Impact on properties in Hartley, Cloonsheerrvagh, Cartown and Drumlumman, Cornamucklagh, Cloonmulligan, Dromore, Garvlough and Aughriman South.	No significant visual impacts expected.	Impact on residential properties at R280, Ros Airgid, Oaklands and Summerhill Road, including Summer Hill (House)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Scoring							
Qualitative Assessment	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Not Significant** or **Neutral**		**Moderate Negative**
Score / Impact Level	**1**	**1**	**1**	**1**	**4**		**2**
Ranking Order	**4th**	**5th**	**3rd**	**2nd**	**1st**		**N/A**

***** *It is noted that these views and prospects are recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029 (January 2022).*

Table 7.5.8.2 Stage 1 Landscape and Visual Summary Scoring Matrix of Option Corridors West of Drumsna Junction (Node J)

Assessment Criteria	**CYAN OPTION CORRIDOR**	**ORANGE OPTION CORRIDOR**	**PURPLE OPTION CORRIDOR**	**DARK GREEN OPTION CORRIDOR**	**BLUE WEST OPTION CORRIDOR**		**BLACK OPTION CORRIDOR**
Landscape Impact	1	1	2	2	4		2
Visual Impact	1	1	1	1	4		2
Scoring							
Qualitative Assessment	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Not Significant** or **Neutral**		**Moderately Negative**
Score / Impact Level	**1**	**1**	**1**	**1**	**4**		**2**
Preference	**Least Preferred**	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

Option Corridors: East of Drumsna Junction (Node J)

In total there are four option corridors (Purple East, Green, Yellow and Blue East) located to the east of Node J at Drumsna Junction. The Green and Blue East (Management) Option Corridors are centred on the existing N4 road corridor. The Yellow Option Corridor runs to west of the existing N4 at the junction with Local Road L1475 at Fearnaght/Faulties. The Purple East Option Corridor includes for new junction east of Drumsna (east of Node J) and runs to the east of the Annaduff Church, School and the existing N4 at Aghamore.

Therefore, for the most part the Purple East – and especially the Green and Yellow Option Corridors will have broadly similar landscape and visual impacts. These are associated with widening of the existing road corridor, with loss of roadside vegetation, impact on roadside properties, accesses, screening, gardens and potentially requiring removal of some dwellings. All option corridors have potential to impact the edge of Gortinty (Drumgilra) Lough.

The impacts will be most significant along particular sections of the N4, where residential properties/other properties closely front the road corridor at:

- L7429 Road Junction (Drumsna/Annaduff)
- R201 Mohill Road Junction (Annaduff)
- Along the N4, and at junctions with L7430 Local Road, fronting Gortinty (or Drumilra) Lough
- L7464 Local Road (Gortinty/Drumgilra)
- Along the N4 through Drumgilra
- Along the N4 through Aghamore – including at Leitrim GAA Centre of Excellence and Annaduff GAA Grounds (Green and Yellow Option Corridors)
- Along N4 from east of Aghamore through Moher and Fearnaght

Blue East Option Corridor

The Blue East Option Corridor comprises a Management Option which provides for interventions on the existing road infrastructure to address identified transport difficulties.

It is assumed that interventions along the existing road corridor would be localised in extent and primarily within the existing corridor of the road.

Any negative landscape and/or visual impacts are likely to be localised and of temporary or short-term duration. Significant landscape or visual impacts are not anticipated.

Purple East Option Corridor

For the most part the Purple East Option Corridor follows the existing N4 from Drumsna to Faulties and landscape and visual impacts common to all option corridors are detailed under Section 7.5.8.3 above.

However, the Purple East Option Corridor also provides for a new junction at Drumsna/Annaduff (east of Drumsna) and for new alignment passing to the east of Annaduff Church and School at Aghamore. Therefore, the option corridor intrudes into the setting of the River Shannon south of Drumsna (Annaduff), west of the existing N4 and Lough Adaff or Spa Lough (also Lough Annaduff or Gortconnollan Lough) east of the N4 at Drumsna.

Further east the Purple East Option Corridor passes east of the existing N4 at Aghamore crossing Local Road L3470 between Annaduff Church/School to the west and a local road with residential properties to the east. The off-line section of the Purple East Option Corridor impacts a series of field boundaries with mature trees[47].

Green and Yellow Option Corridors

The Green and Yellow Option Corridors are very similar and follow the existing N4 from Drumsna to Fearnaght and landscape and visual impacts common to both option corridors are detailed under Section 7.5.8.3 above.

Between Fearnaght and Faulties (Nodes G to F) the Yellow Option Corridor passes south/west of the existing N4 at its junction with Local Road L1475 – however, there is minimal landscape and visual difference with both corridors.

In contrast to the Purple East Option Corridor, the Green and Yellow Option Corridors follow the existing N4 through Aghamore, where the church grounds, residential properties and sports ground closely front the existing N4 road corridor. Widening of the existing road corridor through this alignment would be likely to give rise to significant landscape and visual impacts.

[47] Many of the mature trees are Common Ash (*Fraxinus excelsior*) and the now widespread Ash dieback disease (caused by fungal pathogen *Hymenoscyphus fraxineus) is prevalent on trees nationwide including this area/region.*

Table 7.5.8.3 Assessment Matrix of Options Corridors: East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Landscape Effects	Impact on roadside trees, hedgerows and plantings. Potential impact on edge of Gortinty (Drumgilra) Lough. Impact on grounds of residential, sports and other properties.	Impact on roadside trees, hedgerows and plantings. Potential impact on edge of Gortinty (Drumgilra) Lough. Impact on grounds of residential, sports and other properties.	Impact on roadside trees, hedgerows and plantings and on sections of field boundaries. Potential impact on setting of section of River Shannon and Lough Annaduff. Potential impact on edge of Gortinty (Drumgilra) Lough. Likely deep cut through ridge at Aghamore. Impact on grounds of residential properties.	No Significant landscape impacts expected.
Visual Effects	Impact on residential property fronting existing N4 road corridor – including through Aghamore. View and Prospect V25 of River Shannon from N4 at Faulties*.	Impact on residential property fronting existing N4 road corridor – including through Aghamore. View and Prospect V25 of River Shannon from N4 at Faulties*.	Impact on residential property fronting existing N4 road corridor. Less impact on properties through Aghamore than other options. View and Prospect V25 of River Shannon from N4 at Faulties*.	No Significant visual impacts expected.
Scoring				
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Major** or **Highly Negative**	**Not Significant** or **Neutral**
Score / Impact Level	**2**	**2**	**1**	**4**
Ranking Order	**3rd**	**2nd**	**4th**	**1st**

***** *It is noted that this view and prospect is recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029 (January 2022).*

Table 7.5.8.4 Stage 1 Landscape and Visual Summary Scoring Matrix of Option Corridors East of Drumsna Junction (Node J)

Assessment Criteria	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**	**BLUE EAST OPTION CORRIDOR**
Landscape Impact	2	2	2	4
Visual Impact	1	1	1	4
Scoring				
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Major** or **Highly Negative**	**Not Significant** or **Neutral**
Score / Impact Level	**2**	**2**	**1**	**4**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Preferred**

7.5.8.4 Summary

The Blue (Management) Option Corridor, both west and east, with minimal works within the existing road corridor, is the Preferred option across the full extent of the study area in terms of landscape and visual impacts.

Thereafter, to the west of Drumsna Junction (Node J) option corridors (Purple West and Dark Green), are marked as Intermediate, providing an upstream crossing (of Carrick-on-Shannon) of the River Shannon. These are more preferrable compared to downstream crossing option corridors (Cyan and Orange), which are marked as Least Preferred.

As a northern option corridor, Dark Green is more preferrable compared to Purple West and as a southern option corridor, Cyan is more preferrable compared to Orange.

To the east of Drumsna Junction (Node J) all option corridors follow the existing N4 to a greater or lesser degree, with the Purple East Option Corridor, marked as Least Preferred, diverting around the existing settlement along the N4 at Aghamore. With less landscape impact either the Green or Yellow Option Corridors are more preferrable compared to Purple East, as they are both marked as Intermediate.

Across the full study area, the Blue (Management) Option Corridor is the Preferred Option. This is then followed by Dark Green Option Corridor, followed by either the Green or Yellow Option corridors, which are marked as Intermediate.

7.5.9 Stage 1 Biodiversity Option Assessment

7.5.9.1 Introduction

This section details the environmental assessment of the Stage 1 Preliminary Options with respect to the Biodiversity constraints identified in Section 4.12 Biodiversity of Chapter 4 – Constraints Study.

The Biodiversity constraints are presented with the Stage 1 Option Corridors in Figures 7.5.9.1.0 to 7.5.9.2.5.

Section 7.5.9.2 outlines the methodology utilised to carry out the assessment, Sections 7.5.9.3 details the options assessment, and a summary is presented in Section 7.5.9.4.

7.5.9.2 Methodology

There are ten Option Corridors, six of which are to the west of Node J at Drumsna Junction (Purple, Dark Green, Black, Orange, Cyan and Blue) and four which are to the east of Node J (Purple, Green, Yellow and Blue).

The Stage 1 biodiversity assessment is based on the "Option Corridor" which is a corridor within which a road based solution could be constructed and in most cases is a 300m wide corridor centred around a possible alignment centreline for a road.

The assessment is mindful that the possible alignments could be realigned within their option corridors and therefore the overall impact of the option corridor is assessed to identify possible impacts.

The principal objectives of this assessment are to:

- Evaluate all Option Corridor corridors contained within each section, based on ecological criteria, as per the National Road Authority (NRA) Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)[48] and the Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (2018)[49]
- Assess the significance of the likely impacts on each of the biodiversity receptors potentially impacted by each option corridor. As per the Transport Infrastructure Ireland (TII)[2] guidance, this step discounted biodiversity receptors or ecological sites where the risk of significant impacts is unlikely

[48] National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

[49] Chartered Institute for Ecology and Environmental Management (CIEEM), 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1.pdf

considering where the application of standard mitigation and best practice during construction is unambiguous and success is highly likely

- To assess each option in accordance with Transport Infrastructure Ireland's Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (TII, 2016)2.

To fulfil these objectives, an assessment of the likely or potential impacts of each option corridor on ecological receptors is carried out so that an informed comparison of the option corridors can be made with cognisance of the potential ecological consequences.

Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Alongside the term "biodiversity", the terms "ecology" and "ecological" are also used throughout this section of the report as a broader term to refer to the relationships of biodiversity receptors to one another and to their environment.

Biodiversity Stage 1 Assessment Process

The process by which the option corridors were assessed was as follows:

- The key ecological receptors within the study area were identified based on a combination of desktop data, consultation (i.e. relevant bodies/organisations) and field surveys
- The key ecological receptors were assigned an ecological value based on a geographic frame of reference ranging from international to local importance
- The likely impacts of each of the option corridors on the key ecological receptors were identified and assessed, indicating which, if any, of these are likely to be significant, and at what geographical level
- The impacts of each of the option corridors on the key ecological receptors were scored in accordance with the TII approach[50], on a seven-point scale ranging from 'Major or Highly Negative (1)' to 'Major or Highly Positive (7)'[51];
- The overall cumulative impact of each option corridor across all the key ecological receptors affected was also scored on the same seven-point scale
- The scores attributed to each of the option corridors were assessed comparatively and assigned a preference ranking

[51] In respect of the Black Option, this is not comparatively compared, rather assessed as a standalone assessment. However, it is similarly described in as far as is possible based on the detail provided of likely or potential impacts on key ecological receptors

[51] In respect of the Black Option, this is not comparatively compared, rather assessed as a standalone assessment. However, it is similarly described in as far as is possible based on the detail provided of likely or potential impacts on key ecological receptors

Key Ecological Receptors

Key ecological receptors are those biodiversity receptors confirmed, or likely to occur, within the study area with an ecological value of local importance (higher value) or greater and, therefore likely to affect the scoring and ranking of the option corridors. These include:

- Designated sites for nature conservation (e.g. SACs, SPAs, NHAs, pNHAs and Nature Reserves)
- Sensitive habitats (e.g. non-designated areas of Annex I habitat[52], non-Annex I semi-natural woodland habitats and watercourses)[53]
- Sensitive species (e.g. freshwater pearl mussel *Margaritifera margaritifera* and whooper swan *Cygnus cygnus*)
- Ecological sites (identified from a combination of desktop and field assessment)

The key ecological receptors were initially identified in the constraints study detailed in Section 4.12 - Biodiversity based on collation of available existing information from the desk study and consultations with relevant bodies/organisations and focussed on the known/potential ecological value for the habitats/species present. In the case of the ecological sites, the boundaries were initially defined based on interpretation of orthophotography and collation of available existing habitat information.

Walkover surveys of the study area were undertaken in August and September 2020, along with specialist habitat surveys of two locations within the River Shannon floodplain:

1. Northwest of Carrick-on-Shannon in the townlands of Corryolus and Cloonman
2. In the townlands of Cortober, Cordrehid, Attirory, Rinnacurreen and Drumkeeran to the south of Carrick-on-Shannon

This was further supplemented for this Stage 1 Assessment with an additional field survey undertaken in February 2021. The purpose of the field surveys was to ground truth and verify the orthophotography interpretation and selection of ecological sites, refine site boundaries, assess the ecological evaluation of each of the identified ecological sites and to detect any additional ecological sites not identified during the desk study. Walkover surveys of ecological sites which were located in proximity to, or overlapped with, one or more of the option corridors, were undertaken in February 2021.

[52] The short-hand names of Annex I habitats is used in this assessment, as per: NPWS, 2019. The Status of European Habitats and Species in Ireland. Volume 2: Habitat Assessments. Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol2_Habitats_Article17.pdf

[53] Watercourses are referred to as per: Environmental Protection Agency, (EPA), 2022. Online Map Viewer. Available at: https://gis.epa.ie/EPAMaps/

In some cases, a small number of ecological sites were viewed from a distance, owing to limited access or winter river levels covering certain areas (EC29, EC30, EC31, EC32, EC48, EC52, EC77 and EC80). Furthermore, in a small number of situations ecological sites could not be viewed at a distance due to the local topography or limited access (EC02, EC03 and EC05). However, assumptions were made on the value of those ecological sites based on local information gathered during previous constraints field surveys and desk studies as necessary.

Where possible, during the site walkover surveys, habitat types were classified using the Guide to Habitats in Ireland (Fossitt, 2000)[54] and the likelihood/potential for Annex I habitat types was confirmed or inferred based on the professional judgement of the surveyor, with reference to the Interpretation manual of European Union Habitats EUR 28 (CEC, 2013)[55]. Where it was not possible to confirm the presence of Annex I habitats, a precautionary approach was adopted with regards to the identification of the potential presence of Annex I habitats within an ecological site.

It should be noted that the Stage 1 Assessment is based on the option corridors.

Ecological Valuation

The key ecological receptors identified have been valued with regard to ecological valuation guidance set out in Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)[56] and Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018)[57].

The following geographic frame of reference is used when valuing the key ecological receptors:

- International importance
- National importance
- County importance
- Local importance (higher value)

[56] National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

[56] National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

[57] Chartered Institute for Ecology and Environmental Management (CIEEM), 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1.pdf

All Annex I habitats that lie outside of European sites, are valued as being of at least national importance, given that these habitats are of high conservation concern. Priority Annex I habitat types that lie outside of European sites may be valued as being of international importance given that they are of the highest conservation concern at a European level (i.e., natural habitat types in danger of disappearance)[58].

For individual sites (e.g. designated sites, watercourses or ecological sites identified during the Constraints Study), the overall ecological valuation for each of the key ecological receptors was based upon the highest value receptor known to be present, or potentially present, within the site.

Assessment Criteria

The assessment of each option corridor included both a quantitative and qualitative assessment. Firstly, the impacts on each key ecological receptor were assessed.

Although a given option corridor may impact upon a particular key ecological receptor, the direct impact(s) on the site may not necessarily directly impact on the highest value receptor(s). This is accounted for in the assessment as much as possible, based on the level of ecological information available.

To assess the likely ecological impacts of each option corridor on individual key ecological receptors, the following criteria are applied, with the use of professional judgement as to the likelihood of significant effects occurring:

- Potential impacts on an ecological receptor of national/international importance were assessed as being major or highly negative
- Potential impacts on an ecological receptor of county importance were assessed as being moderately negative
- Potential impacts on a receptor of local importance (higher value) were assessed as being minor or slightly negative

To assess the likely cumulative overall ecological impacts for each option corridor, the following criteria were applied, in conjunction with the use of professional judgement as to the likelihood of significant effects occurring:

- Biodiversity impacts are major or highly negative if:
    - the impact is directly on one or more designated sites valued as international or national importance (i.e. SAC, SPA, pNHA or NHA)

or

    - the impacts associated with constructing a road within the option corridor would likely result in an adverse effect on the integrity of the SAC/SPA/pNHA/NHA site (i.e. for SAC/SPA this could equate to the loss of qualifying interest habitat or undermining the conservation objectives and

[58] From the definition of "*priority natural habitat types*" in Article 1(d) of the Habitats Directive (Council Directive 92/43/EEC).

for pNHA/NHA this could relate to the loss of features for which the site is designated)

- Biodiversity impacts are moderately negative if:
  - the impact is directly on one or more non-designated ecological sites valued as national or county importance, or numerous ecological sites valued as local high importance

or

  - the impacts associated with constructing a road within the option corridor would likely result in permanent/long-term effects on non-qualifying interest Annex I habitat or on a species population considered to be of national importance

or

  - Impacts associated with constructing a road within the option corridor would likely have permanent/long-term effects on a habitat(s) or on a species population considered to be of county/local (high) importance
- Biodiversity impacts are minor or slightly negative if:
  - the impact is directly on a small number of ecological sites valued as local (high) importance

or

  - the impacts associated with constructing a road within the option corridor would likely have permanent/long-term effects on a habitat(s) or on a species population considered to be of local (high) importance.

Considering these cumulative impacts on the key ecological receptors identified, each option corridor was scored, based on the seven-point scale listed in Table 7.3.1 of this report, and an integer was assigned according to the impact significance.

As all option corridors are likely to have some level of a negative impact on biodiversity, neutral or positive impact scorings do not apply in this assessment, as in the absence of a design and/or mitigation there is no understanding that any option requiring construction could be assessed as neutral or positive.

Each of the option corridors were also comparatively assessed in terms of the overall impact significance, in order to provide a preference ranking. The preference ranking was as follows:

- Preferred
- Intermediate
- Least Preferred

In accordance with the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)[56], key ecological receptors within the study area were not assessed against the option corridors where the risk of significant

impacts is unlikely, considering where the delivery of standard mitigation and best practice during construction is unequivocal and success is highly likely. For example, with the application of standard pollution control measures during construction and an operational drainage and pollution control system designed to current standards, sensitive biodiversity receptors downstream of option corridors are not likely to be affected. However, it should be noted that potential watercourse crossings were considered in this assessment, as it cannot be assumed that clear-span crossings will be possible at each crossing point. In addition, potential watercourse crossings will undoubtedly result in habitat loss, with regards riparian habitat, and other indirect impacts on the watercourse in question (e.g. disturbance to QI species, spread of invasive species).

7.5.9.3 Stage 1 Biodiversity Option Corridor Assessment

This section details the biodiversity Stage 1 Preliminary Assessment of the Option Corridors. Key ecological receptors which are located within, or partially within, an option corridor, and on which the option corridors were assessed, are presented in Table 7.5.9.1.

Only direct impacts were considered. Indirect impacts, such as those resulting from air quality impacts/impacts to hydrogeology were not considered at this stage of the assessment.

Table 7.5.9.1 Key Ecological Receptors Located within, or Partially within, an Option Corridor

Site Name	Description	Ecological Value
Lough Eidin pNHA [001643]	Designated site (pNHA). Lake, lakeshore habitat and extensive areas of seasonally flooded wet grassland (callows), with confirmed stand of Annex I 6410 Molinia meadows habitat adjacent to the River Shannon. Important wintering bird site supporting Greenland white-fronted geese.	National
EC02**[59]	Broadleaf woodland.	Local (high)
EC03**[60]	Broadleaf woodland.	Local (high)
EC05**	Broadleaf woodland and scrub. Part of ecological site intersects with pNHA. Potential for *91E0 habitat.	International
EC06	Broadleaved / wet woodland within floodplain of the River Shannon. Areas of potential priority Annex I *91E0 habitat.	International
EC12	Immature broadleaved / wet woodland (including some recently planted).	Local (high)
EC16	Broadleaved / wet woodland / scrub, marsh and wet grassland on bank of River Shannon. Areas of confirmed and potential priority Annex I *91E0 habitat.	International
EC27	Broadleaved / wet woodland and scrub.	Local (high)
EC28	Broadleaved / wet woodland and scrub.	Local (high)
EC30	Broadleaved / wet woodland / scrub in River Shannon floodplain. Hydrologically connected to the river. Potential for priority Annex I *91E0 habitat.	International

[59] Double asterisk** alongside ecological sites in column 1 have been assessed solely on desk study and interpretation of aerial photography

[60] The asterisk* denotes that the Annex I Habitat is a priority habitat in the context of the Habitats Directive. It is noted that individual parcels of the priority Annex I habitat *91E0 represent a hydrologically and hydrogeologically interconnected habitat across the River Shannon Callows ecosystem, that although occurring in isolation, persists owing to the coherent hydrological and hydrogeological regime that supports them

Site Name	Description	Ecological Value
EC31	Broadleaved / wet woodland / scrub and wet grassland in River Shannon floodplain. Hydrologically connected to the river. Potential for priority Annex I *91E0 habitat.	International
EC32	Broadleaved / wet woodland / scrub and wet grassland in River Shannon floodplain. Hydrologically connected to the river. Potential for priority Annex I *91E0 habitat.	International
EC35	Broadleaved / wet woodland / scrub and wet grassland / marsh habitat on bank of River Shannon. No *91E0 habitat located within corridor footprint.	Local (high)
EC47	Broadleaved / wet woodland and scrub.	Local (high)
EC48	Broadleaved woodland / wet woodland. Potential for priority Annex I *91E0 habitat.	International
EC49	Broadleaved woodland / wet woodland.	Local (high)
EC50	Marsh, wet grassland and scrub. Potential to develop into priority Annex I *91E0 habitat in the short to medium term. Contains an area of Annex I Transition mires habitat [7140].	National
EC51	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats. Confirmed priority Annex I *91E0 habitat present.	International
EC52	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats. Confirmed and potential priority Annex I *91E0 habitat present.	International
EC62	Artificial lake with surrounding semi-natural grassland and scrub.	Local (high)
EC63	Broadleaved / wet woodland and wet grassland.	Local (high)
EC77	Broadleaved woodland, scrub, semi-natural grassland and wet grassland. Potential for peatland habitats.	International
EC78	Broadleaved / conifer woodland and wet grassland. Area of recently planted oak woodland bordering N4. Wet grassland with devil's bit scabious Succisa pratensis and potential for Annex II marsh fritillary Euphydryas aurinia butterfly.	Local (high)
EC80	Conifer plantation with border of broadleaf / wet woodland along the River Shannon.	Local (high)
EC87	Broadleaved woodland and mixed conifer / broadleaf woodland.	Local (high)
EC88	Broadleaved and conifer woodland along the River Shannon.	Local (high)
EC97	Lake Gortconnellan or Spa Lough and associated wet grassland and scrub.	County

Site Name	Description	Ecological Value
EC99	Broadleaved / wet woodland, scrub and wet grassland on bank of River Shannon. Potential for priority Annex I *91E0 habitat.	International
EC105	Lake Drumgilra or Gortinty Lough and associated wetland, broadleaved / wet woodland and scrub habitats. Potential for priority Annex I *91E0. Confirmed Whooper swan location along eastern bank of lake.	International
EC112	Broadleaved / wet woodland, scrub and wet grassland.	Local (high)
EC113	Lake Bog Lough and associated wetland, peatland and woodland habitats. Likely to support Annex I peatland and potentially Annex I woodland habitats (e.g., 91D0 and *91E0 respectively).	International
Killukin stream	River known to support brown trout Salmo trutta.	County
River Shannon	Nationally important watercourse of a large scale which runs through numerous counties and intersects a number of upstream (e.g., Lough Arrow SAC [001673]) as well as downstream European sites, the nearest of which is Lough Forbes Complex SAC [001818]. A number of other European sites including the Lower River Shannon SAC [002165] are present in the downstream receiving environment and species for which this is designated are likely to be present throughout the Shannon watercourse.	National
Clougher [Roscommon]	Watercourse	Local (high)
Aghancarra stream	Watercourse	Local (high)
Ardglass stream	Watercourse	Local (high)
Drumsna stream	Watercourse	Local (high)
Unnamed stream – border of Annaduff and Gortinty	Watercourse	Local (high)
Gortinty stream	Watercourse	Local (high)
Cornaslieve_26 stream	Watercourse	Local (high)
Lismoyle_26 stream	Watercourse	Local (high)
Kiltycarney stream	Watercourse	Local (high)

Site Name	Description	Ecological Value
Kildorragh_26 stream	Watercourse	Local (high)
Unnamed stream – Kilmaddoroe Lough to Bran Lough to Carrickevy Lough to the River Shannon	Watercourse	Local (high)
Attifinlay stream	Watercourse	Local (high)
Kilmaddaroe stream	Watercourse	Local (high)
Lisnagat stream	Watercourse	Local (high)
Unnamed stream – border of Annaduff and Derryoughter	Watercourse	Local (high)
Woodbrook house stream	Watercourse	Local (high)
Tumna stream	Watercourse	Local (high)
Knockadalteen_26 stream	Watercourse	Local (high)
Clooneigh_26 stream	Watercourse	Local (high)
Knockananima stream	Watercourse	Local (high)
Aghameeny stream	Watercourse	Local (high)
Killasanowl stream	Watercourse	Local (high)
Unnamed stream – from the Shannon at Annaghbeg to Drumlumman	Watercourse	Local (high)

Ecological Receptors West of Drumsna Junction (Node J)

Table 7.5.9.2 below provides a summary of the number of ecological receptors impacted by each option corridor.

Table 7.5.9.2 No. of Biodiversity Impacts for each Option Corridor – West of Drumsna Junction (Node J

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Significant impact on sites of International Importance (major or highly negative)	3	2	5	6	3		0
Significant impact on sites of National Importance (major or highly negative)	3	2	2	2	2		0
Significant impact on sites of County Importance (moderately negative)	1	1	0	0	0		0
Significant impact on sites of Local Importance (Higher Value) (minor or slightly negative)	17	15	18	15	22		2

Black Option Corridor

The Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon and provides connectivity by joining the R280 to the Summerhill Road and on to the Castlecara Road.

It intersects two watercourses of local importance (higher value), namely the Lisnagat stream and the Attifinlay stream both of which drain into the River Shannon at Carrick-on-Shannon.

No ecological sites or designated sites are intersected by the Black Option Corridor; however, some landtake of green field sites will be required to facilitate this option. As such it is considered to have a minor negative impact and assigned a PAG score of 3.

Cyan Option Corridor

The Cyan Option Corridor impacts on Lough Eidin pNHA which is ecologically important at a national level. This pNHA site is composed of a mosaic of habitats including wet woodland, wet grassland, improved grassland and raised bog. Areas of the priority Annex I habitat type Alluvial woodland [*91E0] have been confirmed through field surveys within the wider pNHA site. The Cyan Option Corridor could result in c. 1ha of direct habitat loss, with the majority of this likely comprising wet and improved grassland. It must be noted that the priority Annex I habitat *91E0 within the study area represents a hydrologically and hydrogeologically interconnected habitat across the River Shannon Callows ecosystem, and while each ecological site has been individually identified and evaluated, the importance of this habitat lies in its connection with and reliance on the hydrological and hydrogeological conditions and functioning in the wider landscape.

At the most westerly point of the Cyan Option Corridor, between nodes A and C the Cyan Option Corridor intersects two ecological sites: namely EC06 and EC12. EC06 is comprised of broadleaved/wet woodland within floodplain of the River Shannon, with potential *91E0 habitat (a priority Annex I habitat) and thus is of international ecological importance. The Cyan Option Corridor clips a small section of EC06 and would result in direct habitat loss of *c.* 0.5ha. EC12 is composed of immature broadleaf and wet woodland which provides amenity value for a local business – "Carrick Quads" and is of local importance (higher value). The majority of this ecological site could be lost as a result of the Cyan Option Corridor being progressed.

Further east, between nodes C and D the Cyan Option Corridor intersects a number of ecological sites including EC35, EC50, EC51 and EC52. EC35 consists of broadleaved/wet woodland, scrub and wet grassland/marsh habitat on the bank of the River Shannon. No Annex I habitats were noted within the corridor. EC50 is of national importance due to the presence of marsh, wet grassland, confirmed Transitional mires and quaking bogs 7140 habitat and scrub which is considered to have the potential to develop into priority Annex I Alluvial woodland *91E0 habitat in the short to medium term. Sites EC51 and EC52 are both of international importance due to the confirmed presence of priority Annex I Alluvial woodland

*91EO habitat. The Cyan Option Corridor clips the northern and western boundaries of EC50, EC51 and EC52 before reconverging with the existing N4 at node D. It is estimated that the corridor could result in the direct loss of c. 3.3ha, c. 1.3ha, and c.4.4ha of habitat loss for EC50, EC51 and EC52 respectively.

The penultimate section of Cyan Option Corridor, between nodes D and E intersects three ecological sites including EC62, EC63 and EC78. All three of these ecological sites are of local importance (higher value). EC62 consists of an artificial lake with surrounding semi-natural grassland and scrub, while EC63 comprises a mixture of broadleaf/wet woodland and wet grassland fields. EC78 comprises a combination of broadleaved/conifer woodland and wet grassland, as well as an area of recently planted oak woodland bordering the existing N4 road. However, the only section of this ecological site that is intersected by the Cyan Option Corridor consists of immature mixed broadleaf woodland and scrub.

The final section of the Cyan Option Corridor, between nodes E and J, crosses three ecological sites as it moves eastward along the existing N4 road – EC80, EC87 and EC88, all of which are valued as being of local importance (higher value). EC80 comprises a conifer plantation bordered by broadleaf/wet woodland along the banks of the River Shannon. Although the Cyan Option Corridor crosses into EC80, there is unlikely to be any direct interaction as this ecological site lies on the opposite side of the River Shannon to the existing N4. Both EC87 and EC88 consist of broadleaf/conifer woodlands.

The Cyan Option Corridor crosses a number of watercourses of local importance (higher value), including the Lismoyle_26 stream, the Kilmaddaroe stream, the Woodbrook House stream, the Tumna stream, the Clooneigh_26 stream, the Kiltycarney stream, the Kildorragh stream, the Killasanowl stream and the Knockananima stream, all of which are tributaries of the River Shannon. In addition to the above, the Cyan Option Corridor also crosses one watercourse – the Killukin stream between node C-D, ranked as being of county importance, as it is known to support populations of brown trout *Salmo trutta*. The Cyan Option Corridor between nodes C and D also crosses one watercourse of national importance, the River Shannon. The River Shannon is a large watercourse which runs through numerous counties intersecting a number of European sites upstream and in the downstream receiving environment, including the Lower River Shannon SAC [002165][61]. Habitats and species for which this is designated are likely to be present throughout the River Shannon watercourse.

The Cyan Option Corridor is ranked as Intermediate for the following reasons:

- It would result in direct impacts (*c.* 1ha) on Lough Eidin pNHA, a site of national importance, as well as another ecological site of national importance, namely EC50 which supports a small area of Annex I 6410 *Molinia* meadow habitat. Lough Eidin pNHA is intersected by three other option corridors, although in respect of landtake, the Cyan Option Corridor results in the lowest area of landtake within the pNHA.

[61] The Lower River Shannon SAC is located in the downstream receiving environment of the proposed corridor and hydrologically connected via the River Shannon.

- It intersects threes sites of international importance – EC06, EC51 and EC52 (with a combined estimated total habitat loss of c. 9.5ha), as well as eight ecological sites of local importance (higher value).
- It crosses one watercourse of national importance – the River Shannon, as well as one watercourse of county importance, namely the Killukin stream. A further nine watercourses of local importance (higher value) are potentially impacted by the Cyan Option Corridor.

Orange Option Corridor

The Orange Option Corridor crosses three watercourses between nodes B and C; the Tumna stream, the Knockadalteen_26 stream and the Knockananima stream, all of which are local importance (higher value). This option crosses one watercourse of county importance between node C and D; the Killukin stream (which is known to support populations of brown trout *Salmo trutta* and one watercourse of national importance between nodes C and D, namely the River Shannon.

Between nodes D and E, the Orange Option Corridor crosses two watercourses (the Kilmaddaroe stream and the Kiltycarney stream), both of which are ranked as being of local importance (higher value) and finally, between nodes E and J the Orange Option Corridor crosses and additional three streams, all of which are valued as local importance (higher value); the Lismoyle stream, the Killasanowl stream and the Kildorragh stream.

The Orange Option Corridor does not intersect with any ecological sites between nodes B and C. Further east, between nodes C and D the Orange Option Corridor intersects a number of ecological sites EC35, EC50, EC51 and EC52. EC35 consists of broadleaved/wet woodland, scrub and wet grassland/marsh habitat on the banks of the River Shannon. No Annex I habitats were noted within this option corridor. Site EC50 is of national importance due to the presence of marsh, wet grassland, confirmed Transitional mires and quaking bogs 7140 habitat and scrub which is considered to have the potential to develop into priority Annex I *91E0 habitat in the short to medium term. EC51 and EC52 are both of international importance due to the confirmed presence of priority Annex I *91E0 habitat. The Orange Option Corridor clips the northern and western boundaries of EC50, EC51 and EC52 before converging with the existing N4 at node D. It is estimated that the corridor could result in the direct loss of c. 2.8ha, c.1.2ha and c.4.4ha of habitat loss for EC50, EC51 and EC52 respectively.

The next section of the Orange Option Corridor, between nodes D and E intersects three ecological sites including EC62, EC63 and EC78. All three of these ecological sites are of local importance (higher value). EC62 consists of an artificial lake with surrounding semi-natural grassland and scrub, while EC63 comprises broadleaf/wet woodland and wet grassland fields. EC78 comprises a combination of broadleaved/conifer woodland and wet grassland as well as an area of recently planted oak woodland bordering the N4. However, the only section of this ecological site that is intersected by the Orange Option Corridor consists of immature mixed broadleaf woodland and scrub.

The final section of the Orange Option Corridor, between nodes E and J, crosses three additional ecological sites including EC80, EC87 and EC88, all of which are valued as being of local importance (higher value). EC80 comprises a conifer plantation bordered by broadleaf/wet woodland along the banks of the River Shannon. Although this option crosses into EC80, there is unlikely to be any direct interaction as this ecological site lies on the opposite side of the River Shannon to the existing N4. Both EC87 and EC88 consist of broadleaf/conifer woodlands.

From a biodiversity perspective, the Orange Option Corridor is the Preferred option corridor West of Drumsna Junction (Node J) for the following reasons:

- It would not result in any impacts to Lough Eidin pNHA (national importance) by virtue of its location. As with all other option corridors, however, it would result in impacts of potentially national significance to the River Shannon, as well as one ecological site of national importance EC50.
- It would result in direct impacts on two sites of international importance – EC51 and EC52 (with an estimated combined total habitat loss of c. 8.4ha).
- It would also impact on seven ecological sites (EC35, EC62, EC63, EC78, EC80, EC87 and EC88) which would be significant at the local scale, as the habitats which would be lost there are of local importance (higher value).
- It would also result in impacts to one watercourse of county importance (Killukin stream), as well as resulting in potential impacts on eight watercourses, significant at the local scale.

Purple West Option Corridor

The Purple West Option Corridor crosses a number of watercourses of local importance (higher value), including the Cornaslieve_26 stream, the Kiltycarney stream, an unnamed stream – Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon, the Kilmaddaroe stream, the Tumna stream, an unnamed stream – from the River Shannon at Annaghbeg to Drumlumman, the Lismoyle stream, the Killasanowl stream, the Kildorragh stream and the Aghameeny stream, all of which are tributaries of the River Shannon. In addition to the above, this option also crosses the River Shannon, a watercourse of national importance, northeast of node B as well as potential interactions with the River Shannon between nodes E and J.

The Purple West Option Corridor could considerably impact Lough Eidin pNHA, an ecologically important site at a national level. This pNHA site is composed of a mosaic of habitats including wet woodland, wet grassland, improved grassland, riparian woodland, marsh and raised bog. The Purple Option Corridor cuts through a large proportion of the pNHA and it is estimated that it could result in c. 2.8ha of direct habitat loss, with the majority of this comprising wet grassland and marsh vegetation. Areas of riparian woodland (with priority Annex I alluvial woodland *91E0 habitat) have been confirmed within and adjacent to the pNHA boundary, as has a stand of Annex I 6410 Molinia grassland habitat, which is within the pNHA where it intersects the Purple West Option Corridor.

Between node B and the River Shannon, on the western side of Carrick-on-Shannon the Purple West Option Corridor bisects ecological site EC16. This ecological site is valued as international importance due to the confirmed presence of priority Annex I alluvial woodland *91E0 habitat. This site, located along the banks of the River Shannon, comprises broadleaved/wet woodland, scrub, marsh and wet grassland. The Purple West Option Corridor is estimated to possibly result in the direct loss of c.3.2ha of EC16, c. 0.7ha of which corresponds to priority Annex I alluvial woodland *91E0 habitat.

Extending north towards Hartley Court, the Purple West Option Corridor completely envelops two ecological sites of local importance (higher value), namely EC27 and EC28, which consist mostly of broadleaf/wet woodland and scrub as well as two other ecological sites of international importance (EC30 and EC32). Both EC30 and EC32 comprise broadleaved/wet woodland and scrub mosaics within the River Shannon floodplain, with potential for priority Annex I alluvial woodland *91E0 habitat. It is estimated that the Purple Option Corridor would result in the direct loss of EC30 and EC32 (c. 0.8ha and 1.8ha respectively). As the Purple Option Corridor continues northeast it crosses into another ecological site EC31, a site of international ecological importance. As with EC30 and EC32, habitats present within EC31 include broadleaved/wet woodland, scrub and wet grassland within the River Shannon floodplain. There is also the potential for *91E0 habitat to occur within this site. This option corridor interacts with the eastern boundary of this ecological site and would result in c. 1.2ha of direct habitat loss.

As the Purple West Option Corridor turns eastward towards node E it interacts with EC47, EC48 and EC49. Both EC47 and EC49 are valued as local importance (higher value) comprising broadleaf/wet woodland and scrub. The Purple Option Corridor intersects a small section of EC47; however, it is unlikely that this will result in any impacts on this ecological site. EC48 consists of broadleaved/wet woodland with potential for priority alluvial woodland *91E0 habitat to occur. EC48 is surrounded by flooded drainage ditches. The entire southern half of EC48 (c. 0.4ha) would likely be lost as a result of this option corridor.

The next section of the Purple West Option Corridor, north of node E intersects the western border of EC78, which is valued as local importance (higher value). EC78 comprises four distinct areas and is characterised by a combination of broadleaved/conifer woodland and wet grassland, as well as an area of recently planted oak woodland bordering the existing N4. However, the only section of this ecological site that is intersected by the Purple West Option Corridor consists of immature mixed broadleaf woodland and scrub and an area of mixed broadleaf/conifer woodland.

The final section of the Purple West Option Corridor, between nodes E and J, crosses three additional ecological sites including EC80, EC87 and EC88, all of which are valued as being of local importance (higher value). EC80 comprises a conifer plantation bordered by broadleaf/wet woodland along the banks of the River Shannon. Although this option crosses into EC80, there is unlikely to be any direct interaction as this ecological site lies on the opposite side of the River Shannon to the existing N4. Both EC87 and EC88 consist of broadleaf/conifer woodlands.

From a biodiversity perspective, the Purple West Option Corridor is Least Preferred for the following reasons:

- It is estimated that it would result in considerable impacts on Lough Eidin pNHA (c. 28.2ha of direct habitat loss), the greatest loss of habitat across all of the options that intersect with the pNHA, with the exception of the Dark Green Option. Both the Dark Green Option and the Purple option completely bisect the pNHA. Although not statutorily proposed for designation, pNHA's are afforded strict protection under planning objectives contained within the Leitrim County Development Plan 2015- 2021
- It would also have direct impacts on five sites of international importance including EC16, EC30, EC31, EC32 and EC48 (with an estimated combined total habitat loss of c. 7.4ha)
- It could also result in impacts of potentially national significance to the River Shannon

It would also result in impacts on 10 watercourses and eight ecological sites of local importance (higher value).

In summary, given the interaction between the Purple West Option Corridor and the pNHA and given the strict protection currently afforded to pNHA's under planning objectives contained within the Leitrim County Development Plan 2015-2021 this option has been ranked as Least Preferred. This is reinforced by the interactions between the Purple Option Corridor and five additional ecological sites of international importance.

Dark Green Option Corridor

The Dark Green Option Corridor crosses a number of watercourses of local importance (higher value), including the Cornaslieve_26 stream, an unnamed stream – Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon, the Kilmaddaroe stream, the Tumna stream, an unnamed stream – from the River Shannon at Annaghbeg to Drumlumman, the Lismoyle stream, the Killasanowl stream, the Kildorragh stream and the Aghameeny stream, all of which are tributaries of the River Shannon. In addition to the above, this option also crosses the River Shannon, a watercourse of national importance, northeast of node B.

The Dark Green Option Corridor would considerably impact Lough Eidin pNHA, an ecologically important site at a national level. This pNHA site is composed of a mosaic of habitats including wet woodland, wet grassland, improved grassland, riparian woodland, marsh and raised bog. The Dark Green Option Corridor cuts through a significant proportion of the pNHA and it is estimated that it could result in c. 2.8ha of direct habitat loss, with the majority of this comprising wet grassland and marsh vegetation. Areas of riparian woodland (with priority Annex I alluvial woodland *91E0 habitat) have been confirmed within and adjacent to the pNHA boundary, as has a stand of Annex I 6410 *Molinia* grassland habitat, which is within the pNHA where it intersects the Dark Green Option Corridor.

Between node B and the River Shannon, on the western side of Carrick-on-Shannon the Dark Green Option Corridor bisects ecological site EC16. This ecological site is valued as international importance due to the confirmed presence of priority Annex I alluvial woodland *91E0 habitat. This site, located along the banks of the River Shannon, comprises broadleaved/wet woodland, scrub, marsh and wet grassland. The Dark Green Option Corridor is estimated to possibly result in the direct loss of c. 3.2ha of EC16, c. 0.7ha of which corresponds to priority Annex I alluvial woodland *91E0 habitat.

Extending north towards Hartley Court, the Dark Green Option Corridor completely envelops two ecological sites of local importance (higher value), namely EC27 and EC28, which consist mostly of broadleaf/wet woodland and scrub as well as two other ecological sites of international importance (EC30 and EC32). Both EC30 and EC32 comprise broadleaved/wet woodland and scrub mosaics within the River Shannon floodplain, with potential for priority Annex I *91E0 habitat. It is estimated that the Dark Green Option Corridor would result in the direct loss of EC30 and EC32 (c. 0.8ha and c. 1.8ha respectively). As this option corridor continues northeast it crosses into another ecological site EC31, a site of international ecological importance. As with EC30 and EC32, habitats present within EC31 include broadleaved/wet woodland, scrub and wet grassland within the River Shannon floodplain. There is also the potential for *91E0 habitat to occur within this site. This option corridor interacts with the eastern boundary of this ecological site and would result in c. 1.2ha of direct habitat loss.

As the Dark Green Option Corridor turns eastward towards node E it interacts with EC47, EC48 and EC49. Both EC47 and EC49 are valued as local importance (higher value) comprising broadleaf/wet woodland and scrub. The Dark Green Option Corridor intersects a small section of EC47, and it is predicted unlikely that any impacts on this ecological site will occur as a result of this option corridor being progressed. EC48 consists of broadleaved/wet woodland with potential for priority Annex I alluvial woodland *91E0 habitat to occur. EC48 is surrounded by flooded drainage ditches. The entire southern half of EC48 (c. 0.4ha) would likely be lost as a result of this option corridor.

The next section of the Dark Green Option Corridor heading towards node J bisects EC77, which is valued as international importance. EC77 comprises broadleaved woodland, scrub, semi-natural grassland and wet grassland based on orthophotography. Given the timing associated with the inclusion of the Dark Green option corridor it was not possible to survey EC77, however based on desktop data and orthophotography EC77 has potential for peatland habitats and associated Annex I habitats. In light of this EC77 was valued as international importance on a precautionary basis. The Dark Green Option Corridor would result in c. 7.5ha of direct habitat loss on EC77.

The final section of the Dark Green Option Corridor, between nodes E and J, crosses three additional ecological sites; EC87 and EC88, both of which are valued as being of local importance (higher value) and consist of broadleaf/conifer woodlands.

From a biodiversity point of view, the Dark Green Option Corridor is the Least Preferred for the following reasons:

- It is estimated that it would result in significant impacts on Lough Eidin pNHA (c. 28.2ha of direct habitat loss), the greatest loss of habitat across all of the option corridors that intersect the pNHA, with the exception of the Purple Option Corridor described above. Both the Dark Green Option and the Purple option completely bisect the pNHA. Although not statutorily proposed for designation, pNHA's are afforded strict protection under Planning objectives contained within the County Development Plan 2015-2021.
- It would also have direct impacts on six sites of international importance including EC16, EC30, EC31, EC32, EC48 and EC77 (this option corridor impacts the greatest number of internationally valued ecological sites.)
- It could result in impacts of potentially national significance to the River Shannon.
- It would also result in impacts on nine watercourses and six ecological sites of local importance (higher value).

As with the Purple Option Corridor described above, the primary reasoning behind the ranking of the Dark Green Option Corridor is the interaction between this option corridor and the pNHA and the strict protection currently afforded to pNHA's under planning objectives contained within the Leitrim County Development Plan 2015-2021. The Dark Green Option Corridor is ranked less preferred than the Purple Option Corridor as it also interacts with six additional ecological sites of international importance.

Blue West Option Corridor

The Blue West Option Corridor crosses a number of watercourses of local importance (higher value), including Clougher stream and the Ardglass stream between nodes O and A, the Woodbrook House stream, the Tumna stream and the Clooneigh stream between nodes A and B, the Aghancarra stream, the Attifinlay stream, the Knockadalteen stream and the Knockananima stream between nodes B and D, the Kiltycarney stream and the Kilmaddaroe stream between nodes D and E and finally the Lismoyle stream, the Kildorragh stream and the Killasanowl stream between nodes E and J.

The Blue West Option Corridor also crosses one watercourse of national importance, the River Shannon, between nodes B and D.

The Blue West Option Corridor impacts on Lough Eidin pNHA, once between node O and A and once again between nodes A and B. Lough Eidin pNHA is ecologically important at a national level. This pNHA site is composed of a mosaic of habitats including wet woodland, wet grassland, improved grassland and raised bog. Areas of the priority Annex I habitat type Alluvial woodland [*91E0] have been confirmed through survey within the wider pNHA site. The Blue Option Corridor could result in c. 7.9ha of direct habitat loss, with the majority of this likely comprising wet and improved grassland.

As the Blue West Option Corridor begins at node O and progresses towards node A it interacts with two ecological sites of local importance (higher value); EC02 and EC03, both of which consist of mixed broadleaf woodland based on desktop

information and orthophotography, and two ecological sites of international importance; EC05 and EC06. EC06 is comprised of broadleaved/wet woodland within floodplain of the River Shannon, with potential *91E0 habitat (a priority Annex I habitat). The Blue Option Corridor clips a small section of EC06 and would result in direct habitat loss of c. 1.5ha. Based on a review of orthophotography, EC05 has potential to host priority Annex I Alluvial woodland *91E0 habitat as well as other wet grassland habitat for which Lough Eidin pNHA is designated. This is reinforced by the proximity of the site to EC06 and Lough Eidin pNHA.

The Blue West Option Option Corridor does not interact with any ecological sites between nodes A and B or B and D.

On the northern side of the River Shannon, just past node D, the Blue West Option Corridor clips the northern section of EC52. EC52 is of international importance due to the confirmed presence of priority Annex I Alluvial woodland *91EO habitat. The corridor clips the northern boundary of EC50 adjacent to the existing N4. It is estimated that the option corridor could result in the direct loss of c.0.8ha of habitat loss for EC50. Further east, between nodes D and E the Blue Option Corridor intersects three ecological sites of local importance (higher value); EC62, EC63 and EC78. EC62 consists of an artificial lake with surrounding semi-natural grassland and scrub, while EC63 comprises broadleaf/wet woodland and wet grassland fields. EC78 comprises a combination of broadleaved/conifer woodland and wet grassland as well as an area of recently planted oak woodland bordering the existing N4. However, the only section of this ecological site that is intersected by the Blue West Option Corridor consists of immature mixed broadleaf woodland and scrub.

The final section of the Blue West Option Corridor, between nodes E and J, crosses three ecological sites as it moves eastward along the existing N4 – EC80, EC87 and EC88, all of which are valued as being of local importance (higher value). EC80 comprises a conifer plantation bordered by broadleaf/wet woodland along the banks of the River Shannon. Although this option crosses into EC80, there is unlikely to be any direct interaction as this ecological site lies on the opposite side of the River Shannon to the existing N4. Both EC87 and EC88 consist of broadleaf/conifer woodlands.

From a biodiversity perspective, the Blue West Option Corridor is ranked as Intermediate for the following reasons:

- It would result in direct impacts (c.7.9ha) on Lough Eidin pNHA, a site of national importance, at two separate locations. Lough Eidin pNHA is intersected by three other option corridors. However, unlike the Dark Green and Purple options which completely bisect the pNHA, this option only clips a small section of the designated site adjacent to the existing N4, northwest of Carrick-on-Shannon
- It intersects threes sites of international importance – EC05, EC06 and EC52 (with a combined estimated total habitat loss of c. 2.8ha), as well as eight ecological sites of local importance (higher value)

- It crosses one watercourse of national importance – the River Shannon, as well as 14 watercourses of local importance (higher value)

Table 7.5.9.3 contains the Assessment Matrix of the option corridors west of Drumsna Junction (Node J) and Table 7.5.9.5 contains the Assessment Matrix of the option corridors east of Drumsna Junction (Node J).

Table 7.5.9.3 Biodiversity Assessment Matrix of Options Corridors West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE OPTION CORRIDOR		BLACK OPTION CORRIDOR*
Significant impact on sites of International Importance	3 Major or Highly Negative impacts	2 Major or Highly Negative impacts	5 Major or Highly Negative impacts	6 Major or Highly Negative impacts	3 Major or Highly Negative impacts		0 Major or Highly Negative impact
Significant impact on sites of National Importance	2 Major or Highly Negative impacts	1 Major or Highly Negative impacts	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts		0 Major or Highly Negative impact
Significant impact on sites of County Importance	2 Moderately Negative impacts	2 Moderately Negative impacts	0 Moderately Negative impact	0 Moderately Negative impact	0 Moderately Negative impact		0 Moderately Negative impact
Significant impact on sites of Local Importance (Higher Value)	17 Minor or Slightly Negative	15 Minor or Slightly Negative	18 Minor or Slightly Negative	15 Minor or Slightly Negative	22 Minor or Slightly Negative		2 Minor or Slightly Negative
Overall Assessment	There are 5 Major or Highly Negative impacts, 2 Moderately Negative and 17 Minor or Slightly Negative impacts associated with this option corridor	There are 3 Major or Highly Negative impacts, 2 Moderately Negative and 15 Minor or Slightly Negative' impacts associated with this option corridor	There are 7 Major or Highly Negative impacts, 0 Moderately Negative and 18 Minor or Slightly Negative impacts associated with this option corridor	There are 8 Major or Highly Negative impacts, 0 Moderately Negative and 15 Minor or Slightly Negative' impacts associated with this option corridor	There are 5 Major or Highly Negative impacts, 0 Moderately Negative and 22 Minor or Slightly Negative impacts associated with this option corridor		There are 0 Major or Highly Negative impacts, 0 Moderately Negative' and 2 Minor or Slightly Negative impacts associated with this option corridor

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE OPTION CORRIDOR		BLACK OPTION CORRIDOR*
Scoring							
Qualitative Assessment	Impacts on Lough Eidin pNHA (a nationally important site), three internationally important sites with potential *91E0 Annex I habitat, the River Shannon (a river of national importance), one ecological site of county importance, one watercourses of county importance (Killukin stream) and 17 ecological sites of local importance (higher value) including eight ecological sites and nine watercourses. **Major** or **Highly Negative**	Impacts on two internationally important sites with potential *91E0 Annex I habitat, the River Shannon (a river of national importance), one ecological site of County importance, one watercourses of county importance (Killukin stream) and 15 ecological sites of local importance (higher value) including seven ecological sites and eight watercourses. **Major** or **Highly Negative**	Impacts on Lough Eidin pNHA (a nationally important site), five internationally important sites with potential priority Annex I habitat, the River Shannon (a river of national importance), and 18 ecological sites of local importance (higher value) including eight ecological sites and 10 watercourses. **Major** or **Highly Negative**	Impacts on Lough Eidin pNHA (a nationally important site), six internationally important sites with potential priority Annex I habitats, the River Shannon (a river of national importance), and 15 ecological sites of local importance (higher value) including six ecological sites and nine watercourses. **Major** or **Highly Negative**	Impacts on Lough Eidin pNHA (a nationally important site), three internationally important sites with potential priority Annex I habitat, the River Shannon (a river of national importance) and 11 ecological sites of local importance (higher value) including eight ecological sites and 14 watercourses. **Major** or **Highly Negative**		Impacts on two watercourses of local importance (higher value). **Minor** or **Slightly Negative**
Score / Impact Level	**1**	**1**	**1**	**1**	**1**		**3**
Preference	**Intermediate**	**Preferred**	**Least Preferred**	**Least Preferred**	**Intermediate**		**N/A**

* *This Option Corridor is assessed independently and not compared to the other Option Corridors and as such is not given a preference ranking*

Ecological Receptors East of Drumsna Junction (Node J)

Table 7.5.9.4 below provides a summary of the number of ecological receptors impacted by each option corridor.

Table 7.5.9.4 No. of Biodiversity Impacts for each Option Corridors – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Significant impact on sites of International Importance (Major or Highly Negative)	3	3	3	3
Significant impact on sites of National Importance (Major or Highly Negative)	1	1	1	1
Significant impact on sites of County Importance (Moderately Negative)	1	1	1	1
Significant impact on sites of Local Importance (Higher Value) (Minor or Slightly Negative)	5	5	5	5

<u>Yellow Option Corridor</u>

The Yellow Option Corridor has a largely similar footprint as the Green and Blue Option Corridors and therefore crosses the same watercourses and ecological sites including three sites of international importance (EC99, EC105 and EC113), one site of national importance (River Shannon), one site of county importance (EC97) and seven sites of local importance (higher value).

The Yellow Option Corridor does however differ towards the end of the corridor, between nodes G and H, where it deviates slightly from the existing N4 and crosses further into EC112 (a site of local importance (higher value)) than either the Blue or Green Option Corridors. It is estimated that this option corridor would result in c. 2.5ha of habitat loss of EC112, while the Green and Blue Option Corridors would result in c. 0.8ha of direct habitat loss.

The Yellow Option Corridor was ranked as Intermediate. However, as it crosses slightly further into EC112, it was on a qualitative basis ranked slightly lower than the two preferred options. It is estimated that the difference in total habitat loss at EC112 is minor (c. 1.7ha) especially as this ecological site is valued as local importance (higher value).

Green Option Corridor

The Green Option Corridor crosses three watercourses of local importance (higher value) between nodes J and F; an unnamed stream – border of Annaduff and Derryoughter, an unnamed stream – border of Annaduff and Gortinty and the Drumsna stream and one watercourse of local importance (higher value) between nodes F and G – the Gortinity stream. Additionally, this option corridor interacts with the River Shannon, a nationally important watercourse between nodes J and F.

As the Green Option Corridor begins southeast from node J, it cuts the western edge of EC97. EC97 consists of Gortconnellan/Spa Lough and the associated wet grassland and scrub surrounding the lake. This ecological site has been valued as being of county importance due to the presence of lake and wet grassland habitat, and its potential utilisation by wetland bird species, especially considering its proximity and connectivity (via the Drumsna stream) to the River Shannon.

After EC97, the Green Option Corridor interacts with two ecological sites of international importance prior to reaching node F, namely EC99 and EC105. EC99 is a large site consisting of wet grassland, scrub and broadleaf/wet woodland with potential for priority Annex I Alluvial woodland *91E0 habitat to occur along the banks of the River Shannon. This ecological site runs from the existing N4 along between the River Shannon and the Masonite industrial facility until it reaches the Dublin to Sligo railway line to the south. Although this is a larger site, the Green Option Corridor only cuts a small section of the northern border (c. 2ha). EC105 comprises Grumgilra/Gortinity Lough as well as the surrounding wet grasslands, scrub and broadleaf/wet woodland. This site has been valued as international important due to the potential for priority Annex I Alluvial woodland *91E0 habitat to occur there, as well as the presence of confirmed Birds Directive Annex I Whooper swan *Cygnus cygnus* feeding locations (observed within the wet grassland fields along the south-eastern bank of the lake). As with EC99, this is a large ecological site, however the Green Option Corridor only cuts a portion of the northern border (c. 13.5ha).

There are no interactions between the Green Option Corridor and an ecological site between nodes F and G.

At the final section of the Green Option Corridor, between nodes G and H, the corridor crosses EC112, which is valued as being of local importance (higher value) and EC113 which is valued as being internationally important. EC112 consists of wet grassland and scrub with small areas of broadleaf/wet woodland. EC113 comprises Bog Lough and the associated wet grassland, peatland and woodland habitats, which potentially support Annex I peatland and priority Annex I woodland habitats (e.g., 91D0 (Bog woodland) and *91E0)). This option corridor is estimated to intersect a small section of the western corner (c. 0.7ha) of EC113.

As described in the following sections, all four option corridors to the east of Drumsna Junction (Node J) follow a very similar footprint and interact with the same number of ecological sites and watercourses with any differences between the option corridors being minor. In light of this, all four options are scored similarly (in terms of intersections with ecological sites).

From a biodiversity perspective, the Green Option Corridor is ranked preferred. While it crosses the same numbers of ecological sites as both the Yellow and Purple East Option Corridors, e.g. three sites of international importance, one site of national importance, one site of county importance and seven sites of local importance (higher value), it differs from the Yellow Option Corridor by virtue of its routing along the existing N4 road corridor, resulting in c. 0.8ha of direct habitat loss of EC112 (a site of local importance (higher value) as opposed to c. 2.5ha of habitat loss required for the Yellow Option Corridor.

Purple East Option Corridor

The majority of the Purple East Option Corridor follows the existing N4 with the exception of an off-line deviation around the village of Aghamore between nodes F and G. It also includes a wider footprint to accommodate a proposed junction near Drumsna. The Purple East Option Corridor intersects/crosses the same watercourses and ecological sites as the Green, Yellow and Blue East Option Corridors. These include three sites of international importance (EC99, EC105 and EC113), one site of national importance (River Shannon), one site of County importance (EC97) and seven sites of local importance (higher value).

The only location where this option corridor differs in respect of potential loss of an ecological site, is where it intersects more of EC97, which is ranked as being of county importance. It is estimated that the Purple East Option Corridor would result in an additional loss of EC97 of c. 2ha.

The Purple East Option Corridor was assessed as being the Least Preferred, due to the fact that it would involve slightly more habitat loss of EC97 (a site of county importance) compared with the Green, Yellow and Blue East Option Corridors.

Blue East Option Corridor

The Blue East Option Corridor has an almost identical footprint to the Green Option Corridor and intersects with the same ecological sites and watercourses including three sites of international importance (EC99, EC105 and EC113), one site of national importance (River Shannon), one site of county importance (EC97) and seven sites of local importance (higher value). In light of the similarities between these options, the Green Option and Blue East Option have both been classified as joint Preferred.

Table 7.5.9.5 Biodiversity Assessment Matrix of Option Corridors East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Significant impact on sites of International Importance	3 Major or Highly Negative impacts	3 Major or Highly Negative impacts	3 Major or Highly Negative impacts	3 Major or Highly Negative impacts
Significant impact on sites of National Importance	1 Major or Highly Negative impact	1 Major or Highly Negative impact	1 Major or Highly Negative impact	1 Major or Highly Negative impact
Significant impact on sites of County Importance	1 Moderately Negative impact	1 Moderately Negative impact	1 Moderately Negative impact	1 Moderately Negative impact
Significant impact on sites of Local Importance (Higher Value)	5 Minor or Slightly Negative	5 Minor or Slightly Negative	5 Minor or Slightly Negative	5 Minor or Slightly Negative
Overall Assessment	There are 4 Major or Highly Negative impacts, 1 Moderately Negative and 5 Minor or Slightly Negative' impacts associated with this option corridor	There are 4 Major or Highly Negative impacts, 1 Moderately Negative and 5 Minor or Slightly Negative impacts associated with this option corridor	There are 4 Major or Highly Negative impacts, 1 Moderately Negative and 5 Minor or Slightly Negative impacts associated with this option corridor	There are 4 Major or Highly Negative impacts, 1 Moderately Negative and 5 Minor or Slightly Negative impacts associated with this option corridor

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Scoring				
Qualitative Assessment	Impacts on three Internationally important sites with potential to support *91E0 Annex I habitat, the River Shannon (a river of national importance), one ecological site of county importance and five ecological sites of local importance (higher value) including one ecological site and four watercourses. **Major** or **Highly Negative**	Impacts on three Internationally important sites with potential to support *91E0 Annex I habitat, the River Shannon (a river of national importance), one ecological site of county importance and five ecological sites of local importance (higher value) including one ecological site and four watercourses. **Major** or **Highly Negative**	Impacts on three Internationally important sites with potential to support *91E0 Annex I habitat, the River Shannon (a river of national importance), one ecological site of county importance and five ecological sites of local importance (higher value) including one ecological site and four watercourses. **Major** or **Highly Negative**	Impacts on three Internationally important sites with potential to support *91E0 Annex I habitat, the River Shannon (a river of national importance), one ecological site of county importance and five ecological sites of local importance (higher value) including one ecological site and four watercourses. **Major** or **Highly Negative**
Score / Impact Level	**1**	**1**	**1**	**1**
Preference	**Intermediate**	**Preferred**	**Least Preferred**	**Preferred**

7.5.9.4 Summary

Key ecological receptors within the study area were identified and assigned an ecological value based on a geographic frame of reference ranging from international to local importance. The likely impacts of each of the option corridors on the key ecological receptors were identified and assessed, indicating which, if any, of these are likely to be significant, and at what geographical level.

The impacts of each of the option corridors on the key ecological receptors were identified and assigned an impact rating. The overall cumulative impact of each option corridor across all the key ecological receptors affected was then scored in accordance with the TII approach2, on a seven-point scale ranging from major or highly negative (1) to major or highly positive (7). The scores attributed to each of the option corridors were assessed comparatively and assigned a preference ranking.

Table 7.5.9.6 and Table 7.5.9.7 outline which ecological receptors are impacted by each of the option corridors west of Drumsna Junction (Node J) and east of Drumsna Junction (Node J) respectively.

West of Drumsna Junction (Node J), the Orange Option Corridor was ranked Preferred, whilst the Purple West and Dark Green Corridor were all ranked Least Preferred. The Cyan and Blue corridor were all ranked as Intermediate. The Black Option Corridor was assessed as a stand-alone option and was considered to be minor negative.

East of Drumsna Junction (Node J), the Green and Blue East Option Corridors were ranked Preferred, the Yellow Option Corridor was ranked Intermediate, and the Purple East Option Corridor was ranked Least Preferred.

Table 7.5.9.6 Breakdown of the Key Ecological Receptors which are Impacted by the Proposed Option Corridors – West of Drumsna Junction (Node J)

Option Corridors West of Drumsna Junction (Node J)				
	Receptors of International Importance Impacted	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Black Option Corridor				• Attifinlay Stream • Lisnagat Stream
Cyan Option Corridor	• EC06 • EC51 • EC52	• Lough Eidin pNHA [001643] • River Shannon • EC50	• Killukin stream	• EC12 • EC35 • EC62 • EC63 • EC78 • EC80 • EC87 • EC88 • Lismoyle_26 stream • Kilmaddaroe stream • Woodbrook House stream • Clooneigh_26 stream • Knockananima stream • Tumna stream • Killasanowl stream • Kildorragh_26 stream • Kiltycarney stream
Orange Option Corridor	• EC51 • EC52	• River Shannon • EC50	• Killukin stream	• EC35 • EC62 • EC63 • EC78

Option Corridors West of Drumsna Junction (Node J)				
	Receptors of International Importance Impacted	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
				• EC80 • EC87 • EC88 • Kiltycarney stream • Kilmaddaroe stream • Knockadalteen_26 stream • Knockananima stream • Tumna stream • Lismoyle_26 stream • Kildorragh_26 stream • Killasanowl stream
Purple Option Corridor	• EC16 • EC30 • EC31 • EC32 • EC48	• Lough Eidin pNHA [001643] • River Shannon		• EC27 • EC28 • EC47 • EC49 • EC78 • EC80 • EC87 • EC88 • Cornaslieve_26 stream • Kiltycarney stream • Lismoyle_26 stream • Kildorragh_26 stream • Unnamed stream - Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon

Option Corridors West of Drumsna Junction (Node J)				
	Receptors of International Importance Impacted	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
				• Kilmaddaroe stream • Tumna stream • Killasanowl stream • Aghameeny stream • Unnamed stream - from the Shannon at Annaghbeg to Drumlumman
Dark Green Option Corridor	• EC16 • EC30 • EC31 • EC32 • EC48 • EC77	• Lough Eidin pNHA [001643] • River Shannon		• EC27 • EC28 • EC47 • EC49 • EC87 • EC88 • Lismoyle_26 stream • Kilmaddaroe stream • Killasanowl stream • Kildorragh_26 stream • Tumna stream • Aghameeny stream • Unnamed stream - from the Shannon at Annaghbeg to Drumlumman • Cornaslieve_26 stream • Unnamed stream - Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon

Option Corridors West of Drumsna Junction (Node J)				
	Receptors of International Importance Impacted	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Blue Option Corridor	• EC05 • EC06 • EC52	• Lough Eidin pNHA [001643] • River Shannon		• EC02 • EC03 • EC63 • EC63 • EC78 • EC80 • EC87 • EC88 • Clougher stream [Roscommon] • Aghancarra stream • Ardglass stream • Kiltycarney stream • Lismoyle_26 stream • Kildorragh_26 stream • Attfinlay stream • Kilmaddaroe stream • Tumna stream • Woodbrook house stream • Knockadalteen_26 stream • Knockananima stream • Clooneigh_26 stream • Killasanowl stream

Table 7.5.9.7 Breakdown of the Key Ecological Receptors which are Impacted by the Proposed Option Corridors – East of Drumsna Junction (Node J)

Option Corridors East of Drumsna Junction (Node J)				
	Receptors of International Importance Impacted	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Green Option Corridor	• EC99 • EC105 • EC113	• River Shannon	• EC97	• EC112 • Drumsna stream • Unnamed stream - border of Annaduff and Gortinty • Gortinity stream • Unnamed stream - border of Annaduff and Derryoughter
Yellow Option Corridor	• EC99 • EC105 • EC113	• River Shannon	• EC97	• EC112 • Drumsna stream • Unnamed stream - border of Annaduff and Gortinty • Gortinity stream • Unnamed stream - border of Annaduff and Derryoughter
Purple Option Corridor	• EC99 • EC105 • EC113	• River Shannon	• EC97	• EC112 • Drumsna stream • Unnamed stream - border of Annaduff and Gortinty • Gortinity stream • Unnamed stream - border of Annaduff and Derryoughter

Option Corridors East of Drumsna Junction (Node J)				
	Receptors of International Importance Impacted	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Blue Option Corridor	• EC99 • EC105 • EC113	• River Shannon	• EC97	• EC112 • Drumsna stream • Unnamed stream - border of Annaduff and Gortinty • Gortinity stream • Unnamed stream - border of Annaduff and Derryoughter

7.5.10 Stage 1 Hydrology Option Assessment

7.5.10.1 Introduction

This section details the Stage 1 Assessment of the Options in the context of the hydrological constraints identified in Section 4.13 Hydrology of this report.

The Hydrology constraints are presented with the Stage 1 Option Corridors in Figures 7.5.10.1.0 to 7.5.10.4.5.

Section 7.5.10.2 outlines the methodology that was used to carry out the study, including the assessment criteria. The assessment is presented in Section 7.5.10.3 with a section dealing with the assessment west of Node J and a section dealing with the assessment east of Node J.

The options included in this assessment fall under the following headings:

- Management Option (Blue Option Corridor) (interventions on the existing infrastructure to address the identified transport problems as described in Section 7.1.2 of this document)
- Do-Something Road Based Options

A total of ten option corridors have been taken forward to the preliminary options as described in Section 7.1.2 of this report. There are six option corridors to the west of Node J at Drumsna Junction (Purple West, Dark Green, Black, Orange, Cyan and Blue West) and four option corridors to the east of Node J at Drumsna Junction (Purple East, Green, Yellow and Blue East).

7.5.10.2 Methodology

The principal objectives of the study are to:

- Complete a desk study and field investigations to obtain relevant hydrological data for each proposed option
- Identify and describe sites of known potential hydrological interest
- Assess the significance of the likely impacts of the proposed road scheme on each of these hydrological receptors along each route option corridor
- To evaluate and compare each option based on hydrological criteria, as per NRA Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes[62], taking into account interactions with other environmental disciplines

[62] NRA, Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available from: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

- To assess each option in accordance with the TII Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (2016)2
- Based on the above assessment, to assess, compare and rank the preferred option in order of preference

In fulfilling these objectives, an assessment on the likely impacts of the options on hydrological constraints and ecological receptors, can be carried out. An informed choice can therefore be made with the knowledge of the potential ecological consequences. This enables the importance of the proposed effects and the scope for mitigating these to be appropriately evaluated.

The extent of the overall study areas has been identified and detailed in Chapter 4 Constraints Study, refer to Hydrology Constraints Figures 4.13.1.0 to 4.13.4.5.

The TII Guidelines provide criteria for ranking of the identified hydrological constraints within the assessment study area. Criteria for rating an impact significance that may arise at each hydrological constraint are provided within Box 4.4 of the TII Guidelines and are reproduced in Table 7.5.10.1 below. The impact significance assessment takes into account the attribute importance and the predicted scale and duration of the likely impacts.

Table 7.5.10.1 Criteria for Rating Impact Significance at Route Selection Stage – Rating of Significant Environmental Impacts at Route Selection Stage from Box 4.4 of the Guidelines and associated TII PAG Scores

Impact Level	Attribute Importance				
	Extremely High**	**Very High**	**High**	**Medium**	**Low**
Profound (PAG Major or Highly Negative, 1)	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant (PAG Major or Highly Negative, 1)	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on Significant proportion of attribute		
Moderate (PAG Moderately Negative, 2)	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight (PAG Minor or Slightly Negative, 3)		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible (Not			Temporary impact on small	Temporary impact on significant	Permanent impact on small

Impact Level	Attribute Importance				
	Extremely High**	**Very High**	**High**	**Medium**	**Low**
Significant or Neutral, 4)			proportion of attribute	proportion of attribute	proportion of attribute

***In rating impacts on an 'European site' account must be taken of Article 6(3) and 6(4) of the Habitats Directive (Council Directive 92/43/EEC). Also see guidance contained within Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev 2, National Roads Authority, 2008)*

The TII Guidelines qualitative significance rating of environmental impacts has been correlated with the equivalent qualitative and quantitative assessment scores from the TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi-Criteria Analysis2 and listed in Table 7.3.1. It should be noted that only negative potential impacts are considered in the TII Guidelines whereas the TII PAG multi-criteria assessment is based on the seven-point scale listed in Table 7.3.1 of this report.

Table 7.5.10.2 Correlation of TII Guidelines Significance Rating to an Equivalent TII PAG Score

Significance Rating (TII Guidelines[j])	Equivalent PAG (Description)	Equivalent PAG (Value)
Profound	Major or Highly Negative	1
Significant	Major or Highly Negative	1
Moderate	Moderately Negative	2
Slight	Minor or Slightly Negative	3
Imperceptible	Not Significant or Neutral	4

The final stage of the assessment methodology was to ensure that the requirements of the TII PAG Unit 7.0 - Multi-Criteria Analysis2 were also met by assigning a score to each alternative option based on the scoring procedure within these Guidelines. Where a positive score is assigned, they are from the TII PAG scoring system.

Using the impact scores and professional judgement, the preferred, intermediate or least preferred alternative options were identified.

Stage 1 Options Assessment

Introduction

A total of ten option corridors have been taken forward to the Stage 1 Preliminary Options Assessment as outlined in Table 7.5.10.3 and illustrated with the Hydrology constraints in Figures 7.5.10.1.0 to 7.5.10.4.5.

A preliminary horizontal alignment representing the centreline of the Corridor is provided with the total Corridor width set at 300m (150m either side of the centreline alignment) to allow for movement of the alignment where required. The

total corridor width of 150m is set for the Black Option Corridor (75m either side of the centreline alignment).

The option corridors are assessed in two distinct sections to the west of Drumsna Junction (Node J) and to the east of Drumsna Junction (Node J).

Table 7.5.10.3 Option Corridors

Option Corridors West of Node J	Option Corridors East of Node J
Cyan	Green
Orange	Yellow
Purple West	Purple East
Dark Green	Blue East
Blue West	
Black	

7.5.10.3 Assessment Criteria

In terms of surface hydrology the interception of surface hydrological attributes which are considered in the Option Corridor assessment comprise of features such as watercourses (drains, streams and rivers), standing waterbodies (ponds and lakes), hydro ecological features (comprising wetland and peatland areas, springs and risings, groundwater fed fens), surface water resources (surface water abstractions and potable water supply sources), soft sediments and poor ground conditions and floodplains and flood risk area.

The watercourse intercepted are categorised as follows by their associated catchment areas:

- small drain < 0.25km^2 (25ha)
- small stream 0.25 to 5km^2 (25 to 500ha)
- medium stream 5 to 10km^2 (500 to 1000ha)
- large stream 10 to 20 km^2
- small river 20 to 50km^2
- medium river 50 to 500km^2
- large river > 500km^2

The attribute importance has been assigned based on the criteria set out in Box 4.2 of the TII Guidelines. The streams and small rivers in excess of 0.25km^2 and less than 50 km^2 are attributed medium given their local value. Rivers in excess of 50km^2 and less than 500km^2 are attributed a high importance given their county importance status and the larger rivers in excess of 500km^2 are attributed a very high status given their national importance. It is assumed that all streams and rivers small to large should be considered to be potentially fishery watercourses with

spawning potential. Watercourses namely drains with catchment areas of less than 25ha are considered to be of low importance given their local low status.

Table 7.5.10.4 Watercourses - Attribute Importance

EPA Name	EPA Code	Catchment Area (km^2)	Attribute Importance
River Shannon	26S02	1,300	Very High
Clogher	26C18	28.6	Medium
Ardglass Stream	26A12	2.9	Medium
Woodbrook House Stream	26W01	2.5	Medium
Clooneigh26	26C55	3.0	Medium
Tumma	26T07	1.3	Medium
Caldragh	N/A	1.65	Medium
Kilmaddaroe Stream	N/A	5.79	Medium
Knockadalteen26	26K30	3.5	Medium
Knockananima Stream	26K25	7.6	Medium
Lisnagat	26L18	1.9	Medium
Attifinlay	26A18	1.1	Medium
Drumercool	26D31	1.43	Medium
Killukin River	26D31	33.9	Medium
Danesfort	26D49	0.2	Low
Tonrevagh R	26T97	21	Medium
Rock26	26R17	2.4	Medium
Attirory Stream	26A26	1.4	Medium
Kilmaddaroe Stream	26K24	8.3	Medium
Pollnagappul	26P05	0.9	Medium
Sallaghan26	26S24	0.2	Medium
Kiltycarney	26K39	0.5	Medium
Lismoyle26	26L41	0.7	Medium
Killasanowl	26K38	3.9	Medium
KilDorragh26	26K41	0.6	Medium
Drumsna R	26D53	17.2	Medium
Gortinty Stream	26G35	8.5	Medium
Drumcleavry R	26D57	13.4	Medium
Ardanaffrin	26A40	0.5	Medium
Antfield	26A30	1.5	Medium

Standing Waterbodies

Floodplains and Flood Risk Areas

The floodplains intercepted are categorised as follows by their associated catchment areas:

- Floodplain protecting rural lands with 1 to 5 residential or commercial properties including farm yards from flooding – Low Importance
- Floodplain protecting rural lands with 5 or more residential or commercial properties including farm yards from flooding – Medium Importance
- Floodplain protecting urban areas with 1 to 5 residential or commercial properties from flooding – Medium Importance
- Floodplain protecting urban areas with up to 5 – 10 residential or commercial properties from flooding – High Importance
- Floodplain protecting urban areas with greater than 10 residential or commercial properties from flooding – Very High Importance

Table 7.5.10.5 Floodplains and Flood Risk Areas - Attribute Importance

EPA Name	EPA Code	Catchment Area (km^2)	Description	Attribute Importance
River Shannon	26S02	1,300	Carrick-on-Shannon Urban Area with Flood Risk	Very High
Clogher	26C18	28.6	Rural	Low
Ardglass Stream	26A12	2.9	Rural	Low
Woodbrook house Stream	26W01	2.5	Rural	Low
Clooneigh26	26C55	3.0	Rural	Low
Tumna	26T07	1.3	Rural	Low
Caldragh	N/A	1.65	Rural	Low
Kilmaddaroe Stream	N/A	5.79	Rural	Low
Knockadalteen26	26K30	3.5	Urban Area	Medium
Knockananima Stream	26K25	7.6	Urban Area with Flood Risk	High
Lisnagat	26L18	1.9	Urban Area	Medium
Attifinlay	26A18	1.1	Urban Area	Medium
Drumercool	26D31	1.43	Rural	Low
Killukin River	26D31	33.9	Rural	Low
Danesfort	26D49	0.2	Rural	Low
Tonrevagh R	26T97	21	Rural	Low
Rock26	26R17	2.4	Rural	Low

EPA Name	EPA Code	Catchment Area (km^2)	Description	Attribute Importance
Attirory Stream	26A26	1.4	Rural	Low
Kilmaddaroe Stream	26K24	8.3	Rural	Low
Pollnagappul	26P05	0.9	Rural	Low
Sallaghan26	26S24	0.2	Rural	Low
Kiltycarney	26K39	0.5	Rural	Low
Lismoyle26	26L41	0.7	Rural	Low
Killasanowl	26K38	3.9	Rural	Low
KilDorragh26	26K41	0.6	Rural	Low
Drumsna R	26D53	17.2	Rural	Low
Gortinty Stream	26G35	8.5	Rural	Low
Drumcleavry R	26D57	13.4	Rural	Low
Ardanaffrin	26A40	0.5	Rural	Low
Antfield	26A30	1.5	Rural	Low

Surface Water Resources

The Irish Water Carrick-on-Shannon Public Water Supply abstraction is located in the River Shannon circa 1km upstream of Carrick-on-Shannon Bridge. This is a large abstraction that supplies well over 50% of Leitrim's Water Supply and is considered to be of regional importance and its attribute importance is therefore very high.

Hydro-ecology

The identified aquatic ecological sites within the study area are associated with riparian habitat along the River Shannon channel banks and floodplain area and represent wet woodland and wet grassland including alluvial woodland habitat with potential for *91E0. These habitats are considered to be of very high importance due to their value on a national scale. The only designated sites within the Study area are the Lough Drumhalow pNHA (001643) to the north of Carrick-on-Shannon and Lough Boderg and Bofin pNHA (001642) to the South. Designated Sites downstream of the Study Area which are hydrologically connected via the River Shannon are The Lough Forbes Complex SAC and pNHA (001818) and further downstream is the Lough Ree SAC and pNHA (000440). There are other SAC's, and NHA's such as Clooneen Bog SAC, that are not connected hydrologically (via watercourses) with the study area and therefore not relevant to the surface hydrology assessment. In the assessment the pNHA are attributed high status and the SAC's Very High Status to reflect their European importance.

Soft Sediments and Poor Ground Conditions

Areas of identified with soft sediments from GSI quaternary deposit mapping and local site investigation information classified as alluvium, basin peat, cutover peat, fen peat and lacustrine deposits are given a medium attribute value (local higher

value) as their presence can for a road project generate design and construction difficulties and often the requirement for piling or bridge spanning depending on the depth of soft sediments or in the requirement for excavation, removal and handling and material deposition during construction.

Hydrological Features and General Impacts

The general impact description on hydrological features is summarised here as follows:

Table 7.5.10.6 Summary of Impact Description on Hydrological Features

Hydrological Feature	Potential Impact description
Water courses (Morphology)	Disturbance and morphological impacts from road culverts and from associated local realignment and diversion of streams and drains. Impacts would most likely be permanent in nature on a small or significant proportion of the attribute.
Water courses (Fishery and Morphology)	Culverts and bridge piers acting as debris traps resulting in barrier effects to fish passage, flooding and scouring causing local morphological change to the river channel. Impacts would most likely be permanent in nature on a small or significant proportion of the attribute.
Water courses (Water Quality)	Potential pollution from construction (construction runoff (sediments, hydrocarbons, and concrete spills). Impacts would most likely be temporary in nature on a small or significant proportion of the attribute.
Water courses (Water Quality)	Impact from routine road drainage discharges at proposed outfalls on local and downstream water quality. Potential Risk of significant chemical spillage event from HGV impacting on the downstream water quality, impacts would most likely be temporary in nature on a small or significant proportion of the attribute.
Floodplains and Flood Risk Areas	Potential for reduction in flow conveyance due to encroachment of the active (conveying) floodplain area giving rise to upstream afflux. Culverts and road embankment impeding conveyance, contribute to flooding and drainage outfalls causing upstream afflux within the rivers and streams and impacting flow rates. Impacts would most likely be temporary in nature on a small or significant proportion of the attribute.
Floodplains and Flood Risk Areas	Potential for loss of flood storage due to encroachment by the road formation into floodplain and loss of flood storage volume giving rise to local and downstream impacts on flood levels and flood flows. Impacts would most likely be permanent in nature on a small or significant proportion of the attribute.
Surface Water Resources	The impact from a proposed road development on the Carrick-on-Shannon Public Water Supply abstraction are potentially water quality impacts from both Construction and Operational phases. The impact on the flow regime is likely to be minor given the large catchment area of c. 1295 km^2 and the potential for a temporary impact on a significant proportion of the attribute.
Surface Water Resources	The construction phase impacts that are likely is an increase in suspended solids from the construction works primarily associated with any new River Shannon Bridge crossing. It should be noted that all watercourses within the study area discharge to the River Shannon and therefore a pathway for pollution is present for the entire footprint of the proposed road-based options. In terms of impact on the Carrick-on-Shannon Public

Hydrological Feature	Potential Impact description
	Water Supply abstraction location, it is only the proposed options that are upstream of the abstraction point that could potentially impact on the attribute. Impacts would most likely be temporary in nature on a significant proportion of the attribute.
Hydro-Ecology (Drying)	Direct encroachment of wetland sites and direct loss of wetland area. Drainage effects by the road development on wetland sites resulting in ecological change as a result of drying. Impacts would most likely be permanent in nature on a small or significant proportion of the attribute.
Hydro-Ecology (Water Quality)	Potential pollution impacts on wetland sites from road construction and operation stages from nearby road drainage outfalls. Impacts would most likely be temporary in nature on a small or significant proportion of the attribute.
Hydro-Ecology (Wetlands Loss)	The main potential impacts associated with road construction is direct loss of riparian and wetland areas by encroachment. Impacts would most likely be permanent in nature on a small or significant proportion of the attribute. The drainage effects of the Road development on such wetland features is likely to be permanent in nature on a small proportion of the attribute given the extensive waterbodies involved. The water quality impacts on such wetland features would most likely be temporary in nature on a small proportion of the attribute given the extensive waterbodies involved.
Designated Sites (Hydrological Regime and Water Quality)	Potential for change in the hydrological regime in respect to water quality and drainage impacts from both construction and operation phases on designated sites both directly or indirectly. Impacts would most likely be permanent in nature on a small or significant proportion of the attribute.
Soft ground (Water Quality)	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for increased construction runoff impacts and requirement for the deposition of unsuitable construction material. Impacts would most likely be temporary in nature on a small or significant proportion of the attribute.

The potential impacts identified for each of the hydrological features/receptors identified within the study area are evaluated and in many cases, there are multiple impacts associated with potential hydrological flow and water level change, morphology of the channel and water quality both at construction and operation phase quantified for the same feature. In this option assessment these multiple impacts are all considered both cumulatively and individually for each hydrological feature and maximum impact selected and used in the overall selection scoring process.

7.5.10.4 Stage 1 Hydrology Option Corridor Assessment

Stage 1 Hydrological Assessment -Option Corridors West of Drumsna Junction (Node J)

Cyan Option Corridor

Table 7.5.10.7 Stage 1 Hydrological Assessment of Cyan Option Corridor

Hydrological Attribute	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	This corridor crosses the River Shannon floodplain 1.55km downstream of River Shannon Bridge at Attirory and upstream of Lough Corry. The Shannon Floodplain area encroached (based on the CFRAM 100-year present day predicted flood extents) by the proposed design option represents a floodplain width encroached at the centreline of 630m.	This encroachment of the River Shannon floodplain area has a potential for loss of floodplain storage and causing upstream afflux by obstructing the conveyance. This potentially could result in increased flood levels upstream at Carrick-on-Shannon which has low-lying areas of the town at significant flood risk and requiring a flood relief scheme. The crossing is located immediately downstream of a natural narrowing of the floodplain which will reduce the impact on floodplain conveyance and upstream afflux. A major bridge structure is required at this crossing point to minimize upstream afflux effects on flood risk within Carrick-on-Shannon.
Killukin River Basin part of the Shannon Floodplain	The option corridor crosses the Killukin River Basin that includes floodplain area of the River Shannon with an encroachment width of 218m along the alignment centre line.	Storage loss may not result in significant impacts on the flooding regime in the River Shannon due to the very damped nature of the River Shannon flood hydrograph and the large storage available in the River Shannon at Carrick-on-Shannon. The potential loss of flood storage is considered to represent a moderate negative impact (2) on flooding and flood risk given the relatively small portion of the floodplain area encroached to the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. The overall impact by this option on flooding in the River Shannon at Carrick-on-Shannon is rated as a significant negative impact (1) given the existing upstream flood risk at Carrick-on-Shannon, the extensive floodplain area encroached and the potential for upstream afflux from the bridge crossing. Extending up to Carrick-on-Shannon.

Hydrological Attribute	Description	Impact
Knockananima Stream Flood Risk Area at	The CFRAM flood risk area associated with the Knockananima Stream is encroached by the proposed option upstream and downstream of the Rail line is encroached by the corridor with the total floodplain area within the corridor at 5.43ha.	This has the potential to impact flooding locally from interference with floodplain conveyance and the loss of flood storage. This impact is rated as a moderately negative impact on flooding and flood risk (2).
Water courses		
River Shannon (Morphology, Water Quality Impacts)	River Shannon catchment to the proposed option crossing is large with a catchment area of c. 1336km^2.	It is likely that in channel piers will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers.
	The river channel width from bank to bank is 152m and the floodplain width is 530m at the proposed crossing point making it difficult to avoid the construction of in channel piers and floodplain infilling.	Physical impact by the bridge structure on flow regime is rated as a local moderately negative impact (2).
	Construction activities associated with River Shannon crossing and its floodplain have potential to generate significant pollution from construction activities and associated site runoff, including the potential for concrete and chemical (hydrocarbon) spillages etc.	The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon channel and floodplain area this impact is rated as moderately negative (2).
	Close proximity of corridor to the Shannon river channel near Tully downstream of Jamestown represent additional construction pollution risks for the River Shannon	There is significant dilution available within the River Shannon throughout the year making the impact from routine road drainage discharges at operational stage are rated as minor negative (3).
	The entire length of the proposed road scheme will outfall eventually into the River Shannon via the road drainage outfalls discharging directly and via upstream watercourses introducing spillage risks and routine road drainage pollutant in the form of heavy metals.	The risk of a serious accidental spillage at the operational phase remains but is of a relatively low risk given the road length, traffic numbers and road design and is rated as moderately negative (2).

Hydrological Attribute	Description	Impact
	There are jetties and moorings for leisure craft activities along the western river bank within the corridor which may be affected by the bridge crossing.	The impact on mooring facilities is considered to represent a minor negative impact (3).
Minor Water courses	The Woodbrook House Stream at Cloongownagh that flows into Lough Eidin is crossed at two locations having catchment areas of 2.13 and 2.52km^2 respectively. Trib. Of the Knockanima stream (2.86km^2). Knockanima stream (5.43km^2). Killukin River and floodplain crossed with catchment area of 35km^2. Small Stream at Cooreen / Lisseeghan (1.0km^2) Kilmuddaroe Stream Lisseeghan (6.7km^2) 19 no. small drains (i.e. < 25ha in catchment areas) are intercepted.	Potential for flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 7km2) and easily culverted providing full span of the stream channels to minimize disturbance. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as minor negative impact (3). The Killukin River is classed as a small river at a catchment area of 35km2 with medium importance, and with the flood basin backed up by flooding in the Shannon the hydrological impact is classed as moderately negative (2) possibly requiring large culverts or a bridge structure and the associated construction difficulties. All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local minor negative impact (3). The impact on the local drains is classed at a minor or slightly negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This corridor crosses the River Shannon downstream of the Carrick-on-Shannon public water supply abstraction and at 2.5km downstream there will be no direct water quality impact on this high important abstraction source. A short section of the road corridor for 2.4km at the western end is upstream of the abstraction and consequently has a potential	The River Shannon has significant sustained dilution available throughout the year from its large catchment and large upstream Lakes such that the impact on this attribute from the 2.4km section of road development at construction and operation is rated as a minor negative impact (3). The routine Road Drainage discharges at operational stage represent a permanent impact on a small proportion of the attribute and therefore given the very high attribute

Hydrological Attribute	Description	Impact
	for construction runoff to enter the River Shannon via the Woodfield House Stream and Lough Eidin the River Shannon and therefore has the potential during construction to impact the water quality of the source. At Operation phase routine runoff discharges or an accidental spillage has the potential to enter the River Shannon upstream of the abstraction also.	important this represents a moderately negative impact (2). The operational spillage risk from an accident involving an HGV on the abstraction point represents a minor negative impact.
Hydro-Ecology and Designated Sites		
Ecological Sites of Local Higher	Encroachment by Corridor of Sites EC35, EC 50, EC51, EC35 that represent wet woodland, wet Grassland and Marsh Habitats typical of large floodplain areas. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such site and settling out.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the road is unlikely to result in any significant dewatering and drainage of these wetland habitats and is considered to represent a minor negative impact (3).
Designated sites of SAC, SPA, NHA and pNHA		There will be no direct impact on any designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a minor negative impact.

Hydrological Attribute	Description	Impact
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the 9.2km road length 1.18km is in quaternary identified as Cut over peak and 0.80km is alluvium.	Soft sediments identified from the GSI Quaternary mapping represents 21.5% of the route. It is likely that actual amount encountered may be higher along the River Crossings. This is rated as representing a minor negative impact.

Orange Option Corridor

Table 7.5.10.8 Stage 1 Hydrological Assessment of Orange Option Corridor

Orange Option Corridor	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	This orange option crosses the River Shannon channel and floodplain 1.50km downstream of River Shannon Bridge at Attirory and upstream of Lough Corry. The Shannon Floodplain area encroached (based on the 100year present day predicted flooding extents) by the proposed option represents a floodplain width at the centreline of the corridor crossing of 420m (passing to the south of the housing estate at Attirory).	This encroachment of the River Shannon floodplain area has a potential for loss of floodplain storage and causing upstream afflux by obstructing the conveyance. This potentially could result in increased flood levels upstream at Carrick-on-Shannon which has low-lying areas of the town at significant flood risk and requiring a flood relief scheme. The crossing is located immediately downstream of a natural narrowing of the floodplain which will reduces the impact on floodplain conveyance and upstream afflux. A major bridge structure is required at this crossing point to minimize upstream afflux effects on flood risk within Carrick-on-Shannon.
Killukin River Basin part of the Shannon Floodplain	The option corridor crosses the Killukin River Basin that includes floodplain area of the Shannon with an estimate encroachment width of 302m.	The potential loss of flood storage is considered to represent a moderately negative impact (2) on flooding and flood risk given the relatively small portion of the floodplain area encroached to the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. The overall impact by this option on flooding in the River Shannon at Carrick-on-Shannon is rated as a Significant Negative impact (1) given the existing upstream flood risk at Carrick-on-Shannon, the extensive floodplain area encroached and the potential for upstream afflux from the bridge crossing. Extending up to Carrick-on-Shannon.
Knockananima Stream Flood Risk Area	The CFRAM flood risk area associated with the Knockananima Stream flood risk is encroached by the proposed corridor by 0.602ha by 4.90ha.	This has the potential to impact flooding locally from interference with floodplain conveyance and the loss of flood storage. This impact is rated as a moderately negative impact (2).
Water courses		
River Shannon Channel	River Shannon to the Corridor crossing is large with a Catchment area of 1336km^2 The river channel width from bank to bank at the potential	It is likely that in channel piers will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers.

Orange Option Corridor	Description	Impact
	crossing point is 202m, which includes inlet channel to mooring basin on both banks, makes it difficult to avoid the construction of in-channel bridge piers. The floodplain width at the crossing point is 420m making it difficult to avoid encroachment of floodplain either as earthen embankments, abutments or support piers. Construction activities associated with River Shannon crossing and its floodplain have potential to generate significant pollution from construction site runoff and potential for concrete and chemical spillages etc. Close proximity of corridor to the Shannon River Channel near Tully downstream of Jamestown represent additional construction pollution risks for the River Shannon. The entire length of the proposed road scheme will outfall eventually into the River Shannon via the road drainage outfalls discharging directly and via upstream watercourses introducing spillage risks and routine road drainage pollutant in the form of heavy metals.	Physical impact by the bridge structure on flow regime is rated as local minor negative impact. The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon Channel and floodplain area this impact is rated as moderately negative (2). There is significant dilution available within the River Shannon throughout the year making the impact from routine road drainage discharges to be rated as minor negative (3). The risk of a serious accidental spillage at the operational phase remains but is of a relatively low risk given the road length, traffic numbers and road design and is rated as moderately negative (2).
Minor Watercourses	1 tributary stream at Meera / Tullyleague that flows into Lough Eidin c. 3 at 3.496km^2 in area. Knockanima Stream (5.52km^2) Killukin River and floodplain crossed with catchment area of 35km^2. Small Stream at Cooreen / Lisseeghan (1.0km^2). Kilmuddaroe Stream Lisseeghan (6.7km^2).	Potential for Flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 7km^2) and easily culverted providing full span. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as minor to moderately negative impact (2.5). The Killukin River is classed as a small river at a catchment area of 36km^2 and with the flood basin backed up by flooding in the Shannon the hydrological impact is classed as moderately negative (2) possibly requiring large culverts or a bridge structure.

Orange Option Corridor	Description	Impact
	11 no. small drains intercepted.	All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local minor to moderately negative impact (2.5). The impact on the local drains is classes at a minor negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This corridor is downstream of the Carrick-on-Shannon water supply abstraction and at 2.5km downstream there is unlikely to be any water quality impact on this important abstraction source. A short section of the road corridor for 0.6km at the western N4 tie-in is upstream of the abstraction and consequently has a potential for construction runoff to enter the River Shannon via a drainage channel and proximity of the Shannon Floodplain to the corridor and therefore has the potential during construction to impact the water quality upstream of the abstraction source. At Operation phase routine runoff discharges or an accidental spillage has the potential to enter the River Shannon upstream of the abstraction also from this small 600m section of roadway.	The River Shannon has significant dilution available throughout the year from its large catchment and large upstream lakes such that the impact on this attribute from the 0.6km section of road development at construction and operation is rated as a minor negative impact (3). The routine Road Drainage discharge at operational stage represent a permanent impact on a small proportion of the attribute and therefore given the very high attribute important given to this feature the potential impact magnitude represents a moderately negative impact (2). The operational spillage risk from an accident involving an HGV on the abstraction point represents a minor negative impact given its temporary nature.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors Ecological Sites of Local Higher	Encroachment by Corridor of Sites EC35, EC50, EC51, EC35 that represent wet woodland, wet Grassland and Marsh Habitats typical of large floodplain areas. The potential impact on hydrology of these habitats is potential drainage effects by the	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the Road is unlikely to result in any significant dewatering and drainage of these wetland habitats and is considered to represent a minor negative impact (3).

Orange Option Corridor	Description	Impact
Designated sites of SAC, SPA, NHA and pNHA	proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such site and settling out.	There will be no direct impact on any designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a minor negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the 7.45km road length 1.32km is in quaternary identified as Cut over peak and 0.30km is alluvium.	Soft sediments identified from the GSI Quaternary mapping represents 21.7% of the route. It is likely that actual amount encountered may be higher along the River Crossings. This is rated as representing a minor negative impact (3).

Purple West Option Corridor

Table 7.5.10.9 Stage 1 Hydrological Assessment of Purple West Option Corridor

Purple West Option Corridor	Description	Impact
Floodplains and Flood risk Areas		
River Shannon Floodplain	This corridor crosses the River Shannon floodplain 1.95km upstream of River Shannon Bridge at Corryolus. The Shannon Floodplain area encroached (based on the 100year present day predicted flooding extents) by the proposed option represented a floodplain encroachment width at the centreline of the corridor crossing of 1020m encroaching the Shannon floodplain at three locations along its route.	This has potential for loss of floodplain storage and upstream afflux. The upstream afflux will not impact on the downstream flood risk area in Carrick-on-Shannon and the crossing is sufficiently downstream of Leitrim Village Flood Risk Area as not to be significant in terms of affecting flood risk there. The floodplain storage loss may not result in significant impacts on the flooding regime in the Shannon due to the very damped nature of the Shannon flood hydrograph and the large storage available in the Shannon. The potential loss of flood storage represents a relatively small encroachment of the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. The potential loss of flood storage is considered to represent a permanent impact on a small proportion of the very high importance attribute and therefore represents a significant negative impact (1) on flooding and flood risk.
Water courses		
River Shannon Channel	River Shannon to the Corridor crossing is large with a Catchment area of 1290km^2. The river channel width from bank to bank is 80m at the potential crossing point and the total floodplain width at the river channel crossing is 402m. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc. The entire length of the proposed road will outfall eventually to the	It is likely multiple piers within the floodplain and channel will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers. Physical impact by the bridge structure on flow regime is rated as local minor negative impact. No impacts on moorings neutral (4). The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within

Purple West Option Corridor	Description	Impact
	River Shannon via the road drainage outfalls discharging directly and to upstream drains and tributaries.	the Shannon Channel and floodplain area this impact is rated as moderately negative (2). Pollution from the operation stage via the road drainage is rated as minor negative (3).
Watercourses	1 tributary stream at Meera / Tullyleague that flows into lough Eidin at 3.5km^2 in area. 1 small spring and drain. 1 small Stream at Lisnagat (<1km^2). 1 small stream at Cloonsheeban (1.4km^2). 1 small stream (Cloonmulligan) 3.15km^2. 1 small tributary stream of the Cloonmulligan (c .25km^2). 1 medium Stream at Greagh (5.75km^2). 1 small trib stream of Greagh at Minkill (1.26km^2). 1 small stream at Tully (< 1km^2). 20 drains encountered along route.	Potential for flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 7km^2) and easily culverted providing full span of the stream channels to minimize disturbance. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as minor negative impacts (3) All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local minor negative impact (3). The impact on the local drains is classed at a minor negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This option is 910m upstream of Carrick-on-Shannon water supply abstraction intake with the corridor coming to within 680m of the abstraction point. Such close proximity allows very limited travel time and mixing / dilution of a potential spillage before reaching the abstraction point. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc.	This corridor has the potential for significant impact both during construction of the road development and during its operation life through road drainage runoff and HGV spillage risk. This impact on an important and strategic public abstraction of regional importance is considered to represent both at construction and operation a very significant negative impact (1). Mitigation through design can reduce the risk of spillage event reaching the intake point and provide water treatment and retention pond facilities to reduce the impact of routine runoff reducing the operation impact to a moderate negative.

Purple West Option Corridor	Description	Impact
	The road corridor for the first 6km drains to the River Shannon via numerous small streams and drains upstream of the public abstraction point and therefore vulnerable to pollution from both construction works and operation road drainage discharges and accidental spillage.	
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors	Encroachment by route option of a pNHA (Lough Eidin) on the northeast side of the River Shannon floodplain for almost 730m occurs.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the road is unlikely to result in any significant dewatering and drainage impacts of these wetland habitats and is considered to represent a minor negative impact (3) with the main impact of direct loss of habitat accounted for in the biodiversity section. The road development traverses through the Lough Eidin pNHA for c. 730m associated with encroachment into the River Shannon Floodplain Area. The impact on drainage of the associated wetland areas and River Shannon Callows will represent a moderately negative impact (2) on the hydrological regime of a designated site of national importance.
Ecological Sites of Local Higher	The route option encroaches ecological sites EC16, EC30 and EC32 that represent wet woodland, scrub and wet grassland Habitats within the Shannon Floodplain. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water.	
Designated sites of SAC, SPA, NHA and pNHA	Sediment laden construction runoff reaching such sites and settling out.	There will be no direct impact on any other designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a minor negative impact.

Purple West Option Corridor	Description	Impact
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the 7.98km road mainline length 0.99km is in quaternary identified as cut over peak, 0.34km as basin peat and 0.17km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 18.8% of the route. It is likely that actual amount encountered may be higher along the River Shannon crossings. This is rated as representing a minor negative impact (3).

Dark Green Option Corridor

Table 7.5.10.10 Stage 1 Hydrological Assessment of Dark Green Option Corridor

Dark Green Option Corridor	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	This corridor crosses the River Shannon floodplain 1.95km upstream of River Shannon Bridge at Corryolus. The River Shannon floodplain area encroached (based on the 100-year present day predicted flooding extents) represents a floodplain width encroached at the centreline of the corridor crossing is 835m encroaching the Shannon Floodplain at two locations along its route (Shannon Crossing and to the north of Lisnagat).	This has potential for loss of floodplain storage and upstream afflux. The upstream afflux will not impact on the downstream flood risk area in Carrick-on-Shannon and the crossing is sufficiently downstream of Leitrim Village Flood Risk Area as not to be significant in terms of affecting flood risk there. The floodplain storage loss may not result in significant impacts on the flooding regime in the Shannon due to the very damped nature of the Shannon flood hydrograph and the large storage available in the Shannon. The potential loss of flood storage represents a relatively small encroachment of the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. The potential loss of flood storage is considered to represent a permanent impact on a small proportion of the very high importance attribute and therefore represents a significant negative impact (1) on flooding and flood risk.
Water courses		
River Shannon Channel	River Shannon to the Corridor crossing is large with a Catchment area of 1290km^2. The river channel width from bank to bank is 76m at the potential crossing point and the total floodplain width at the river channel crossing is 393m. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc. The entire length of the proposed road will outfall eventually to the River Shannon via the road	It is likely multiple piers within the floodplain and channel will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers. Physical impact by the bridge structure on flow regime is rated as local minor negative impact. The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon channel and floodplain area this impact is rated as moderately negative (2).

Dark Green Option Corridor	Description	Impact
	drainage outfalls discharging directly and to upstream drains and tributaries.	Pollution from the operation stage via the road drainage is rated as minor negative (3). No impacts on moorings neutral (4).
Watercourses	1 tributary stream at Meera / Tullyleague that flows into lough Eidin at 3.5km^2 in area. 1 small spring and drain. 1 small Stream at Lisnagat (<1km^2). 1 small stream at Cloonsheeban (1.4km^2). 1 small stream (Cloonmulligan) 3.15km^2. 1 small tributary stream of the Cloonmulligan (c .25km^2). 1 small stream the Aghameeny Stream (1.2km^2). 1 small stream the KilMaddaroe Stream (2.75km^2) 1 small stream at Drishoge (< 0.5km^2) 21 drains encountered along route.	Potential for flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 5km2) and easily culverted providing full span of the stream channels to minimize disturbance. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as minor negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local minor negative impact (3). The impact on the local drains is classed at a minor negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This option is 910m upstream of Carrick-on-Shannon water supply abstraction intake with the corridor coming to within 680m of the abstraction point. Such close proximity allows very limited travel time and mixing / dilution of a potential spillage before reaching the abstraction point. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc.	This corridor has the potential for significant impact both during construction of the road development and during its operation life through road drainage runoff and HGV spillage risk. This impact on an important and strategic public abstraction of regional importance is considered to represent both at construction and operation a very significant negative impact (1). Mitigation through design can reduce the risk of spillage event reaching the intake point and provide water treatment and spillage retention area and water quality retention pond facilities to reduce the impact of routine

Dark Green Option Corridor	Description	Impact
	The road corridor for the first 6km drains to the River Shannon via numerous small streams and drains upstream of the public abstraction point and therefore vulnerable to pollution from both construction works and operation road drainage discharges and accidental spillage.	runoff reducing the operation impact to minor negative.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors	Encroachment by route option of a pNHA (Lough Eidin) on the northeast side of the River Shannon floodplain for almost 730m occurs.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the Road is unlikely to result in any significant dewatering and drainage impacts of these wetland habitats and is considered to represent a minor negative impact (3) with the main impact of direct loss of habitat accounted for in the biodiversity section.
Ecological Sites of Local Higher	The route option encroaches ecological sites EC16, EC30 and EC32 that represent wet woodland, scrub and wet grassland habitats within the River Shannon floodplain. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increase drainage flows through displacement of pore water.	The road development traverse through the Lough Eidin pNHA for c. 1.12km associated with encroachment into the River Shannon floodplain area. The impact on drainage of the associated wetland areas and River Shannon Callows will represent a Moderate Negative (2) impact on the hydrological regime of a designated site of national importance.
Designated sites of SAC, SPA, NHA and pNHA	Sediment laden construction runoff reaching such sites and settling out.	There will be no direct impacts on any other designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a minor negative impact.

Dark Green Option Corridor	Description	Impact
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the 7.98km road mainline length 1.13km is in quaternary identified as cut over peak and 0.17km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the River Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 16.2% of the route. It is likely that actual amount encountered may be higher along the River Shannon crossings. This is rated as representing a minor negative impact (3).

Blue West Option Corridor

Table 7.5.10.11 Stage 1 Hydrological Assessment of Blue West Option Corridor

Blue West Option Corridor	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	The Blue West Option Corridor crosses the River Shannon at the existing Carrick-on-Shannon Bridge and avoids the requirement of a bridge structure within the River Shannon and floodplain and avoids any reduction in flow conveyance or reduction in Flood Storage However, the Existing N4 on the western side of the River Shannon near Carrick View Apartments is within a flood risk area and prone to flooding at the predicted 1 in 1000 year return period flood for a distance of almost 200m. On the eastern side of the River Shannon within Carrick-on-Shannon the N4 is also at risk of flooding and historically has flooded there in December 2015 / January 2016 close to the Landmark Hotel for a distance of 130m in addition to another location with a substantial distance of flood encroachment of circa 360m along the N4 close to the Rosebank Retail Park.	The impact on the River Shannon Floodplain and associated Carrick-on-Shannon Flood Risk areas represents a Neutral impact in the respect to utilizing the existing N4 road with some modifications at junctions etc. Substantial sections of this option that utilizes the existing N4 are identified to be within high flood risk areas and have flooded on a number of occasions in the past with the road having to be closed (1999, 2009, 2015/2016 flood events). The section near the Rosebank Retail Park between the two roundabouts for c. 160m has a probability of flooding at 10% in any given year. The flooding in the River Shannon is prolonged and therefore potential extreme events could have the road closed off to traffic for many days. This is not in keeping with the Flood Risk Management Planning guidelines (2009) for major infrastructure projects and consequently is considered to represent a very significant negative impact (1) in respect to flood risk.
Watercourses		
River Shannon	This option will utilize the existing N4 River Shannon Bridge at Carrick-on-Shannon and will not involve further construction encroachment of the River Shannon Floodplain. This limits the impact on the River Shannon both during construction and operational phases. The entire length of the proposed road option will outfall eventually to the River Shannon via the existing road drainage outfalls discharging directly and to upstream drains and tributaries and	Construction as associated with crossing is avoided by this option and therefore there will be no direct impacts of the flow regime or water quality associated with the road crossing. Given the confined nature of the Blue Option Corridor to the existing N4 this could potentially constrain the ability to control and treat construction water runoff before it enters the adjacent watercourses. The construction footprint will be considerably less than the other route options but nevertheless construction in or near watercourses will be required and therefore the construction impact on water quality in

Blue West Option Corridor	Description	Impact
	a number of direct outfalls to the Shannon in the vicinity of Carrick-on-Shannon.	the River Shannon is considered to represent a minor negative impact from this option. Pollution from the operation stage via the road drainage is rated as minor negative (3).
Minor Watercourses	This option uses the Existing N4 road and therefore the existing culverted watercourses encountered will generally be retained. This minimizes disturbance and construction impacts. Some limited construction works will be involved with this management option but area unlikely to involve replacement or upgrade of existing culverts. Some extension may be required and possibly new culverts under realigned sections of local road to facilitate this option.	Given the confined nature of this Blue Option Corridor to the existing N4 this this could potentially constrain the ability to control and treat construction water runoff before it enters the adjacent watercourses. The construction footprint will be considerably less than the other route options but nevertheless some construction in or near watercourses will be required and therefore the overall impact on water quality is considered to represent a minor negative impact and an Imperceptible impact on the hydrological regime of theses watercourses. At operation stage the use of the existing N4 will not easily facilitate the treatment and attenuation of storm water prior to its discharge and consequently the operational impact of road runoff on the receiving watercourses is considered to also represent a minor negative impact.
Surface Water Abstractions		
Carrick-on-Shannon Public Water Supply	This corridor crosses the River Shannon downstream of the Carrick-on-Shannon water supply abstraction. At 1.05km downstream there is unlikely to be any water quality impact on this important abstraction source. The crossing utilizes the existing masonry arch River Shannon Bridge and therefore has no direct footprint within the River Shannon that might give rise to construction pollution. However the northwestern section of the Blue Option Corridor for 3.6km at the western N4 tie-in end is upstream of the abstraction and consequently has a potential for construction runoff to enter the River Shannon via a drainage channel and proximity of the River Shannon Floodplain to the corridor and therefore has the potential	The River Shannon has significant dilution available throughout the year from its large catchment and large upstream lakes such that the impact on this attribute from the 3.6km upstream section of road development at construction (limited as option utilizes the existing N4 with modifications) and operation used untreated existing drainage outfalls and over the edge drainage. The construction impact on the water supply is rated as a minor negative impact (3). The routine road drainage discharge at operational stage represents an existing permanent impact on a small proportion of the attribute and therefore given the very high attribute important given to this feature the potential impact magnitude represents a moderately negative impact (2). The operational spillage risk from an accident involving an HGV on the abstraction point

Blue West Option Corridor	Description	Impact
	during construction to impact the water quality upstream of the abstraction source. At operation phase routine runoff discharges or an accidental spillage has the potential to enter the River Shannon upstream of the abstraction also from this small 3.6km section of corridor.	represents a minor negative impact given its temporary nature.
Hydro-ecology and Designated Sites		
Hydro-ecology and Designated Sites	This option is not identified as encroaching any identified Hydro-ecology Sites along its route not potentially capable of changing the hydrological regime within these sites. The corridor is shown to encroach the Lough Eidin pNHA at its western tie end. However, the existing N4 road which will be utilized for this option is shown to be outside the pNHA and consequently will not result in direct impact. Drainage impacts will be limited as the existing N4 is to be retained with limited construction activities that would give rise to impact or proposed changes in land or road drainage along the option.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the Road is unlikely to result in any no significant dewatering and drainage of these wetland habitats and is considered to represent a neutral impact (4) on identified sites. There will be no direct impact on any designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a minor negative impact.
Soft Sediment and Poor Ground Conditions		
Soft Ground	Along the Blue Option Corridor there is considerable sections of Soft Sediments and Poor Ground Conditions. Notwithstanding that, this option has limited construction activities utilizing the existing N4 road. However, some localized works associated with junctions and access roads will be built on soft ground.	The impact of soft ground on the Blue Option Corridor is rated as representing a minor negative impact (3).

Black Option Corridor

The Black Option comprises a new urban street within Carrick-on-Shannon. The option provides connectivity by interconnecting the R280 to the Summerhill Road and on to the Castlecara Road. The option length is approximately 1.2km.

The lands adjacent to the Black Option drain via a number of small drainage channels south southwest to the River Shannon. The contributing catchment are draining by these streams is 1.3km^2. The flow capacity downstream is limited and therefore road drainage from the Black Option Corridor will require attenuation to prevent downstream impacts and increased flooding, this will be assessed in Phase 3. The western end of this route option encroaches slightly the 100-year flood risk area associated with the River Shannon and the Lisnagat stream. This represents a minor negative impact on flooding and flood risk. The watercourses intercepted by the route heading south southwest are three small streams and two minor drains. The disturbance of these watercourses is rated as a slight negative impact.

This option does not intercept nor discharge directly to the River Shannon and its route drains via the local surface water drains, that downstream are culverted through Carrick-on-Shannon, outfalling to the River Shannon both upstream and downstream of the existing River Shannon Bridge. Importantly the Black Option Corridor drainage enters the River Shannon via the local drains downstream of the Carrick-on-Shannon Public Water Supply abstraction and therefore will not impact this high important regional public water supply source. There are no hydroecological sites along this option nor any impacted downstream.

The route to the north of the Summer Hill Road passes through poor draining peat lands. Soft ground in the form of peat for a length of 430m is present to the northwest of Summerhill Road and alluvium at the eastern end for 105m, almost 45% of the route underlain by potentially soft soil, representing a minor negative impact.

The overall assessment gives a minor negative impact on flooding associated with flooding impact.

Stage 1 Hydrological Assessment- Option Corridors East of Drumsna Junction (Node J)

Yellow Option Corridor

Table 7.5.10.12 Stage 1 Hydrological Assessment of Yellow Option Corridor

Hydrological Attribute	Description	Impact
Floodplains and Flood risk Areas		
Floodplains	This option follows the existing road alignment and therefore avoids direct encroachment into the floodplain area of the River Shannon and the floodplain areas surrounding the lakes at Gortinty Lough and Gortconnellan Lough	There is no direct encroachment into floodplain areas associated with this proposed route and the impact is classified as not significant / neutral (4).
Water courses		
River Shannon Channel	In this eastern section the River Shannon channel is not crossed and the route option avoids its floodplain being an on-line route. However construction works are within close proximity to the floodplain area and the river channel along this section and therefore there is a potential for construction runoff if not controlled and adequately treated to enter the River Shannon via the local drains and streams and via overland routes. The River Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment.	Given the scale of construction activities involved in relatively close proximity to the River Shannon and its floodplain area the construction impact on water quality in the River Shannon is classified as a moderately negative impact (2). Pollution from the operation stage via the road drainage outfalls is rated as minor negative (3).
Watercourses	1 small stream at Drishoge (0.9km^2 in catchment area). 1 small stream (Foxborough) (3.78km^2). 1 small Stream at Crickeen (0.5km^2). 1 large stream Gortconnellan Lough Stream (17.1km^2). Gortinty Stream (5.6km^2). 1 small stream at antfield (0.3km^2).	Potential for flow, morphology and flooding local impacts at these streams associated with culvert upgrades and extensions along the upgraded road to meet OPW Section 50 requirements. The disturbance impact of culverting and locally realigning is rated as minor negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these

Hydrological Attribute	Description	Impact
	1 small tributary stream of the Cloonmulligan (c .25km^2). 14 small drains encountered along route.	watercourses is rated as a local minor negative impact (3). The impact on the local drains is classed at a minor negative impact (3).
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is 12km upstream of eastern options and will not be impacted by the proposed route option (Neutral 4). The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km downstream of Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	The impact rating on the Carrick-on-Shannon surface water abstraction is neutral (4). The impact rating on the downstream Lough Forbes surface water abstraction is moderately negative (2) arising from a temporary potential HGV accidental spillage risk with the attenuation and storm water treatment included in the design.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA).	There will be no direct impact on any designated sites by the proposed options between Drumsna Junction and Faulties. The only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent a moderately negative impact (2), given the distance and attenuation provided by the River Shannon. The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a moderately negative impact. The impact of a major HGV Spillage on the water quality of the SAC is of low risk but

Hydrological Attribute	Description	Impact
Ecological Sites of Local Higher	The route option runs adjacent to ecological sites EC99 representing wet woodland and wet grassland at Derryoughter and EC105 lake and associated wetland and wet woodland at Gortinty Lough. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	given the extremely high importance attribute of this receptor the impact is assessed as a moderately negative impact. Some slight encroachment of EC105 will occur. There is likely to be local drainage effects on these sites from the proposed road construction and road embankment drainage which may result in very localized drying of such habitat immediately adjacent to the road embankment and associated toe drains. This represents a minor negative impact (3). The potential construction impact on water quality within these sites is considered to represent a minor negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the 9.88km road mainline length 1.58km is in quaternary identified as Cut over peak and 0.414km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 20.2% of the route in section B. This is rated as representing a minor negative impact (3).

Green Option Corridor

Table 7.5.10.13 Stage 1 Hydrological Assessment of Green Option Corridor

Hydrological attributes	Description	Impact
Floodplains and Flood Risk Areas		
Floodplains	This Option follows the existing road alignment and therefore avoids direct encroachment into the floodplain area of the River Shannon and the floodplain areas surrounding the lakes at Gortinty Lough and Gortconnellan Lough.	There is no direct encroachment into floodplain areas associated with this proposed route and the impact is classified as not significant or neutral (4).
Water courses		
River Shannon Channel	In this eastern section the River Shannon channel is not crossed, and the route option avoids its floodplain being an on-line route. However, construction works are within close proximity to the floodplain area and the river channel along this section and therefore there is a potential for construction runoff if not controlled and adequately treated to enter the River Shannon via the local drains and streams and via overland routes. The River Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment.	Given the scale of construction activities involved in relatively close proximity to the River Shannon and its floodplain area the construction impact on water quality in the River Shannon is classified as a moderately negative impact (2). Pollution from the operation stage via the road drainage outfalls is rated as minor negative (3).
Water courses	1 small stream at Drishoge (0.9km^2 in catchment area). 1 small stream Foxborough (3.78km^2). 1 small Stream at Crickeen (0.5km^2). 1 large stream Gortconnellan Lough Stream (17.1km^2). Gortinty Stream (5.6km^2). 1 small stream at Antfield (0.3km^2).	Potential for flow, morphology and flooding local impacts at these streams associated with culvert upgrades and extensions along the upgraded road to meet OPW Section 50 requirements. The disturbance impact of culverting and locally realigning is rated as minor negative impact (3) All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is

Hydrological attributes	Description	Impact
	1 small tributary stream of the Cloonmulligan (c .25km^2). 14 small drains encountered along route.	rated as a local minor negative impact (3) The impact on the local drains is classed at a minor negative impact (3)
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is 12km upstream of the eastern options and will not be impacted by the proposed route option neutral (4). The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km from Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	The impact rating on the Carrick-on-Shannon surface water abstraction is neutral (4). The impact rating on the downstream Lough Forbes surface water abstraction is moderately negative (2) arising from a potential HGV accidental spillage risk with the attenuation and storm water treatment included in the design.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA).	There will be no direct impact on any designated sites by the proposed route option between Drumsna Junction and Faulties. The only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent a moderately negative (2), given the distance and attenuation provided by the River Shannon. The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a moderately negative (2). The impact of a major HGV Spillage on the water quality of the SAC is of low risk, but given the extremely high importance

Hydrological attributes	Description	Impact
		attribute of this receptor the impact is assessed as a moderately negative (2). Some slight encroachment of EC105 will occur. There is likely to be local drainage effects on these sites from the proposed road construction and road embankment drainage which may result in very localized drying of such habitat immediately adjacent to the road embankment and associated toe drains. This represents a minor negative impact (3). The potential construction impact on water quality within these sites is considered to represent a minor negative impact (3).
Ecological Sites of Local Higher	The route option runs adjacent to ecological sites EC99 representing wet woodland and wet grassland at Derryoughter and EC105 lake and associated wetland and wet woodland at Gortinty Lough. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material.	Soft sediments identified from the GSI Quaternary mapping represents 20.6% of the route. This is rated as representing a minor negative impact (3).

Hydrological attributes	Description	Impact
	Of the 9.9km road mainline length 1.601km is in quaternary identified as Cut over peak and 0.414km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	

Purple East Option Corridor

Table 7.5.10.14 Stage 1 Hydrological Assessment of Purple East Option Corridor

Hydrological Attributes	Description	Impact
Floodplains and Flood risk Areas		
Floodplains	This option follows the existing road alignment but has a much wider footprint associated with it being a dual carriageway. The option slightly encroaches the River Shannon Floodplain at Tully and again to the south of Gortconnellan Lough and encroaches the northeastern flood area of Gortinty Lough.	The Encroachment of the River Shannon Floodplain and the floodplain of Gortinty Lough by this option represents a minor negative impact (3). on the flooding and the hydrological regime.
Water courses		
River Shannon Channel	In this eastern section the River Shannon channel is not crossed and the route option avoids its floodplain being an on-line route. However construction works are within close proximity to the floodplain area and the river channel along this section and therefore there is a potential for construction runoff if not controlled and adequately treated to enter the River Shannon via the local drains and streams and via overland routes. The River Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment.	Given the scale of construction activities involved in relatively close proximity to the River Shannon and its floodplain area the construction impact on water quality in the River Shannon is classified as a moderately negative impact (2). Pollution from the operation stage via the road drainage outfalls is rated as minor negative (3).
Water courses	1 small stream at Drishoge (0.9km^2 in catchment area). 1 small stream Foxborough (3.78km^2). 1 small Stream at Crickeen (0.5km^2). 1 large stream Gortconnellan Lough Stream (17.1km^2). Gortinty Stream (5.6km^2).	Potential for flow, morphology and flooding local impacts at these streams associated with culvert upgrades and extensions along the upgraded road to meet OPW Section 50 requirements. The disturbance impact of culverting and locally realigning is rated as a minor negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation

Hydrological Attributes	Description	Impact
	1 small stream at Antfield (0.3km^2). 1 small tributary stream of the Cloonmulligan (c .25km^2). 14 small drains encountered along route.	within the corridor on these watercourses is rated as a minor negative impact (3). The impact on the local drains is classed at a minor negative impact (3).
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is many 12km upstream of Tully options and will not be impacted by the proposed route option **(Neutral 4)**. The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km downstream of end of the scheme near Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	The impact rating on the Carrick-on-Shannon surface water abstraction is neutral (4). The impact rating on the downstream Lough Forbes surface water abstraction is moderately negative (2) arising from a potential HGV accidental spillage risk with the attenuation and storm water treatment included in the design.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA).	There will be no direct impact on any designated sites by the proposed route option between Drumsna Junction and Faulties. The indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent a moderately negative (2) given the distance and attenuation provided by the River Shannon. The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a moderately negative (2).

Hydrological Attributes	Description	Impact
		The impact of a major HGV Spillage on the water quality of the SAC is of low risk but given the extremely high importance attribute of this receptor the impact is assessed as a moderately negative impact (2).
Ecological Sites of Local Higher	The route option runs adjacent to ecological sites EC99 representing wet woodland and wet grassland at Derryoughter and EC105 lake and associated wetland and wet woodland at Gortinty Lough. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	Some slight encroachment of EC105 will occur. There is likely to be local drainage effects on these sites from the proposed road construction and road embankment drainage which may result in very localized drying of such habitat immediately adjacent to the road embankment and associated toe drains. This represents a minor negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the 9.9km road mainline length 1.35km is in quaternary identified as Cut over peak and 0.477km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 19.7% of the route. This is rated as representing a minor negative impact (3).

Blue East Option Corridor

Table 7.5.10.15 Stage 1 Hydrological Assessment of Blue East Option Corridor

Hydrological Attributes	Description	Impact
Floodplains and Flood Risk Areas		
Floodplains	The Blue Option Corridor uses the existing N4 road alignment and therefore avoids any direct encroachment into the floodplain area of the River Shannon and the floodplain areas surrounding the lakes at Gortinty Lough and Gortconnellan Lough.	There is no direct encroachment into floodplain areas associated with this proposed route and the impact is classified as neutral (4).
Water courses		
River Shannon Channel	In this option the River Shannon channel is not crossed and the route option avoids its floodplain. Being a management option of the existing N4 road the construction activities in this section will be limited and therefore likely to have a imperceptible impact on the nearby watercourses and the River Shannon. The river Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment and therefore any limited construction and construction runoff will have imperceptible impact on water quality.	Given the minor scale of construction activities involved in the management upgrade of the existing N4 no significant construction activities that might give rise to construction pollution of the nearby River Shannon the construction impact on water quality in the River Shannon is classified as a minor negative impact (3). Pollution from the operation stage via the existing road drainage outfalls on the N4 is rated as minor negative impact (3).
Water courses	This option uses the Existing N4 road and therefore the existing culverted watercourses encountered will generally be retained. This minimizes disturbance and construction impacts. Some limited construction works will be involved with this management option but area unlikely to involve replacement or upgrade of existing culverts. Some extension may be required and possibly new culverts under realigned sections of local road to facilitate this option.	Given the confined nature of the Blue Option Corridor to the existing N4, this could potentially constrain the ability to control and treat construction water runoff before it enters the adjacent watercourses. The construction footprint will be considerably less than the other route options but nevertheless some construction in or near watercourses will be required and therefore the overall impact on water quality is considered to represent a minor negative impact and an imperceptible impact on the hydrological regime of theses watercourses. At operation stage the use of the existing N4 will not easily facilitate the treatment and attenuation of storm water prior to its

Hydrological Attributes	Description	Impact
		discharge and consequently the operational impact of road runoff on the receiving watercourses is considered to also represent a minor negative impact.
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is 12km upstream of the eastern options and will not be impacted by the proposed route option (neutral - 4). The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km downstream of Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	The impact rating on the Carrick-on-Shannon surface water abstraction is neutral (4). The impact rating on the downstream Lough Forbes surface water abstraction is moderately negative (2) from an HGV accidental spillage risk as the existing drainage will be used which has no retention and storm water treatment provided.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors Ecological Sites of Local Higher Designated sites SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA). The route option runs adjacent to ecological sites EC99 representing wet woodland and wet grassland at Derryoughter and EC105 lake and associated wetland and wet woodland at Gortinty Lough. The use of the existing N4 road will avoid causing additional drainage effects on nearby wetland habitats and will significantly limit construction activities to road management activities (i.e. access roads and junctions). The existing road drainage system will be retained by this	There will be no direct impact on any designated sites by the proposed route option between Drumsna and Faulties. The indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent an imperceptible neutral impact (4) given the distance and attenuation provided by the River Shannon and the limited constructional activities involved. The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a moderately negative (2) impact due to the available River Shannon dilution. The impact of a major HGV Spillage on the

Hydrological Attributes	Description	Impact
	option and therefore routine road runoff will discharge without additional treatment and attenuation to the watercourses and eventually into the River Shannon. Sediment laden construction runoff reaching such sites and settling out will be minor given the limited construction activities involved with this option.	water quality of the SAC is of low risk but given the extremely high importance attribute of this receptor the impact is assessed as a moderately negative impact.
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. This option represents very limited construction works and as such handling of the poor ground conditions will not be a significant factor.	Soft sediments identified from the GSI Quaternary mapping represents c. 20% of the Option Corridor Length. However as the existing road is to be retained the impact of poor ground conditions is rated as representing a neutral impact (4).

Table 7.5.10.16 Stage 1 Hydrology Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION
Floodplains and Flood Risk Areas	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative		Minor or Slightly Negative
River Shannon Watercourse	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative	Minor or Slightly Negative		Not Significant or Neutral
Minor Watercourses	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
Surface Water Resources	Moderately Negative	Moderately Negative	Major or Highly Negative	Major or Highly Negative	Moderately Negative		Not Significant or Neutral
Hydro-ecology and designated sites	Minor or Slightly Negative	Minor or Slightly Negative	Moderately Negative	Moderately Negative	Minor or Slightly Negative		Moderately Negative
Soft Sediments and Poor Ground Conditions	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
Scoring							
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Major Negative**	**Major Negative**	**Moderately Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**1**	**1**	**2**		**3**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Least Preferred**	**Preferred**		**N/A**

Table 7.5.10.17 Stage 1 Hydrology Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Floodplains and Flood Risk Areas	Not Significant or Neutral	Not Significant or Neutral	Minor or Slightly Negative	Not Significant or Neutral
River Shannon Watercourse	Moderately Negative	Moderately Negative	Moderately Negative	Minor or Slightly Negative
Minor Watercourses	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative
Surface Water Resources	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative
Hydro-ecology and designated sites	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative
Soft Sediments and Poor Ground Conditions	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Not Significant or Neutral
Scoring				
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**	**Minor Negative**
Score / Impact Level	**2**	**2**	**2**	**3**
Preference	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**

7.5.10.5 Summary

Standalone Black Corridor Assessment

The Black Option representing 1.2km urban street improvement will have an overall minor negative impact on hydrology in terms of flooding and flood risk and minor impact in respect to on watercourses and soft ground. It has been assessed as a stand-alone option and is not compared with other options in the section.

Option Corridors to the West of Drumsna Junction (Node J)

The Blue West Option Corridor which is a management option of the existing N4 road is identified as having the highest score. This reflects lower hydrological impacts than the other options as a result of less requirement for construction work, retention of existing culverts and avoiding a new bridge crossing of the River Shannon and its floodplains. However, this option is not without significant impact in respect to Flood Risk whereby large section of the existing road is within the 100-year flood risk (Zone A) inundation zone both to the east and west of the River Shannon Bridge at Carrick-on-Shannon. A 150m section has been identified as flooding more frequently than a 1 in 10-year flood return period event which would result in road closure and diversions for many days during such events. Taking account of climate change in respect to flooding this is likely to increase in frequency in the medium term (i.e. over the next 50 years) to every other year. The Blue West Option Corridor will also retain the existing road storm drainage which does not meet current design standards in terms of attenuation and storm water quality treatment with almost 5km of the option located upstream of the highly important water abstraction public water supply source from the River Shannon. This represents a moderate negative impact. However, when compared to the other four Option Corridors to the west of Drumsna Junction (Node J) the Blue West Option Corridor scores slightly better and is the Preferred Option from a hydrological perspective.

The remaining options to the west of Drumsna Junction (Node J) are very similar in terms of their overall hydrological impact quantitative rating of major negative (1) and moderate negative (2). The key criterion that affects the differences between the northern options (Dark Green and Purple Option Corridors) and the southern options (Orange and Cyan Option Corridors) preference is impact on flood risk and impact on the Carrick-on-Shannon public water supply abstraction source from the River Shannon. The abstraction location is 1km upstream of Carrick-on-Shannon Bridge and therefore driving the decision between crossing the River Shannon upstream or downstream of Carrick-on-Shannon. All crossings will involve a major bridge structure and local interference with the floodplain and potentially the river channel at the crossing point. The crossings of the River Shannon both upstream and downstream will involve infilling and loss of floodplain area which will slightly impact the Carrick-on-Shannon flood risk area. The downstream crossings, Orange and Cyan Options Corridor, through generation of bridge afflux will potentially impact the Carrick-on-Shannon flood risk area with a greater impact than the upstream crossings for Purple and Dark Green Option Corridors. However given the “Very High” attribute status of the River Shannon Floodplain and the Carrick-

on-Shannon flood risk area the impacts of all upstream and downstream options are quantified as a major negative impact. From a flooding and flood risk only perspective the Preferred Option would be a crossing upstream with Dark Green more preferred than Purple in terms of slightly lesser floodplain encroachment. In respect to Surface Water Resources and the impact on the Carrick-on-Shannon drinking water abstraction and potentially public health concerns, the upstream crossing options are least preferred as there is a much higher risk of water quality impacts on the source both at construction and operation phases than the downstream crossing options.

The Cyan and Orange Option Corridors can only potentially impact this water supply source via the small section of route at their respective western tie-in locations that drain to the River Shannon via the small tributaries that enter the River Shannon. These enter the River Shannon on the opposite bank, upstream of the abstraction point, and therefore the impact assessed as moderate negative but significantly less impacting than the upstream options. Therefore from a hydrological impact the preference is for a downstream crossing option with the Orange Option Corridor being preferred over the Cyan Option Corridor as the Orange Option Corridor has a smaller impact on the Knockananima Stream flood risk area and only a 600m corridor length draining the Shannon upstream of the abstraction point.

Option Corridors to the East of Drumsna Junction (Node J)

For the eastern section there are four Option Corridors Blue East, Yellow, Green and Purple East. The overall impact of these options is a minor negative for the Blue East Option Corridor and moderate negative for the other three options. Therefore, the Blue option is Preferred representing minor negative impact and the Yellow, Green and Purple are given Intermediate preference and represent moderate negative impact scores.

General Conclusion

There are no identified profound impacts associated with any of the Stage 1 Option Corridors and the potential impact to the Carrick-on-Shannon public water supply abstraction source can potentially be reduced through mitigation both for construction and operation phases to reduce the potential risk to a regionally important water supply. The impact on flooding caused by the River Shannon bridge crossing cannot be fully mitigated but can be reduced through the design phase to ensure that flood conveyance is not significantly impeded by any potential bridge structures.

7.5.11 Stage 1 Hydrogeology Option Assessment

7.5.11.1 Introduction

This section details the Stage 1 Assessment of the Options with respect to the hydrogeological constraints identified in Section 4.5 Hydrogeology of this report.

The hydrogeological constraints are presented with the Stage 1 Options on Figures 7.5.11.1.0 to 7.5.11.3.5.

Section 7.5.11.2 outlines the methodology that was used to carry out the study, including the assessment criteria The assessment criteria is presented in Section 7.5.11.3 with Section 7.5.11.4 dealing with the Stage 1 Assessment of the Options.

The options included in this assessment fall under the following headings:

- Do-minimum Option (Planned and Committed Projects)
- Management Option (on-line improvements, and traffic management measures as described in Section 7.1.2 of this document)
- Do-Something Road Based Options

A total of ten Option Corridors have been taken forward to the preliminary options as described in Section 7.1.2 of this report. There are six option corridors to the west of node J at Drumsna Junction (Purple West, Dark Green, Black, Orange, Cyan and Blue West) and three option corridors to the east of Node J at Drumsna Junction (Blue East, Purple East, Green and Yellow).

7.5.11.2 Methodology

This assessment was prepared in accordance with the requirements of the National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009[63].

In line with these Guidelines, the assessment study area for this Stage 1 Option Corridors Assessment is a 300m wide corridor within which the fenceline may move. The assessment is carried out within the 300m wide corridors for all the Option Corridors.

The NRA Guidelines[63] provide criteria for ranking of the identified hydrogeological constraints within the assessment study area. The criteria are presented in Section 4.14 Hydrogeology. Criteria for rating an impact significance that may arise at each hydrogeological constraint are provided within Box 4.4 of the NRA Guidelines and in Table 7.5.11.1. The impact significance assessment takes into account the attribute importance and the predicted scale and duration of the likely impacts.

[63] NRA (2009) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available from: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

Table 7.5.11.1 Criteria for Rating Impact Significance at Route Selection Stage – Rating of Significant Environmental Impacts at Route Selection Stage from Box 4.4 of the Guidelines[63]

Impact Level	Attribute Importance				
	Extremely High**	**Very High**	**High**	**Medium**	**Low**
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on Significant proportion of attribute		
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

***In rating impacts on an 'European site' account must be taken of Article 6(3) and 6(4) of the Habitats Directive (Council Directive 92/43/EEC). Also see guidance contained within Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev 2, National Roads Authority, 2008)*

The NRA Guidelines qualitative significance rating of environmental impacts have been correlated with the equivalent qualitative and quantitative assessment scores from the TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi-Criteria Analysis2 (listed in Table 7.3.1). The correlation is shown in Table 7.5.11.2. It should be noted that only negative potential impacts are considered in the NRA Guidelines whereas the TII PAG2 multi-criteria assessment is based on the seven point scale presented in Table 7.3.1 of this report.

Table 7.5.11.2 Correlation of NRA Guidelines Significance Rating to an Equivalent TII PAG score

Significance Rating (NRA Guidelines[63])	Equivalent PAG (Description)	Equivalent PAG (Value)
Profound	Major or Highly Negative	1
Significant	Major or Highly Negative	1
Moderate	Moderately Negative	2
Slight	Minor or Slightly Negative	3
Imperceptible	Not Significant or Neutral	4

The final stage of the assessment methodology was to ensure that the requirements of the TII PAG Unit 7.0 - Multi-Criteria Analysis2 were also met by assigning a score to each option corridor based on the scoring procedure within these Guidelines. Where a positive score is assigned, they are from the TII PAG scoring system.

Using the impact scores and professional judgement, the preferred, intermediate or least preferred corridors were identified.

The option corridor study comprised a desk study and site visit collating the hydrogeological information available (Constraints Study, Section 4.14).

7.5.11.3 Assessment Criteria

In line with NRA Guidelines, the hydrogeological attributes which are considered in the Option Corridors assessment are presented in Table 7.5.11.3. This table also outlines the assessment criteria that will be applied to each of these features.

Table 7.5.11.3 Hydrogeological Assessment Criteria Summary

Hydrogeological Features to be Assessed	Means of Assessment of Potential Impacts
Karst features along each corridor and the risk presented to them by the road scheme	The proximity to the feature. The length of the corridor within feature protection zone or zone of contribution.
The classification and extent of aquifers underlying each corridor and increased risk presented to them by road scheme	Aquifer classification. Extent of aquifer – provided as the length of the corridor as a percentage which is underlain by a particular aquifer classification. Aquifer vulnerability – provided as the length of the corridor, as a percentage, which is underlain by aquifer which is classified as extreme vulnerability. Removal of subsoil cover or part of aquifer (cuttings along corridors) which may give rise to changes in groundwater level and change in aquifer vulnerability.

Hydrogeological Features to be Assessed	Means of Assessment of Potential Impacts
High yielding water supply wells and springs and increased risk presented by the road scheme	The proximity to the feature. The length of the corridor within protection zone or zones of contribution.
Groundwater dependant habitats and the risk presented to them by the road scheme	The proximity and the position (upgradient or downgradient) to the feature. Removal of subsoil cover or part of aquifer (cuttings along corridor) which may give rise to changes in groundwater level. Removal of part of the habitat by the option corridor.

It should be noted that other low importance hydrogeological features were gathered during the desk study phase of the constraints study and are presented in Section 4.14. This information was gathered to provide the wider context of the scheme, however, the features listed in Table 7.5.11.3 have been used in this assessment to compare the Option Corridors and identifiy a Preferred Option.

7.5.11.4 Stage 1 Option Corridors Assessment

Karst

There are no significant karst features identified along any of the Option Corridors. Some karst spring type features were identified during the site walkover, however these were relatively minor drainage features and as such are not assigned a feature importance. Therefore, with regard to karst landforms and features all the corridors are considered Neutral.

Aquifer Classification and Groundwater Bodies

The aquifers identified in the constraints study are presented in Section 4.14 of the Constraints Study. The potential impact on the aquifer along each corridor is a combination of the type and extent of the aquifer, aquifer vulnerability and presence of deep cuttings (removal of soil and/or rock to road design elevations) along each option corridor.

The corridors west of Node J are underlain by Regionally Important Aquifer where the bedrock is karstified and dominated by conduit flow (Rkc). East of Node J the area is underlain by three types of aquifers; a Regionally Important Aquifer where the bedrock is karstified and dominated by conduit flow (Rkc), Locally Important Aquifer where the bedrock is generally moderately productive (Lm) and Poor Aquifer where the bedrock is generally unproductive only in local zones (Pl).

In this assessment the aquifer extent and type for the corridors are compared by the depth of cutting in each aquifer type. Cuts between 5 and 10m in depth are considered to be a permanent impact on a small proportion of the aquifer. Cuts greater than 10m in depth are considered to be a permanent impact on a significant proportion of the aquifer.

Roads constructed in deep cuttings can impact on the groundwater by causing dewatering of the groundwater in the vicinity. The deeper the cutting the more significant and more extensive the impact. In addition, the removal of the soil and bedrock in the excavation will increase the vulnerability of the aquifer at that location, as vulnerability is largely dependent on the depth and permeability of subsoil above the aquifer. The potential change in aquifer vulnerability as a result of cutting is be calculated based on the existing elevation at the option centreline, the proposed cutting at the centreline according to the proposed option design and the underlying ground condition properties.

The assessment considers both the increase in Extreme vulnerability areas as a result of development, and the total extent of the route option underlain by Extreme vulnerability aquifers.

The results of the assessment on the aquifers from options west of Node J are summarised in Table 7.5.11.4 and results for the options east of Node J are summarised in Table 7.5.11.5. All the options include cuts greater than 5m deep with the exception of the Green Option where all cuts are less than 5m deep and the Blue West and Blue East Options where no cutting is proposed. The blue option corridors are located in both the western part and the eastern part of the study area.

Table 7.5.11.4 Assessment of Aquifers West of Drumsna Junction (Node J)

Assessment Criteria		CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Assessment of impact on Aquifer classification	Aquifer classification	Rkc	Rkc	Rkc	Rkc	Rkd		Rkc
	Attribute importance	High	High	High	High	High		High
	Total length of cut 5 to 10m (m)	290	100	1420	1080	0		140
	Total length of cut >10m (m)	100	0	330	570	0		0
Assessment of the increase in aquifer vulnerability	Total length of extreme (E), existing conditions (m)	5,200	3,810	1,870	1,210	5940		0
	Total length of extreme (E), proposed design conditions (m)	5,340	3,880	2,130	1,980	5940		0
	Increase in extreme (E) vulnerability (m)	140	70	260	770	0		0
Assessment Summary	Significance rating (NRA Guidelines[63])	Significant	Moderate	Significant	Significant	Imperceptible		Moderate
	Equivalent PAG (Description)	Major or Highly Negative	Moderately Negative	Major or Highly Negative	Major or Highly Negative	Not Significant or Neutral		Moderately Negative
	Equivalent PAG (Value)	1	2	1	1	4		2

Table 7.5.11.5 Assessment of Aquifers East of Drumsna Junction (Node J)

Assessment Criteria		GREEN OPTION CORRIDOR			YELLOW OPTION CORRIDOR			PURPLE EAST OPTION CORRIDOR			BLUE EAST OPTION CORRIDOR		
Assessment of impact on Aquifer classification	Aquifer classification	Rkc	Lm	Pl	Rkc	Lm	Pl	Rkc	Lm	Pl	Rkc	Lm	Pl
	Attribute importance	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
	Total length of cut 5 to 10m (m)	0	0	0	0	60	230	0	280	140	0	0	0
	Total length of cut >10m (m)	0	0	0	0	0	0	0	0	0	0	0	0
Assessment of the increase in aquifer vulnerability	Total length of extreme (E), existing conditions (m)	610	1,420	1,060	610	1,380	1,020	620	1,610	920	610	1420	1060
	Total length of extreme (E), proposed design conditions (m)	610	1,420	1,060	610	1,400	1,020	620	1,610	920	610	1420	1060
	Increase in extreme (E) vulnerability	0	0	0	0	20	0	0	0	0	0	0	0
Assessment Summary	Significance rating (NRA Guidelines[63])	Imper-ceptible	Imper-ceptible	Imper-ceptible	Imper-ceptible	Slight	Imper-ceptible	Imper-ceptible	Slight	Imper-ceptible	Imper-ceptible	Imper-ceptible	Imper-ceptible
	Equivalent PAG (Description)	Not Signif-icant or Neutral	Not Signif-icant or Neutral	Not Signif-icant or Neutral	Not Signif-icant or Neutral	Minor or Slightly Negative	Not Significant or Neutral	Not Signif-icant or Neutral	Minor or Slightly Negative	Not Signif-icant or Neutral	Not Signif-icant or Neutral	Not Signif-icant or Neutral	Not Signif-icant or Neutral
	Equivalent PAG (Value)	4	4	4	4	3	4	4	3	4	4	4	4

Groundwater Resources

Groundwater sources are not considered in the option comparison assessment as there are no high yield water supply springs and wells i.e. public water supplies or group water scheme supplies along the corridors. No Source Protection Zones associated with public or group groundwater supply schemes are located along the option corridors.

The majority of groundwater abstraction wells identified within the corridors are of low importance. The NRA Guidelines suggests that little or no weighting should be given to the number of such wells along each corridor and/or their distance from the centre line when assessing relative impacts. In the case of low yielding water supply wells, the ranking of the level of potential impact is unnecessary, as wells will either have to be replaced or removed.

Groundwater Contamination

There are no discharge and emissions licensed facilities identified within any of the option corridors.

A number of abandoned and historical quarries and pits have been identified within the option corridors west of Node J, refer to Figures 4.15.4.0 to 4.15.4.5 for further details. However, the potential for the contamination of groundwater from these quarries is expected to be insignificant and therefore with regard to groundwater contamination all the corridors are considered Neutral.

Groundwater Flooding

There are no areas of historic groundwater flooding within any of the option corridors. Therefore, with regard to groundwater flooding all the corridors are considered Neutral.

Hydro-ecology

Groundwater dependent habitats which are present within the assessment study area of the corridors comprise Lough Eidin proposed Natural Heritage Area (pNHA) and undesignated areas of Annex I Habitat including Alluvial Forests [*91E0], Transition Mires and Quaking Bogs [7140] and Bog Woodland [*91D0]. These undesignated areas are labelled “ECxx” with the xx being a numeral for each site. Refer to Figures 7.12.0 to 7.12.6. Biodiversity impacts on groundwater dependent habitats are assessed as part of the biodiversity option corridors assessment. The hydrogeological assessment of groundwater dependent habitats focuses on the groundwater components of the features i.e. changes to groundwater level which may impact recharge to the feature, or changes to groundwater quality.

The proximity of the habitat to the corridor is considered with regard to increased pollution risk from untreated surface water run-off or accidental spillage of fuel from the road affecting groundwater quality. However, as per Section 4.4 of the NRA Guidelines, the assessment has considered the application of standard mitigation and best practice during construction is unambiguous and success is highly likely. Therefore, it is assumed that standard drainage design measures will

be put in place to reduce the risk of run-off from the road affecting groundwater quality, reducing this risk.

Based on the potential dewatering assumption noted in Section 7.5.11.4, the presence of dewatering associated with deep cuttings is assessed in conjunction with the options located up or down gradient of the habitat for the potential impact to groundwater level.

If part of the habitat may be removed by an option corridor, impact to the general groundwater regime in this area is considered. Note: the area within the option corridor has been used to establish if an option may directly impact the habitat.

Deep cuttings and habitat removal are therefore considered the primary potential impact to groundwater dependent habitats and the local groundwater regime. Where the groundwater dependent habitat is located within the option corridor this is considered to be a permanent impact on a small proportion. Where there is a cutting of greater than 5m within 100m of the habitat this is considered to be a permanent impact on a significant proportion. The assessed impacts to groundwater dependent habitats are outlined below and summarised in Table 7.5.11.9.

A conservative approach was taken regarding these habitats in advance of detailed design, detailed survey and groundwater monitoring. These features have been assessed as if they are dependent on surface water and groundwater, refer to Section 7.5.10 for the Stage 1 Preliminary Options Assessment for Hydrology. The hydrogeological assessment of these habitats focuses on the groundwater components of the features i.e. changes to groundwater level which may impact recharge to the feature, or changes to groundwater quality.

Lough Eidin pNHA

Lough Eidin pNHA contains extensive areas of wet grasslands which flood in the winter. The pNHA is of national importance and classified to be of Very High importance according to the NRA guidelines. Refer to Figures 7.12.2.0 to 7.12.2.6 for details of its extents.

Lough Eidin pNHA is located within the Purple West, Dark Green and Blue West Option Corridors. There is a cutting greater than 5m deep associated with the Dark Green Option Corridor within 100m of Lough Eidin pNHA. As the proposed cutting is >5m in depth is it considered to be a permanent impact on a significant proportion of the attribute.

There are no cuttings associated with the Purple West or Blue West Option Corridors which are greater than 5m in depth and within 100m of the Lough Eidin pNHA. Therefore, the impact of both the Purple West and Dark Green Options is considered to be a permanent impact on a small proportion of the attribute.

Annex I Habitats

Priority Annex I Habitat [91E0*] Alluvial Woodlands and Annex I Habitats Transition Mires and Quaking Bogs [7140] and Bog Woodland [91D0] identified within the study area are valued by the Project Biodiversity Specialist to be on a national scale. According to the NRA guidelines groundwater dependant habitats

valued on a national scale are considered to be of Very High importance. There are pockets of alluvial woodland across the area. For the purpose of this assessment, they are considered as one attribute as they make up a relatively small proportion of the national habitat.

A summary of the habitats and the impact due to the proposed Option Corridors is provided in Table 7.5.11.6. Refer to Biodiversity Figures 7.5.9.1.0 to 7.5.9.1.5. The potential hydro-ecology impact by the option corridors west of Node J are presented in Table 7.5.11.7. There are no hydro-ecology sites east of Node J and the impact on hydro-ecology from the option corridors are considered to be neutral.

Table 7.5.11.6 Hydrogeological Assessment of the Impact to Annex 1 Habitats

Habitat ID	Description	Location (Option Corridor)	Impact	Justification for Impact
EC16	Broadleaved / wet woodland / scrub, marsh and wet grassland on the banks of River Shannon with areas of confirmed and potential Alluvial Woodland [*91E0] habitat.	Purple and Dark Green	A permanent impact on a small proportion of the attribute	The habitat is located more than 100m from proposed cuts >5m deep
EC28	Potential Alluvial Woodland [*91E0]	Purple and Dark Green	A permanent impact on a significant proportion of attribute	The Purple and Dark Green Option Corridors include cuttings >5m deep located within 20m of the habitat.
EC50	Marsh, wet grassland and scrub with the potential to develop into Alluvial Woodland [*91E0] habitat in the short to medium term. The habitat also contains an area of Annex I Transition mires [7140].	Cyan and Orange	A permanent impact on a small proportion of the attribute	The habitat is located more than 100m from proposed cuts >5m deep
EC51	Broadleaved / wet woodland, scrub and wet grassland with potential for peatland habitats as well as Alluvial Woodland [*91E0]	Cyan and Orange	A permanent impact on a small proportion of the attribute	The habitat is located more than 100m from proposed cuts >5m deep
EC52	Broadleaved / wet woodland, scrub and wet grassland with potential for peatland habitats as well as Alluvial Woodland [*91E0]	Cyan, Orange and Blue	A permanent impact on a small proportion of the attribute	The habitat is located more than 100m from proposed cuts >5m deep
EC88	Broadleaved and conifer woodland along the River Shannon with potential for Alluvial Woodland [*91E0].	Cyan, Orange, Purple, Blue and Dark Green	A permanent impact on a small proportion of the attribute	The habitat is located more than 100m from proposed cuts >5m deep

Table 7.5.11.7 Stage 1 Hydro-ecology Assessment West of Drumsna Junction (Node J)

Option Corridor	Biodiversity Features Dependent on Water	Attribute Importance	Potential Impact: Temporary/permanent Impact on 'X' Proportion of Attribute (from Table 1.2) Box 4.4[63]	Box 4.4[63] Impact Level	PAG Qualitative Ranking	PAG Value
Black Option Corridor	No groundwater dependant habitats within the study area or within close proximity of the black option corridor.	N/A	N/A	N/A	Not Significant or Neutral	4
Cyan Option Corridor	Alluvial Woodlands [*91E0] habitat	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
	Transition mires [7140]	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
Orange Option Corridor	Alluvial Woodlands [*91E0] habitat	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
	Transition mires [7140]	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
Purple West Option Corridor	Alluvial Woodlands [*91E0] habitat	Very High	Significant (Permanent)	Profound	Major or Highly Negative	1
	Lough Eidin pNHA	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
Dark Green Option Corridor	Alluvial Woodlands [*91E0] habitat	Very High	Significant (Permanent)	Profound	Major or Highly Negative	1
	Lough Eidin pNHA	Very High	Significant (Permanent)	Profound	Major or Highly Negative	1
Blue West Option Corridor	Alluvial Woodlands [*91E0] habitat	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
	Lough Eidin pNHA	Very High	Small (Permanent)	Significant	Major or Highly Negative	1

Table 7.5.11.8 Stage 1 Hydrogeology Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Aquifer Classification	Major or Highly Negative: Relatively moderate length of deep cuttings in high importance aquifer. Small increase in extreme vulnerability.	Moderately Negative: Relatively short length of deep cuttings in high importance aquifer and none greater than 10m deep. Small increase in extreme vulnerability.	Major or Highly Negative: Relatively long length of deep cuttings in high importance aquifer. Relatively moderate increase in extreme vulnerability.	Major or Highly Negative: Relatively long length of deep cuttings in high importance aquifer. Relatively large increase in extreme vulnerability.	Not Significant or Neutral: No proposed cutting leading to loss of aquifer or increase in vulnerability.		Moderately Negative: Relatively small length of deep cuttings in high importance aquifer and none greater than 10m deep. No increase in extreme vulnerability
Hydro-ecology	Major or Highly Negative: 2 No. habitats of national importance located within Option Corridor.	Major or Highly Negative: 2 No. habitats of national importance located within Option Corridor.	Major or Highly Negative: 2 No. habitats of national importance located within Option Corridor. Cutting >5m deep located within 100m of alluvial woodland.	Major or Highly Negative: 2 No. habitats of national importance located within Option Corridor. Cutting >5m deep located within 100m of alluvial woodland and Lough Eidin pNHA.	Major or Highly Negative: 2 No. habitats of national importance located within Option Corridor.		Not Significant or Neutral: No groundwater dependant habitats within the Option Corridor.
Scoring							
Qualitative Assessment	**Moderately Negative** Relatively moderate impact on aquifer and hydro-ecology compared to other options.	**Moderately Negative** Relatively moderate impact on aquifer and hydro-ecology compared to other options.	**Major** or **Highly Negative** Greatest impact on hydro-ecology and aquifers.	**Major** or **Highly Negative** Greatest impact on hydro-ecology and aquifers.	**Major** or **Highly Negative** Lesser impact on hydro-ecology compared to other options and minimal impact on aquifers.		**Moderately Negative** Moderate impact on aquifers.
Score / Impact Level	**1**	**1**	**1**	**1**	**1**		**2**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Least Preferred**	**Preferred**		**N/A**

Table 7.5.11.9 Stage 1 Hydrogeology Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Aquifer Classification	Minor or Slightly Negative: Relatively moderate length of deep cuttings in medium and low importance aquifers. No cuttings greater than 10m in depth. Small increase in extreme vulnerability	Not Significant or Neutral: No cuttings greater than 5m deep and no increase in extreme vulnerability	Minor or Slightly Negative: Relatively moderate length of deep cuttings in medium and low importance aquifers. No cuttings greater than 10m in depth. No increase in extreme vulnerability	Not Significant or Neutral
Hydro-ecology	Not Significant or Neutral Major or highly negative	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Scoring				
Qualitative Assessment	**Minor** or **Slightly Negative** Slight impact on underlying aquifers	**Not Significant** or **Neutral** Minimal impact on underlying aquifers and hydro-ecology	**Minor** or **Slightly Negative** Slight impact on underlying aquifers	**Not Significant** or **Neutral** Minimal impact on underlying aquifers and hydro-ecology
Score / Impact Level	**3**	**4**	**3**	**4**
Preference	**Intermediate**	**Preferred**	**Intermediate**	**Preferred**

7.5.11.5 Summary

All the option corridors have been assessed for the hydrogeological constraints identified within each option corridor.

There are no karst features, sources of groundwater contamination or records of historical groundwater flooding identified within the option corridors. There are also no groundwater sources or groundwater abstractions which are considered greater than low importance within the option corridors. Therefore, these features are all considered Neutral when comparing the option corridors.

The assessment is based on the impact to the aquifers and the impact on the groundwater dependant habitats.

Comparison between Option Corridors West of Drumsna Junction (Node J)

West of Node J the Blue West Option Corridor presents the Preferred option as it is associated with the least potential impact on hydro-ecology and the underlying aquifers. The Blue West Option Corridor is not associated with any cuttings and encounters fewer groundwater dependant habitats compared to the other options.

The Orange and Cyan Option Corridors are Intermediate options. There are fewer large cuttings associated with the Cyan Option and Orange Option Corridors and cuttings within close proximity to groundwater dependant habitats are relatively shallow.

The Purple West and Dark Green Option Corridors are Least Preferred as they are associated with significant cuts within relatively close proximity to Alluvial Woodlands [*91E0] habitat and the Lough Eidin pNHA. The Dark Green Option is considered less preferred than the Purple West as it would cause a considerably greater increase in extreme vulnerability compared to the Purple Option.

Comparison between Option Corridors East of Drumsna Junction (Node J)

There are no groundwater dependant habitats located east of Node J and the assessment is based on the impact to the aquifers.

East of Node J the Blue East and Green Options present the least potential impact on hydro-ecology and the underlying aquifers as both are associated with minimal cuttings and are therefore the Preferred options. The Yellow and Purple East Options are associated with a longer length of deep cutting and therefore are less preferred and ranked as Intermediate.

7.5.12 Stage 1 Soils and Geology Option Assessment

7.5.12.1 Introduction

This section details the Stage 1 Preliminary Options Assessment with respect to the Soils and Geology constraints identified in Section 4.17 Soils and Geology of the Constraints Study.

The Option Corridors assessed are those discussed in Section 7.1.2 of the Option Selection Report.

The Soils and Geology constraints are presented with the Stage 1 Option Corridors in Figures 7.5.12.1.1 to 7.5.12.4.5.

Section 7.5.12.2 outlines the methodology that was used to carry out the assessment and outlines the assessment criteria which were used. Section 7.5.12.3 presents the assumptions that were adopted as part of the assessment. The Stage 1 Preliminary Options Assessment is also presented in Section 7.5.12.3 with the summary of the assessment presented in Section 7.5.12.4.

A total of ten option corridors have been developed for Stage 1 Assessment as described in Section 7.1.2 of this report. The option corridor names for inclusion in the tables in this assessment are as follows:

- West of Drumsna Junction (Node J):
  - Cyan Option Corridor
  - Orange Option Corridor
  - Purple West Option Corridor
  - Dark Green Option Corridor
  - Blue West Option Corridor
  - Black Option Corridor
- East of Drumsna Junction (Node J):
  - Green Option Corridor
  - Yellow Option Corridor
  - Purple East Option Corridor
  - Blue East Option Corridor

The following elements of each option corridor will be assessed with respect to Soils and Geology, the basis of these widths is outlined in Section 7.1.2.

- Corridor – approximately a 300m wide corridor with the exception of the Black Option Corridor which is approximately 150m wide

The study area, constraints, and Stage 1 Options considered in the Soils and Geology assessment are shown on the figures listed in the table below.

Table 7.5.12.1 List of figures for the Stage 1 Soils and Geology Assessment

Figure Number	Title	Sheet
Figure 7.15.12.1.0 – Figure 7.15.12.1.5	Soil Deposits Map	Sheet 1 to 6
Figure 7.15.12.2.0 – Figure 7.15.12.2.5	Subsoil Deposits Map	Sheet 1 to 6
Figure 7.15.12.3.0 – Figure 7.15.12.3.5	Bedrock Geology Map	Sheet 1 to 6
Figure 7.15.12.4.0 – Figure 7.15.12.4.5	Geological Pressures	Sheet 1 to 6

7.5.12.2 Methodology

This assessment has been prepared in line with the following guidance:

- NRA, 2009 Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology on National Road Schemes (herein referred to as NRA Guidelines)[64]
- The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[65]
- NRA, 2008 Environmental Impact Assessment of National Road Schemes – a Practical Guide[66]

The NRA Guidelines provide useful criteria for rating of the identified soils and geology constraints (herein referred to as Criteria). Each criterion comprises of individual attributes which have been assigned an Importance using Box 4.1 of the NRA Guidelines. The Importance ratings are listed in the table below. The Assessment differentiates between the Option Corridors through the 'Magnitude of Impact'.

The 'Magnitude of Impact' assesses the impact that each Option Corridor has on each criterion attribute, a 'Magnitude of Impact' is assigned using Box 5.1 of the NRA Guidelines as presented in the table below. The magnitude of the potential impacts that may arise for each criterion attribute have been assessed based on the information that is currently available.

A 'Significance of impact' has then been determined from the table below based on the 'Importance of Attribute' and the 'Magnitude of Impact'. The terminology

[64] NRA, 2008. Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available from: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf
[65] EPA, 2017. Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available from: https://www.epa.ie/publications/monitoring--assessment/assessment/draft-guidelines-on-the-information-to-be-contained-in-environmental-impact-asse.php
[66] National Roads Authority, 2008. Environmental Impact Assessment of National Road Schemes – a Practical Guide. Available at: https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf

adopted in the summary tables in Section 7.5.12.3 to describe the significance of an impact is that used in Box 5.4 of the NRA Guidelines as it is more succinct and more appropriate for the purposes of this assessment.

The negative and positive potential impacts of the Option Corridors on Soils and Geology have been considered in the analysis. The positives were taken into account by reducing the overall negative impacts of individual attributes.

Table 7.5.12.2 Rating of Significant Environmental Impacts (from Box 5.4 of NRA Guidelines)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Once an impact level was determined for each associated criterion attribute for each Option Corridor, an overall impact rating was assigned to that criterion using the TII Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 - Multi-Criteria Analysis (MCA)2. The scoring system identified in Table 7.3.1 of this report was used to rank Option Corridors is outlined in Section 2.4 of the TII PAG:

7.5.12.3 Assessment Criteria

A preliminary sensitivity analysis of each criterion identified as part of the constraints study (Geomorphology, Soils, Subsoils, Bedrock Geology, Landside Susceptibility, Contaminated Sites, Economic Geology, Geological Heritage) has been undertaken prior to the completion of the Multi-Criteria Analysis (MCA). The purpose of this sensitivity analysis is to identify the criteria that are key differentiators between each of the Option Corridors. The criteria that are identified as being key differentiators will make up the criteria for the MCA.

It should be noted that the Blue West and Blue East Option Corridors have not been assessed as part of this sensitivity analysis as this Option Corridor follows existing infrastructure with only upgrades to junctions planned. The impacts associated with the Blue West Option Corridor are significantly less than the other Option Corridors with minimal earthworks and impact to the Soils and Geology, therefore the impact from these Options are considered Neutral (i.e. 4 on the PAG Unit 7 seven point scale). If it was included as part of the sensitivity analysis it would skew the results rather than meaningfully input into it.

The criterion of earthworks material balance herein referred to as 'Earthworks' did not form part of the preliminary sensitivity analysis as this is considered a significant key differentiator between the Options and will be considered in the MCA in Section 7.5.12.3.

The preliminary sensitivity analysis was completed by undertaking the following steps:

- Calculating the length over which each Option Corridor impacts each criterion and converting this to a percentage of the total Option Corridor Length
- The difference between the range of percentage impact between Option Corridors (Greatest Difference) of a criterion was calculated
- The results from the sensitivity analysis show the criterion as either having a Greatest Difference of ≤5% or > 5%. Following a qualitative assessment of the analysis it was concluded that the criterion with a Greatest Difference >5% are considered key differentiators and will be included in the Preliminary Options Assessment

The following have been excluded from the Sensitivity Analysis for the following reasons:

- **Geomorphological features:** drumlins and ribbed moraines are considered to be captured in the earthwork and economic geology criterion and therefore have not been assessed as a standalone criterion
- **Subsoils - Glacial Till:** As Glacial Till is widespread throughout the study area and common to all Option Corridors it is not considered a differentiator and was eliminated from the analysis under the Subsoil criterion
- **Economic Geology - Active Quarry and Pit Sites:** are not impacted by the Option Corridors and therefore are not considered under the Economic Geology criterion
- **Contaminated Sites - Urban Wastewater Treatment (UWWT) plants & Water Framework Directive (WFD) Section 4 discharge points:** are not impacted by the Option Corridors and not considered under the Contaminated Sites criterion

The results from the analysis are presented in following two tables.

Table 7.5.12.3 Preliminary Sensitivity Analysis Results – West Drumsna Junction (Node J)

Constraint / Criterion	Impact %				Greatest Difference	Selected as MCA Sub-Criteria (>5%)
	Cyan	Orange	Dark Green	Purple		
Soil Deposits (well drained soil types which are important for agriculture)	0%	0%	3%	2%	3%	No
Soft Soils (Alluvium, Peat and Lacustrine)[1]	62%	62%	51%	48%	14%	Yes
Bedrock (Karst)	0%	0%	0%	0%	0%	No
Bedrock (Volcanic geology)	0%	0%	0%	0%	0%	No
Landslide Susceptibility (moderately high to high)	1%	1%	0%	0%	1%	No
Contaminated Sites[2]	32%	20%	9%	7%	25%	Yes
Economic Geology[3]	70%	74%	67%	76%	9%	Yes
Geological Heritage	0%	0%	0%	0%	0%	No

Table 7.5.12.4 Preliminary Sensitivity Analysis Results – East of Drumsna Junction (Node J)

Constraint / Criterion	Impact %			Greatest Difference	Selected as MCA Sub-Criteria (>5%)
	Purple	Green	Yellow		
Soil Deposits (well drained soil types which are important for agriculture)	0%	0%	0%	0%	No
Soft Soils (Alluvium, Peat and Lacustrine)*	36%	39%	40%	4%	No
Bedrock (Karst)	0%	0%	0%	0%	No
Bedrock (Volcanic geology)	35%	35%	34%	1%	No
Landslide Susceptibility (Moderately high to high)	1%	1%	1%	0%	No
Contaminated Sites**	16%	15%	13%	3%	No
Economic Geology***	75%	70%	70%	5%	No
Geological Heritage	16%	19%	18%	3%	No

* *The subsoils of Alluvium, Peat and Lacustrine deposits are considered in the analysis under the heading of Soft Soils.*
** *The Contaminated Sites criterion includes made ground areas, historic quarry and pit sites, historic industrial sites, licenced industrial sites and waste facilities.*
*** *The Economic Geology criterion includes shallow bedrock (based on 'X' or 'E' groundwater vulnerability), high to very high crushed rock and granular aggregate potential areas and mineral resource locations.*

The results of the analysis for the Section West of Drumsna Junction revealed that the criteria of Soil Deposits, Bedrock (Karst and Volcanic Geology), Landslide Susceptibility and Geological Heritage had a Greatest Difference of <5% between the Option Corridors. The criteria of Soft Soils, Contaminated Sites and Economic Geology had a Greatest Difference of >5% and therefore will be brought forward into the MCA for the Stage 1 Preliminary Options Assessment for the Section West of Drumsna Junction.

The analysis for the Section East of Drumsna Junction revealed that there are no key differentiators between the Option Corridors as these for the most part all follow the alignment of the existing N4 corridor.

As mentioned previously the earthworks material balance is a key differentiator for the Options and will also be considered in the MCA in addition to the criteria listed prior.

While some of the Soils and Geology criteria have been excluded for the MCA for the Stage 1 Preliminary Options Assessment, it is possible that these criteria maybe considered in the next stage of the Option Assessments and for the Preferred Option in the EIAR where appropriate.

The following assumptions have been adopted as part of the Stage 1 Preliminary Options Assessment:

1. A buffer zone outside of each of the Option Corridors has not been adopted as the Option Corridor widths are considered to be all-inclusive.
2. All area measurements that are provided as part of the assessment have been rounded up to the nearest 1,000m^2.
3. Earthwork volumes (i.e. bulk cut/fill and surplus/deficit volumes) have been estimated based on the current carriageway designs produced as part of the Stage 1 Preliminary Options Assessment with the following assumptions:
    a) Cut volumes are based on 1V:2H slopes.
    b) Fill volumes are based on 1V:2H slopes.
    c) Volumes are based on 100mm depth of topsoil on slopes and verges.
    d) Volumes are based on a 700mm pavement box (250mm bituminous layer, 150mm Clause 804 layer and a 300mm capping layer), including on-line realignments. This pavement box arrangement would be broadly consistent with a subgrade CBR of 4.0%.

e) Volumes reported are for mainline corridors only (i.e. volumes exclude side roads, excavated material for utilities, gantries and structures).

f) Volumes do not consider topsoil removal, over-excavation in soil and rock, temporary works or construction compounds.

g) Volumes do not consider any earthwork requirements associated with the River Shannon Bridge crossing, including foundations and abutments.

h) Bulk earthwork volumes do not include for excavate and replace volumes associated with soft soils, soft soil excavate and replace volumes will be considered separately.

i) Bulk earthwork volumes do not include for excavate and replace volumes associated with made ground areas.

j) Volumes have not been classified into material types (suitable, unsuitable or marginal material) as part of Stage 1. Only bulk volumes are considered.

k) Opportunities to source material and reuse of material not suitable as general fill is not included in the Stage 1 assessment.

l) Volumes relate to in-situ volumes only, material bulking factors have not been applied.

m) Volumes have been rounded up to the nearest 1,000m^3.

n) In the calculation of the bulk earthwork volumes it has been assumed that all existing pavement will not be reused and a new pavement will be constructed.

o) The earthwork volumes for the Cyan, Orange, Dark Green and Purple West and Purple East Option Corridors are calculated for a dual carriageway. The adopted carriageway width is in accordance with TII Road Type and Cross-Section Type 2 Dual Carriageway, Publication Number CC-SCD-00005, April 2017.

p) The earthwork volumes for the Green and Yellow Option Corridors are calculated for a single carriageway to the east of Drumsna. The adopted single carriageway width is in accordance with TII Road Type and Cross-Section Type 1 Single Carriageway, Publication Number CC-SCD-00001, December 2017.

4. The new bridge crossing the Shannon will not be constructed prior to commencement of earthworks. Hence opportunities to move material across the Shannon will be limited.

5. Cut material won on either side of the River Shannon will not be hauled from East to West of the River Shannon and vice versa.

6. Borrow areas sufficiently large enough will be located both east and West of the River Shannon to supply sufficient material to both sides for the proposed earthworks.

7. Disposal of unsuitable material to a licenced facility.
8. Unsuitable cut material has not been accounted for as part of the Stage 1 Assessment.
9. Soft soils, if intersected by the Option Corridors, are assumed to be treated by excavation and replacement.
10. The temporary side slopes which are used to provide stability during the excavation of soft soils are assumed to be 1V:2H for the downslope from the outside edge of verge and 1V:1H for the upslope from the toe of the downslope. This is presented in Plate 7.5.12.1.

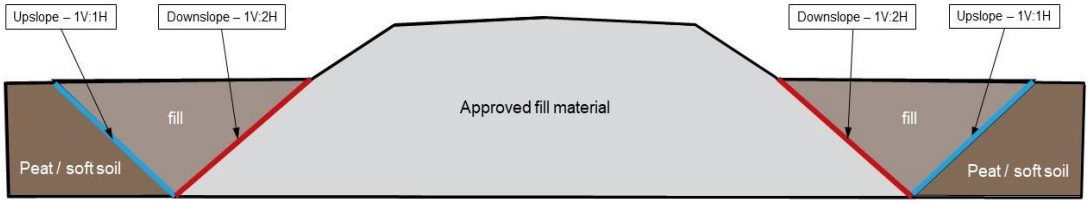

Plate 7.5.12.1 Assumed Soft Soil Excavate and Replace Section

The material from identified potentially contaminated sites (landfills, waste related sites, historic heavy industrial sites, historic quarries and pits and areas of made ground) are considered to require excavation and disposal to an appropriate licenced facility if intersected.

11. The horizontal extents of soft soils have been determined using the GSI Quaternary sediment mapping, the depths are based on available historic ground investigation and the GSI Groundwater Vulnerability map which gives an indication of the thickness of the overburden.
12. The soft soil volumes have been calculated for a dual carriageway section for the Cyan, Orange, Dark Green and Purple West Option Corridors. The adopted carriageway width is in accordance with TII Road Type and Cross-Section Type 2 Dual Carriageway, Publication Number CC-SCD-00005, April 2017.
13. There are no earthworks along the Blue Option Corridor only upgrades to Junctions.

7.5.12.4 Stage 1 Option Corridors Assessment

The outcome of the sensitivity analysis revealed that the following criteria shall be brought forward to the MCA to assist in determining the Options Selection from a soils and geology perspective:

- Criteria considered for Option Corridors West Node J at Drumsna Junction:

- Contaminated Sites comprising of horizontal extent of made ground, landfills and waste related sites, historic industrial sites, historic quarries and pits and licenced industrial sites
- Economic Geology comprising of horizontal extent of high to very high crushed rock aggregate potential, horizontal extent of high to very high granular aggregate potential and Mineral Localities
- Earthworks comprising of bulk cut and fill volumes, volume of soft soils and overall earthwork balance
- Criteria considered for Option Corridors East of Node J at Drumsna Junction:
- Earthworks comprising of bulk cut and fill volumes and overall earthwork balance

Following a review of these criteria it was decided that the criterion of Soft Soils would be better assessed as an attribute under the criterion of Earthworks as it will be assessed in terms of material management requirements and not in terms of subsoil importance. Plate 7.5.12.2 shows the assessment criteria and associated attributes that will form part of the MCA for the Stage 1 Preliminary Options Assessment.

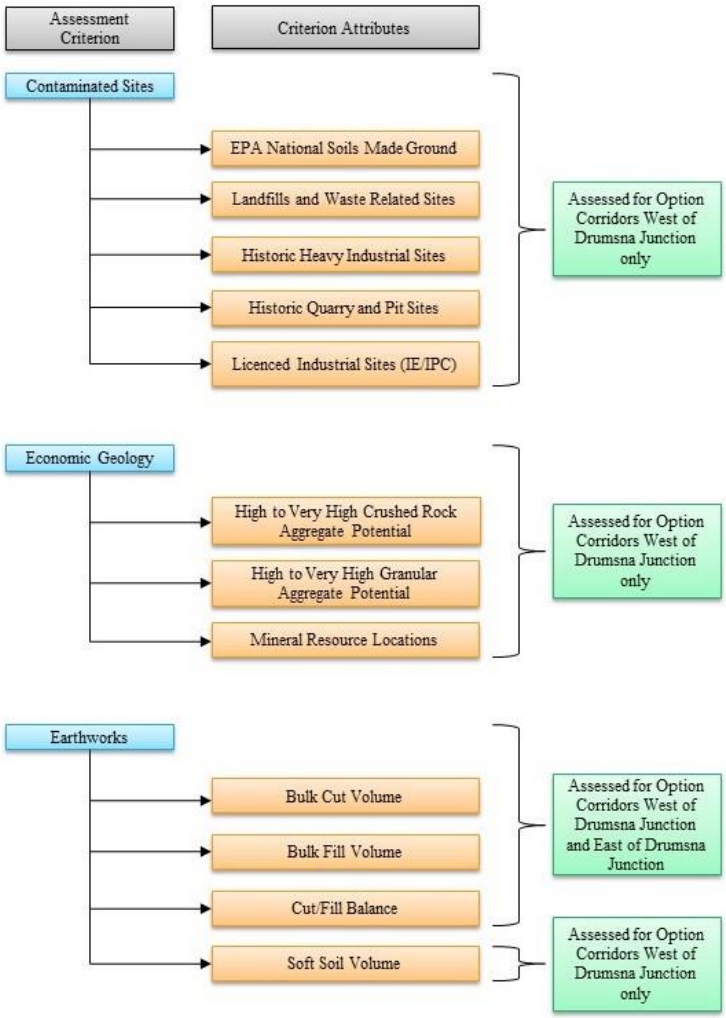

Plate 7.5.12.2 Assessment Criteria and Associated Attributes

Contaminated Sites

A number of sites of potential areas of contamination have been identified through consultation with the relevant authorities and the Constraints Study. The history, contents and volumes of these areas are not known sufficiently to confirm and provide accurate quantities of contaminated material at this stage. Therefore, a conservative approach has been taken, considering the entire plan area identified as comprising potentially contaminated material, as this type of material would require excavation and disposal to an appropriate licenced facility if intersected.

Note that the results from the sensitivity analysis presented in Section 7.5.12.3 demonstrated that contaminated sites are a key differentiator between the Option Corridors West of Drumsna Junction only, therefore, contaminated sites have not been assessed for Option Corridors East of Drumsna Junction.

Importance of Attribute

The made ground deposits recorded on the EPA National Soils mapping have been assessed as part of the contaminated sites assessment. Made ground deposits are considered to be of high importance due to the possible amount of material requiring excavation, its unsuitability for reuse and the material being potentially contaminated, which is considered to have a high significance on a local scale.

Landfills, waste related sites, historic heavy industrial sites, historic quarry and pit sites are considered to be of high importance as the nature of the material at these locations is unknown and these sites are considered to potentially contain material that will need to be disposed to an appropriate licenced facility, this is considered significant on a local scale.

Licenced industrial emission (IE) and integrated pollution control (IPC) sites are considered regulated and licenced facilities where the risk of ground contamination is less likely to occur, these sites are considered to be of low importance on a local scale.

Magnitude of Impact

The extent of the made ground for each Option Corridor has been calculated by clipping the plan area of made ground in the EPA National Soils mapping with each of the Option Corridor boundaries in GIS software ArcMap. The extents and impact of made ground are therefore based on area (m^2). The area of made ground intersected by the Options West of Drumsna Junction range between 59,000m^2 to 155,000m^2 and are all less than 10.0% of the total corridor areas. Therefore, the impact on made ground is considered to be small adverse.

The identified landfill, waste related sites, historic heavy industrial sites, historic quarry and pit sites and Industrial Emissions/Integrated Pollution Control (IE/IPC) sites have been assessed based on whether or not they are intersected by any of the Option Corridors. Note that the historic heavy industrial sites, historic quarry and pit sites and IE/IPC sites are available as point features, therefore, to account for the horizontal extents a 50m buffer has been applied to these sites in ArcMap as part of the assessment.

Of the 17 No. landfill or waste related sites identified in the Constraints Study three of them are impacted by the Cyan Option Corridor, West of Drumsna Junction:

- Three old permit sites in the Cloongownagh townland along the existing N4, approximately 2.5km west of Carrick-on-Shannon. These are thought to have been used for the recovery and disposal of material as part of the N4 realignment. The Cyan Option Corridor intersects approximately 269,000m² of this site, this is considered to be a moderate adverse impact.

Of the seven historic heavy industrial sites identified in the Constraints Study, two of them will be impacted by the Option Corridors:

- Carrick-on-Shannon historic gas works site - located on the western side of Carrick-on-Shannon near the Carrick-on-Shannon station (E: 593042, N: 798676). The footprint of the site is 2,000m² and is considered small scale, from a review of historic maps it appears that the site was developed into a commercial premise between 1995 and 2000, the risk of significant contaminated material being present is considered low. This site is intersected by the Cyan and Orange Option Corridors and is considered to be a moderate adverse magnitude of impact.

- Carrick-on-Shannon Rail Station- located on the western side of Carrick-on-Shannon (E: 592993, N: 798776). This site is still in use as a train station and has been in use since the late 1800's to early 1900's and may contain contaminated ground. This site is intersected by the Cyan and Orange Option Corridors and is considered to be a moderate adverse magnitude of impact.

Of the 40 No. historic quarry and pit sites identified in the Constraints Study, seven of them will be impacted by the Option Corridors West of Drumsna Junction. The Option Corridors West of Drumsna Junction impact between one and four sites each aside from the Blue Option which does not intersect any. As the area of these sites are small scale in comparison to the overall Corridor areas the impact on these is considered small adverse.

When an IE/IPC site is intersected by an Option Corridor it is considered to have a small adverse magnitude of impact. The Irish Rubber Components Ltd. Industrial Emission Site identified in the Constraints Study is the only IE/IPC site impacted and is intersected by the Orange Option Corridor.

The assessment of potential sites containing contaminated material is presented the following table .

Option Corridors East of Drumsna Junction

Although the contaminated sites criterion is not considered a key differentiator for the Stage 1 Option Corridors East of Drumsna Junction, it is important to note that the following identified potentially contaminated sites are intersected by these Options:

- 3 No. disused landfill/waste related sites

- 5 No. historic quarry sites

Table 7.5.12.5 Summary of Contaminated Sites Assessment for the Option Corridors West of Drumsna Junction (Node J)

Option Corridor	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Cyan Option Corridor	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	151,000 m^2	High	Small Adverse	Moderately / Slight	Moderately Negative
		Landfills and Waste Related Sites	Cloongownagh	269,000 m^2	High	Moderately Adverse	Significant / Moderate	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Gas works site	Intersected	High	Moderately Adverse	Significant / Moderate	
			Carrick-on-Shannon Rail Station	Intersected	High	Moderately Adverse	Significant / Moderate	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	4 No.	High	Small Adverse	Moderately / Slight	
		Licenced Industrial Sites	IE Site - Irish Rubber Components Ltd (P0641-01)	Not Intersected	Low	Negligible*	Imperceptible	
Orange Option Corridor	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	155,000 m^2	High	Small Adverse	Moderately / Slight	Moderately Negative
		Landfills and Waste Related Sites	Cloongownagh	Not Intersected	High	Negligible*	Imperceptible	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Historic Gas works site	Intersected	High	Moderately Adverse	Significant / Moderate	

Option Corridor	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
			Carrick-on-Shannon Rail Station	Intersected	High	Moderately Adverse	Significant / Moderate	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	4 No.	High	Small Adverse	Moderately / Slight	
		Licenced Industrial Sites	IE Site - Irish Rubber Components Ltd (P0641-01)	Intersected	Low	Small Adverse	Imperceptible	
Dark Green Option Corridor	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	59,000 m^2	High	Small Adverse	Moderately / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Cloongownagh	Not Intersected	High	Negligible*	Imperceptible	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Historic Gas works site	Not Intersected	High	Negligible*	Imperceptible	
			Carrick-on-Shannon Rail Station	Not Intersected	High	Negligible*	Imperceptible	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	3 No.	High	Small Adverse	Moderately / Slight	
		Licenced Industrial Sites	IE Site - Irish Rubber Components Ltd (P0641-01)	Not Intersected	Low	Negligible*	Imperceptible	

Option Corridor	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple West Option Corridor	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	60,000 m^2	High	Small Adverse	Moderately / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Cloongownagh	Not Intersected	High	Negligible*	Imperceptible	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Historic Gas works site	Not Intersected	High	Negligible*	Imperceptible	
			Carrick-on-Shannon Rail Station	Not Intersected	High	Negligible*	Imperceptible	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	1 No.	High	Small Adverse	Moderately / Slight	
		Licenced Industrial Sites	IE Site - Irish Rubber Components Ltd (P0641-01)	Not Intersected	Low	Negligible*	Imperceptible	
Blue West Option Corridor	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	This Option Corridor follows existing infrastructure with only upgrades to junctions planned. Therefore, there are considered	High	Negligible*	Imperceptible	Not Significant or Neutral
		Landfills and Waste Related Sites	Cloongownagh		High	Negligible*	Imperceptible	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Historic Gas works site		High	Negligible*	Imperceptible	

Option Corridor	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
			Carrick-on-Shannon Rail Station	no impacts on contaminated sites.	High	Negligible*	Imperceptible	
		Historic Quarry and Pit Sites	Historic Quarries and Pits		High	Negligible*	Imperceptible	
		Licenced Industrial Sites	IE Site - Irish Rubber Components Ltd (P0641-01)		Low	Negligible*	Imperceptible	

**A negligible magnitude of impact is assigned when an identified potentially contaminated site is not intersected by an Option Corridor*

Economic Geology

A number of economic geology sites have been identified across the study area through the Constraints Study, these include:

- High to very high crushed rock aggregate potential
- High to very high granular aggregate potential
- Mineral resource locations

Any Option Corridor intersecting these areas of economic geology would be sterilising resources that are considered to have a high quality on a local scale.

Note that the results from the sensitivity analysis presented in the methodology subsection of this section demonstrated that economic geology sites are a key differentiator between the Option Corridors West of Drumsna Junction only, therefore, economic geology sites have not been assessed for Option Corridors East of Drumsna Junction.

Importance of Attribute

Areas of very high to high crushed rock and granular aggregate potential are considered to be a high-quality resource on a local scale with a high importance.

Mineral resource locations are considered to have a high importance. The removal, partial removal or impact on these sites would result in a loss of a proven high quality, significant and valuable resource on a local scale.

Magnitude of Impact

The extent of the very high to high crushed rock and granular aggregate potential for each Option Corridor has been calculated by clipping the plan area of the GSI Aggregate Potential Mapping in GIS software ArcMap. The extents and impact of very high to high crushed rock and granular aggregate potential are therefore based on area (m^2).

The area of very high to high crushed rock potential intersected by the Options West of Drumsna Junction (aside from the Blue West Option) are all greater than 1,000,000m² which is greater than 25% of the total Corridor areas, the impact is considered to be moderate adverse.

The area of very high to high granular aggregate potential intersected by the Dark Green and Purple Options West of Drumsna Junction is 100,000m² which is less than 5% of the total Corridor areas, therefore the impact is considered to be small adverse.

The identified mineral resource locations have been assessed based on whether or not they are intersected by any of the Option Corridors.

When a mineral resource location is intersected by an Option Corridor it is considered to that a very small percentage of the mineral resource will be sterilised

by the Option Corridor. Therefore, the impact of a mineral resource location is considered to be small adverse.

When no areas of very high to high crushed rock and granular aggregate potential or mineral resource locations are intersected by an Option Corridor these criterion attributes are assigned a negligible magnitude of impact.

The assessment of areas of economic geology is presented in the table below.

Table 7.5.12.6 Summary of Economic Geology Assessment for the Option Corridors West of Drumsna Junction (Node J)

Option Corridor	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Cyan Option Corridor	Economic Geology	High to Very High Crushed Rock Aggregate Potential	Extent of High to Very High Potential	1,638,000 m^2	High	Moderately Adverse	Significant / Moderate	Minor or Slightly Negative
		High to Very High Granular Aggregate Potential	Extent of High to Very High Potential	0 m^2	High	Negligible*	Imperceptible	
		Mineral Resource Location	Mineral Resource Location	1 No.	High	Small Adverse	Moderately / Slight	
Orange Option Corridor	Economic Geology	High to Very High Crushed Rock Aggregate Potential	Extent of High to Very High Potential	1,485,000 m^2	High	Moderately Adverse	Significant / Moderate	Minor or Slightly Negative
		High to Very High Granular Aggregate Potential	Extent of High to Very High Potential	0 m^2	High	Negligible*	Imperceptible	
		Mineral Resource Location	Mineral Resource Location	1 No.	High	Small Adverse	Moderately / Slight	
Dark Green Option Corridor	Economic Geology	High to Very High Crushed Rock Aggregate Potential	Extent of High to Very High Potential	1,103,000 m^2	High	Moderately Adverse	Significant / Moderate	Moderately Negative
		High to Very High Granular Aggregate Potential	Extent of High to Very High Potential	100,000 m^2	High	Small Adverse	Moderately / Slight	

Option Corridor	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
		Mineral Resource Location	Mineral Resource Location	0 No.	High	Negligible*	Imperceptible	
Purple Option Corridor	Economic Geology	High to Very High Crushed Rock Aggregate Potential	Extent of High to Very High Potential	1,358,000 m^2	High	Moderately Adverse	Significant / Moderate	Moderately Negative
		High to Very High Granular Aggregate Potential	Extent of High to Very High Potential	100,000 m^2	High	Small Adverse	Moderately / Slight	
		Mineral Resource Location	Mineral Resource Location	0 No.	High	Negligible*	Imperceptible	
Blue Option Corridor	Economic Geology	High to Very High Crushed Rock Aggregate Potential	Extent of High to Very High Potential	This Option Corridor follows existing infrastructure with only upgrades to junctions planned. Therefore, there are considered no impacts on economic geology sites.	High	Negligible*	Imperceptible	Not Significant or Neutral
		High to Very High Granular Aggregate Potential	Extent of High to Very High Potential		High	Negligible*	Imperceptible	
		Mineral Resource Location	Mineral Resource Location		High	Negligible*	Imperceptible	

**A negligible magnitude of impact is assigned when an identified area of economic geology is not intersected by an Option Corridor*

Earthworks

An earthworks assessment has been carried out to estimate the potential bulk cut/fill and soft soil earthwork volumes for the Option Corridors. The assumptions that were used for this assessment are presented in Section 7.5.12.3.

Bulk Earthworks Volumes

The bulk earthwork volumes for each of the Option Corridors are presented in the two tables below.

Table 7.5.12.7 Bulk Earthwork Volumes for the Option Corridors West of Drumsna Junction (Node J)

Option Corridor	West of River the River Shannon			East of the River Shannon			Total Balance (m^3)
	Sum of Cut m^3	Sum of Fill m^3	Deficit / Surplus m^3	Sum of Cut m^3	Sum of Fill m^3	Deficit / Surplus m^3	
Cyan Option Corridor	137,000	419,000	282,000 (deficit)	60,000	316,000	256,000 (deficit)	538,000 (deficit)
Orange Option Corridor	52,000	200,000	148,000 (deficit)	62,000	303,000	241,000 (deficit)	389,000 (deficit)
Dark Green Option Corridor	5,000	132,000	127,000 (deficit)	788,000	888,000	100,000 (deficit)	227,000 (deficit)
Purple Option Corridor	2,000	91,000	89,000 (deficit)	707,000	660,000	47,000 (surplus)	42,000 (deficit)
Blue Option Corridor	No Mainline Earthwork Volumes						

Table 7.5.12.8 Bulk Earthwork Volumes for the Option Corridors East of Drumsna Junction (Node J)

Option Corridor	Sum of Cut m^3	Sum of Fill m^3	Deficit / Surplus m^3
Purple Option Corridor	221,000	127,000	94,000 (surplus)
Green Option Corridor	81,000	47,000	34,000 (surplus)
Yellow Option Corridor	170,000	107,000	63,000 (surplus)
Blue Option Corridor	No Mainline Earthwork Volumes		

As is presented in the tables above there are large material deficits, ranging between 227,000m^3 and 538,000m^3 for the Cyan, Orange and Dark Green Option Corridors,

West of Drumsna (Node J). In addition to this there are substantial deficits East (100,000m^3 to 256,000m^3) and West (89,000m^3 to 282,000m^3) of the River Shannon. There also are very significant earthworks volumes of cut and very significant volumes of fill for the Purple and Dark Green Option Corridors east of the River Shannon on the section West of Drumsna (Node J). As outlined in the assumptions the River Shannon is a significant constraint to undertaking the Earthworks for the project.

Soft Soil Volumes

An additional challenge for the earthworks material balance are the volumes of soft soils within all of these Option Corridors which will be required to be excavated and replaced with suitable material. Table 7.5.12.9 below summarises the volumes of soft soil deposits within each of the Option Corridors West of Drumsna Junction. The Soft Soils East of Drumsna Junction are not considered in this Stage of the Preliminary Options Assessment as these Options predominately follow the existing N4 alignment and the soft soils are assumed to have been removed as part of the construction of the existing N4.

Table 7.5.12.9 Soft Soil Volumes for the Option Corridors West of Drumsna Junction (Node J)

Option Corridor	West of River the River Shannon	East of the River Shannon	Total Soft Soil (m^3)
	Soft Soil Volume m^3	Soft Soil Volume m^3	
Cyan Option Corridor	112,000	203,000	315,000
Orange Option Corridor	113,000	212,000	325,000
Dark Green Option Corridor	36,000	489,000	525,000
Purple Option Corridor	39,000	454,000	493,000
Blue Option Corridor	No Mainline Earthwork Volumes		

Soft soils are extensive across the study area and are considered significant on a local scale, occurring on the low-lying ground in between drumlin features and on the floodplain of the River Shannon. It will be excavated from areas where it exists under the formation of the proposed Option Corridors in order to achieve a suitable bearing stratum. Given this, the volume of soft soils along each of the Options Corridors are considered as having a high importance.

The following methodology has been adopted in the determination of the soft soil volumes:

1. The polygons for Alluvium, Lacustrine and Peat deposits from the GSI Quaternary Sediment map and the historical ground investigation data have been used to determine the location and plan area for each of the soft soil areas.

The plan area of the soft soil areas considered in this assessment are taken over the entire carriageway width plus the verge plus the embankment slope plus the temporary side slopes with the centre line taken as the centre line of the Option Corridor.

2. The average depth of the soft soils at each identified soft soil area is used in the volume calculation. In areas where there is historic GI the average depths of the soft soils have been estimated from this information. In areas where there is no existing GI, the soft soil depths are based on the average depth across all of the Option Corridors for each soft soil. Depths of these deposits will be confirmed once the Phase 2 Ground Investigation is complete.

The overall earthwork deficit (combining bulk cut and fill volumes and volumes of soft soils) West of Drumsna Junction and West of the River Shannon, the material deficits are in the order of 128,000m^3 to 394,000m^3 on the Orange, Cyan, Dark Green and Purple Option Corridors. This deficit in suitable engineering fill will need to be sourced within or in the vicinity of these Option Corridors in this area.

East of the River Shannon and West of Drumsna Junction the overall earthwork deficit ranges from 407,00m^3 to 589,000m^3 on the Orange, Cyan, Dark Green and Purple Option Corridors. This deficit in suitable engineering fill will need to be sourced within or in the vicinity of these Option Corridors in this area.

East of Drumsna Junction there is a surplus of 34,000m^3 to 94,000m^3 of material as all of the Option Corridors are more or less following the existing alignment of the N4.

It is clear that there are challenges with regards to the availability of suitable engineering fill and the reuse/repurpose of unsuitable material for the construction of all of the Option Corridors both West and East of Drumsna Junction. It is assumed for the purposes of the Stage 1 Preliminary Options Assessment that suitable material can be sourced, and unsuitable material will be disposed of to a licenced facility for all of the Options Corridors. At Stage 2 of the assessment, it is proposed that an exercise will be undertaken to determine opportunities for sourcing suitable material and reusing and repurposing unsuitable material. This exercise will be undertaken using desktop information, Phase 2 ground investigation data, intelligence gathered from the public consultation process and observations from the supervision of the ground investigation.

As a result, the Stage 1 Assessment will focus on the analysis of the bulk earthworks and soft soil volumes for each of the Option Corridors only.

Importance of Attribute

The importance of the Earthworks Criterion Attributes for the Option Corridors for the Cyan, Orange, Dark Green, Purple West, Purple East, Green and Yellow Options are rated as high due to the significance of the volumes of the bulk earthworks and soft soils across all of the Option Corridors on a local scale.

The importance rating of low was given to the Blue Option Corridor as there are no earthworks planned along this Option Corridor, only upgrades to junctions.

Magnitude of Impact

The magnitude of the impact of the bulk earthwork volumes, soft soil volumes and overall earthwork balance have been assessed based on the following limits which are considered appropriate for small, moderate and large earthwork requirements:

- Small Adverse – less than 100,000m^3
- Moderate Adverse – between 100,000m^3 and 350,000m^3
- Large Adverse – greater than 350,000m^3

West of Drumsna Junction the Option Corridors have been assessed as follows:

- The large cut volumes of the Purple Option Corridor (709,000m³) and the Dark Green Option Corridor (793,000m³) have been assigned a large adverse magnitude impact due to the high cut volumes in soil and rock. The lesser cut volumes of 197,000m³ on the Cyan Option Corridor and 114,000m³ on the Orange Option Corridor have been given a moderate adverse magnitude of impact.
- The Dark Green Option Corridor has the highest volume of fill (1,020,000m³) followed by the Cyan and Purple Option Corridors (735,000m³ and 751,000m³ respectively) and then the Orange Option Corridor with 503,000m³. Considering the magnitude of these volumes these have all been assigned a large adverse magnitude of impact.
- All Option Corridors have significant soft soil volumes. The Dark Green (525,000m³) and Purple Option (493,000m³) have been assigned a large adverse impact. The Cyan (315,000m³) and Orange (325,000m³) Option Corridors have the lesser volumes and have been assigned a moderate adverse impact.
- When looking at the overall earthwork balance (cut, fill and soft soil volumes) the Cyan Option Corridor has a deficit of 853,000m^3, the Orange Option Corridor has a deficit of 714,000m³, the Dark Green Option Corridor has a deficit of 752,000m³ and the Purple Option Corridor has a deficit of 535,000m³ and have all be assigned a large adverse magnitude of impact.
- The Blue Option Corridor has scored negligible on all of the above as there are no earthworks planned on this Option only upgrades to existing junctions.

East of Drumsna Junction the Option Corridors have been assessed as follows:

- The Purple (221,000m³) and Yellow (170,000m³) Option Corridors have the largest cut volumes and have been assigned a moderate adverse impact. The Green Option Corridor gives a small adverse impact based on the lowest cut volume of 81,000m³.
- For the volumes of fill the Purple Option Corridor (127,000m^3) and Yellow Option Corridor (107,000m^3) have a moderate adverse impact and the Green Option Corridor (47,000m^3) has a small adverse impact.

- The cut/fill balance for all of the Option Corridors East of Drumsna result in a surplus which can be reused in the Option Corridors West of the River Shannon to reduce the deficit and lessen the impact of the material imbalance along these Corridors. As a result, the surplus volumes for the Purple (94,000m^3), Green (34,000m^3) and Yellow (63,000m^3) Option Corridors are considered to have a small adverse magnitude of impact.
- The Blue Option Corridor has scored negligible on all of the above as there are no earthworks planned on this Option Corridor only upgrades to existing junctions.

Table 7.5.12.10 Summary of the Earthworks Assessment for the Option Corridors West of Drumsna Junction (Node J)

Option Corridor	Criterion	Criterion Attributes	Description	Volume (m^3) or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Cyan Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	197,000	High	Moderate Adverse	Significant / Moderate	Major or Highly Negative
			Fill (m^3)	735,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	315,000		Moderate Adverse	Significant / Moderate	
			Overall Deficit (m^3)	853,000		Large Adverse	Severe / Significant	
Orange Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	114,000	High	Moderate Adverse	Significant / Moderate	Major or Highly Negative
			Fill (m^3)	503,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	325,000		Moderate Adverse	Significant / Moderate	
			Overall Deficit (m^3)	714,000		Large Adverse	Severe / Significant	
Dark Green Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	793,000	High	Large Adverse	Severe / Significant	Major or Highly Negative
			Fill (m^3)	1,020,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	525,000		Large Adverse	Severe / Significant	
			Overall Deficit (m^3)	752,000		Large Adverse	Severe / Significant	

Option Corridor	Criterion	Criterion Attributes	Description	Volume (m^3) or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple West Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	709,000	High	Large Adverse	Severe / Significant	Major or Highly Negative
			Fill (m^3)	751,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	493,000		Large Adverse	Severe / Significant	
			Overall Deficit (m^3)	535,000		Large Adverse	Severe / Significant	
Blue Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	This Option Corridor follows existing infrastructure with only upgrades to junctions planned. Therefore, there are no mainline earthwork volumes	Low	Negligible	Imperceptible	Not Significant or Neutral
			Fill (m^3)			Negligible	Imperceptible	
			Cut / Fill Balance (m^3)			Negligible	Imperceptible	
			Soft Soil (m^3)			Negligible	Imperceptible	

Table 7.5.12.11 Summary of the Earthworks Assessment for the Option Corridors East of Drumsna Junction (Node J)

Option Corridor	Criterion	Criterion Attributes	Description	Volume (m^3)	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple East Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	221,000	High	Moderate Adverse	Significant / Moderate	Moderately Negative
			Fill (m^3)	127,000		Moderate Adverse	Significant / Moderate	
			Cut / Fill Balance (m^3)	94,000 (surplus)		Small Adverse	Moderate / Slight	
Blue East Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	This Option Corridor follows existing infrastructure with only upgrades to junctions planned. Therefore, there are no mainline earthwork volumes	Low	Negligible	Imperceptible	Not Significant or Neutral
			Fill (m^3)			Negligible	Imperceptible	
			Cut / Fill Balance (m^3)			Negligible	Imperceptible	
Green Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	81,000	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
			Fill (m^3)	47,000		Small Adverse	Moderate / Slight	
			Cut / Fill Balance (m^3)	34,000 (surplus)		Small Adverse	Moderate / Slight	

Option Corridor	Criterion	Criterion Attributes	Description	Volume (m^3)	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Yellow Option Corridor	Earthworks	Bulk Earthworks	Cut (m^3)	170,000	High	Moderate Adverse	Significant / Moderate	Moderately Negative
			Fill (m^3)	107,000		Moderate Adverse	Significant / Moderate	
			Cut / Fill Balance (m^3)	63,000 (surplus)		Small Adverse	Moderate / Slight	

A standalone assessment has been undertaken of the Black Option Corridor to determine the baseline impacts on the Soils and Geology within this Option. A summary of the assessment for each of the criterion that were included in the sensitivity analysis is provided in the table below.

Table 7.5.12.12 Standalone Assessment Table – Black Option Corridor

Assessment Criteria	Black Option Corridor
Soil Deposits (well-drained soil types which are important for agriculture)	The Black Option Corridor does not intersect any soil types that are important for agriculture (well drained), therefore the significance of the impact on agricultural soils is **Imperceptible**.
Bedrock (Karst)	The Black Option Corridor does not intersect any karst features, therefore the significance of the impact on karst features is **Imperceptible**.
Bedrock (Volcanic Geology)	The Black Option Corridor does not intersect any volcanic bedrock formations, therefore the significance of the impact on volcanic geology is **Imperceptible**.
Landslide Susceptibility (Moderately high to high susceptibility)	The Black Option Corridor does not intersect areas of moderately high to high landslide susceptibility, therefore the significance of the impact on landslide susceptibility is **Imperceptible**.
Contaminated Sites	Approximately 6.0% of the Black Option Corridor intersects made ground with no identified potentially contaminated sites. Due to the unknown nature of the material across made ground areas these areas are considered to have a high importance. Given the small percentage of the Black Option Corridor that is underlain by made ground the magnitude is considered to be small adverse.

Assessment Criteria	Black Option Corridor
	Therefore, the significance of the impact on contaminated sites is considered to be **Moderate / Slight**.
Economic Geology	Approximately 8.0% of the Black Option Corridor intersects areas of high to very high crushed rock aggregate potential, with no high to very high granular aggregate potential areas, active quarries or pits or mineral localities intersected. Areas of high to very high crushed rock aggregate potential are considered to have a medium importance as these areas do not have a high significance on a local scale. Given the small percentage of the Black Option Corridor that is underlain by high to very high crushed rock aggregate potential the magnitude is considered to be small adverse. Therefore, the significance of the impact on economic geology is considered to be **Slight**.
Geological Heritage	The Black Option Corridor does not intersect any recorded geological heritage areas, therefore the significance of the impact on geological heritage is considered to be **Imperceptible**.
Earthworks	The earthwork requirement for the Black Option Corridor is considered to have a high importance on a local scale. The earthwork volumes for the Black Option Corridor are as follows, the magnitude of impact is considered to be small adverse:

Assessment Criteria	Black Option Corridor
	Bulk Cut Volume = 40,000m^3 Bulk Fill Volume = 54,000m^3 Bulk Cut / Fill Balance = 14,000m^3 (Deficit) Soft Soil Volume = 41,000m^3 Therefore, the significance of the impact on earthworks is considered to be **Significant / Moderate**.
Qualitative Assessment	**Significant** earthwork requirement when considering the short corridor length.
Score / Impact Level	1
PAG Description	**Major or Highly Negative**.

7.5.12.5 Summary

West of Drumsna Junction (Node J)

West of Drumsna Junction the Blue West Option Corridor is the Preferred Option Corridor, the Purple West, Dark Green and Orange Option Corridors are of Intermediate preference, and the Cyan Option and the Purple West Corridor are the Least Preferred (Refer to Table 7.5.12.13).

Table 7.5.12.13 Stage 1 Soils and Geology Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Contaminated Sites	Moderately Negative	Moderately Negative	Minor or Slightly Negative	Minor or Slightly Negative	Not Significant or Neutral		Moderate / Slight
Economic Geology	Minor or Slightly Negative	Minor or Slightly Negative	Moderately Negative	Moderately Negative	Not Significant or Neutral		Slight
Earthworks	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Not Significant or Neutral		Significant / Moderate
Scoring							
Qualitative Assessment	Largest impact on potential contaminated sites and largest overall earthwork deficit (853,000m³) **Major** or **Highly Negative**	Second largest impact on potential contaminated sites and third largest overall earthwork deficit (714,000m³) **Moderately Negative**	Smallest overall earthwork deficit (535,000m³) **Moderately Negative**	Second largest overall earthwork deficit (752,000m³) and the most significant bulk cut and fill volumes. **Major** or **Highly Negative**	Minimal impact on Soils and Geology. **Not Significant** or **Neutral**		**Major** or **Highly Negative**
Score / Impact Level	**1**	**2**	**2**	**2**	**4**		**1**
Preference	**Least Preferred**	**Intermediate**	**Intermediate**	**Least Preferred**	**Preferred**		**N/A**

The reasons are as follows:

- The Cyan Option Corridor intersects the largest number of identified potentially contaminated sites and the second largest area of made ground which results in a Significant impact on the soils and geology. The Cyan Option Corridor also intersects the largest area of high to very high aggregate potential (1,638,000m^3). With respect to earthworks, the Cyan Option Corridor has the largest earthwork deficit (853,000m^3) when both the bulk earthworks deficit and the soft soil volumes are combined. The Cyan Option Corridor is considered the Least Preferred Option West of Drumsna Junction.
- The Orange Option Corridor intersects a similar quantity of Made Ground and Crushed Rock Aggregate Potential as the Cyan Option and also intersects the historic gas works site and the railway station. The bulk earthworks volumes are similar to that of the Cyan Option but the overall deficit when combining both the bulk earthworks and soft soil volumes is less (714,000m^3). This is considered an Intermediate Option West of Drumsna Junction.
- The Dark Green Option Corridor has the largest cut and fill earthwork volume requirement, the largest soft soil volume and a significant earthwork deficit. The combined deficit between soft soil and bulk earthworks is 752,000m^3. Its impact level has been ranked similar to that of the Cyan Option as due to the large volumes of both cut and fill and the similar overall deficits. The Cyan Option does impact the attribute of Contaminated Sites more than the Dark Green but the bulk earthworks on the Dark Green Option is so significant that it brings this Option in line with the Cyan Option.
- The Purple West Option Corridor intersects the smallest area of made ground and the least number of identified potentially contaminated sites. The Purple Option Corridor intersects the second smallest area of high to very high aggregate potential, however, this area is still considered significant. In terms of earthworks, this Option has a significant cut and fill earthwork volume requirement, however it's combined bulk earthworks and soft soil deficit is significantly less (535,000m^3) than the other Options. As a result, the Purple West Option Corridor is considered more preferable than the Dark Green, Cyan and Orange Option Corridors West of Drumsna Junction and is Intermediate.
- The Blue West Option Corridor is considered to have minimal impact on the Soils and Geology as there are no earthworks planned only upgrades to existing junctions. It is therefore considered the Preferred Option Corridor West of Drumsna Junction.
- The Black Option Corridor has a significant earthwork requirement when considering the short corridor length and area and is considered to have a Major or Highly Negative impact.

East of Drumsna Junction (Node J)

East of Drumsna Junction the Blue East Option Corridor is the Preferred Option Corridor, the Green and Yellow Option Corridors are of Intermediate preference, and the Purple East Option Corridor is least preferred (Refer to Table 7.5.12.14).

The reasons are as follows:

- The Purple Option Corridor has the largest cut and fill earthwork volume requirement. This results in the Purple Option Corridor being the Least Preferred Option Corridor East of Drumsna Junction
- The Yellow Option Corridor has the second largest cut and fill earthwork requirement and is considered Intermediate East of Drumsna Junction
- The Green Option Corridor has the smallest cut and fill earthwork requirement (excluding the Blue Option Corridor). As a result, the Green Option Corridor is considered Intermediate and more preferrable than the Yellow Option Corridor East of Drumsna Junction
    - The Blue Option Corridor is considered to have least impact on the Soils and Geology and therefore is considered the Preferred Option Corridor East of Drumsna Junction.

Table 7.5.12.14 Stage 1 Soils and Geology Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Assessment Criteria	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**	**Blue East Option Corridor**
Earthworks	Moderately Negative	Minor or Slightly Negative	Moderately Negative	Not Significant or Neutral
Scoring				
Qualitative Assessment	Second largest cut and fill earthwork volume. **Moderately Negative**	Smallest cut and fill earthwork volume. **Minor** or **Slightly Negative**	Largest cut and fill earthwork volume. **Moderately Negative**	Minimal impact on Soils and Geology. **Not Significant** or **Neutral**
Score / Impact Level	**2**	**3**	**2**	**4**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Preferred**

7.6 Stage 1 Options – Economic Assessment of Option Corridors

7.6.1 Introduction

As part of the Stage 1 Assessment of the option corridors an economic assessment of each of option corridor described in Section 7.1.2 was undertaken in accordance with the requirements of the TII Cost Management Manual.

Section 7.6.2 outlines the methodology utilised to carry out the cost assessment, Sections 7.6.3 details the cost assessment to the west of Node J at Drumsna, Section 7.6.4 details the cost assessment to the east of Node J at Drumsna and a summary is presented in Section 7.6.5.

As outlined in Section 7.1 it is necessary to assess an incremental build-up of intervention when considering Economy as there are significant differences in cost depending on the level of intervention. As noted above the Blue Option Corridor represents the Management Option which comprises the maximum reuse of the existing mainline infrastructure. All the remaining option corridors include a portion of new mainline infrastructure. For the option corridors to the west of Drumsna Junction, two design scenarios were developed to inform the assessment of what is the appropriate level of intervention required to provide the optimum transport solution. These design scenarios were developed using a single carriageway and a dual carriageway cross-section and are costed accordingly. This exercise was undertaken so that an understanding of the cost differential between various cross-sections is obtained. However, in the final compilation of the matrix for Stage 1 assessment, the Economy assessment will also present the costs which align with the Environment and Engineering assessments. The Black Option Corridor comprises an urban street type intervention.

7.6.2 Methodology

7.6.2.1 Overview

The methodology adopted in preparing the Stage 1 cost estimate ranges comprised the following elements:

- Horizontal and vertical alignments were developed for each of the option corridors in order to establish an indicative footprint and indicative earthworks quantities. Refer to the plan and profile details presented in Figures 7.3.2.0 to 7.3.15.6
- As the cross-section has not been determined as this early stage, an incremental approach to the cross-section selection is required which necessitates the requirement for cost estimates for reuse of the existing cross-section (i.e., Management Option), a Type 1 Single Carriageway and Type 2 Dual Carriageway

- Option corridors within the street network of the town of Carrick-on-Shannon will be designed as an urban street to the Design Manual for Urban Roads and Streets (DMURS) design standard
- All major quantities and grouping thereof were determined in accordance with the TII Method of Measurement for each Option Corridor
- Assessment and quantification of land use and planning impacts for input to the land and property cost
- Identification and assessment of advance works and other contracts required for the delivery of each Option Corridor
- Compilation of cost estimate ranges using the TII's database of unit rates where applicable
- Comparative assessment to out-turn and forecast costs from previous schemes was undertaken to ensure cost ranges were comparable
- For the option scenarios to the west of Drumsna Junction, a direct comparison was undertaken for the four dual carriageway scenarios and also a separate comparison was undertaken for the five single carriageway scenarios which identified any significant differences in the cost assessment
- Compilation of cost estimates using the TII's database of unit rates where applicable
- Comparative assessment of out-turn and forecast costs from previous schemes was undertaken to ensure costs were comparable
- Once all elements of the overall costs were compiled, a Project Specific Risk Contingency allowance of 15% was applied to the costings
- Inflation allowances for construction and Land and Property costs amounting to 3% were applied to the estimates as well as an overall 5% Programme Risk
- Costs were categorised into nine ranges, similar to cost ranges set out in Chapter 5 of the National Development Plan but with the inclusion a new category for costs less than €20M. The costs for each of the option corridors are also quoted in multiples of the lowest cost option corridor in each section, i.e. the cheapest option is given a value of X or Y with X applicable west of Drumsna and Y applicable east of Drumsna and the other option corridors are a multiple of that. The PAG Score rating is also included in the table below, with 1 being the most expensive and 7 being the most financially beneficial.

Table 7.6.2.1 Cost Range Categories

Category	Cost Range	PAG Score
i	€0 - €1M	7
ii	€1M - €10M	7
iii	€10M+	6
A	€20M - €50M	5

Category	Cost Range	PAG Score
B	€50M - €100M	4
C	€100M - €250M	3
D	€250M - €500M	2
E	€500M - €1BN	1
F	€1BN+	1

No Cost Benefit Analysis (CBA) was undertaken for the Stage 1 economic assessment. The economic assessment is limited to construction and delivery costs and is for comparative purposes only.

7.6.2.2 Option Corridors to be Assessed

There are six option corridors to the west of Drumsna and four option corridors to the east of Drumnsa. However, as the cross-section within the option corridors is not defined at this stage, a total of 14 scenarios are considered in the Stage 1 cost assessment to enable a robust comparison and assessment. The differing scenarios within a corridor refer to the cross-section type utilised namely Type 1 Single Carriageway, Type 2 Dual Carriageway or urban street, and this is summarised below in Table 7.6.2.1 and Table 7.6.2.2.

Please note, the Economic assessment is the only Stage 1 Assessment which considers both single and dual cross-sections within each option corridor.

The Blue West Option Corridor contains the Management Option and considers management improvements only to the existing cross-section and the Black Option Corridor assumes an urban street type cross-section. Within the Purple West Option Corridor, Dark Green Option Corridor, Cyan Option Corridor and the Orange Option Corridor two design scenarios are costed and assessed as set out in Table 7.6.2.1. To the east of Drumsna Junction, each corridor contains one design scenario as set out in Table 7.6.2.2.

Table 7.6.2.1 Scenarios within Option Corridors West of Drumsna Junction (Node J)

Option Corridor	Scenario Reference	Description
Blue West	Scenario 1	Management Option / Existing cross-section
Purple West	Scenario 1 (Red)	Single Carriageway
	Scenario 2 (Purple)	Dual Carriageway
Dark Green	Scenario 1 (Dark Green)	Single Carriageway
	Scenario 2 (Grey)	Dual Carriageway
Cyan	Scenario 1 (Cyan)	Single Carriageway
	Scenario 2 (Pink)	Dual Carriageway
Orange	Scenario 1 (Brown)	Single Carriageway
	Scenario 2 (Orange)	Dual Carriageway
Black	Scenario 1	Urban Street Link

Table 7.6.2.2 Scenarios within Option Corridors East of, Drumsna Junction (Node J)

Option Corridor	Scenario Reference	Description
Blue East	Scenario 1	Management Option / Existing cross-section
Green	Scenario 1	Single Carriageway
Yellow	Scenario 1	Single Carriageway
Purple East	Scenario 1	Dual Carriageway

Both the new construction length (i.e. the length of new mainline construction associated with each option) and the trip travelled length (i.e. the distance from Node O on the existing N4 to the Node J on the existing N4) were considered in the breakdown of costs. The trip lengths travelled for each option are given in Table 7.6.2.3 and Table 7.6.2.4 below. The options are split into west and east of Drumsna (Node J).

Table 7.6.2.3 Trip Lengths of Option Corridors West of Drumsna Junction (Node J)

Option Corridor	Scenario Reference	Description	Trip Length – West of Point J (km)	New Mainline Construction (km)
Purple West	Scenario 1 (Red)	Single Carriageway	13.385	9.972
	Scenario 2 (Purple)	Dual Carriageway	13.344	10.009
Dark Green	Scenario 1 (Dark Green)	Single Carriageway	13.219	9.843
	Scenario 2 (Grey)	Dual Carriageway	13.219	9.843
Cyan	Scenario 1 (Cyan)	Single Carriageway	12.416	11.177
	Scenario 2 (Pink)	Dual Carriageway	12.416	11.177
Orange	Scenario 1 (Brown)	Single Carriageway	12.534	9.268
	Scenario 2 (Orange)	Dual Carriageway	12.534	9.304
Blue West	Scenario 1	Management Option / Existing cross-section	12.376	0
Black	Scenario 1	Urban Street Link	N/A	1.107

Table 7.6.2.4 Difference in Trip Lengths of Options East of Drumsna Junction (Node J)

Option Corridor	Scenario	Description	Trip Length - East of Point J (km)	New Mainline Construction (km)
Blue East	Scenario 1	Management Option / Existing cross-section	7.876	0
Purple East	Scenario 1	Dual Carriageway	7.982	7.616
Yellow	Scenario 1	Single Carriageway	7.864	7.865
Green	Scenario 1	Single Carriageway	7.878	7.864

The cost estimate ranges for each scenario were completed. For all of the 14 scenarios assessed, cost rankings are provided (with 1 being the most expensive option).

7.6.3 Cost Estimate Ranges West of Drumsna Junction (Node J)

Table 7.6.3.1 details the ten scenario cost estimate ranges for the Stage 1 Option Corridors to the west of Drumsna Junction and provides a ranking. Section 7.6.3.1 summarises the assessment of the single carriageway scenarios, Section 7.6.3.2 summarises the assessment of the dual carriageway scenarios.

Table 7.6.3.1 Cost Estimate Ranges West of Drumsna Junction (Node J)

Option Corridor	Scenario Number / Reference Design	Cost Range Category / Factor Relative to Lowest	PAG Score and Preference Dual Carriageway	PAG Score and Preference Single Carriageways
Purple West	Scenario 2 (Purple Design - T2 Dual)	C / 3.2X	PAG Score 3 Preferred	
	Scenario 1 (Red Design - T1 Single)	C / 2.6X		PAG Score 3 Intermediate
Dark Green	Scenario 1 (Dark Green Design - T1 Single)	C / 2.8X		PAG Score 3 Intermediate
	Scenario 2 (Grey Design - T2 Dual)	C / 3.3X	PAG Score 3 Intermediate	
Cyan	Scenario 1 (Cyan Design - T1 Single)	C / 3.2X		PAG Score 3 Least Preferred
	Scenario 2 (Pink Design - T2 Dual)	C / 3.8X	PAG Score 3 Least Preferred	
Orange	Scenario 2 (Orange Design - T2 Dual	C /3.4X	PAG Score 3 Intermediate	
	Scenario 1 (Brown - T1 Single)	C / 2.6X		PAG Score 3 Intermediate
Blue West	Scenario 1 (Blue Design - T1 Single)	B / X		PAG Score 4 Preferred
Black	Scenario 1 (Black Design- Urban Street)	(iii)	N/A	N/A

7.6.3.1 Single Carriageway Summary

The Blue West Option Corridor (Management Option) is the Preferred option in terms of costs on the single carriageway options with the Cyan Option Corridor being the most expensive and Least Preferred, noting that the Cyan Option Corridor (Cyan Design) involves the longest new construction length and is approximately 20% longer than the Orange Option Corridor (Brown Design). The Orange Option

Corridor (Brown Design), Dark Green Option Corridor (Dark Green Design) and Purple West Option Corridor (Red Design) are ranked as Intermediate.

7.6.3.2 Dual Carriageway Summary

The Cyan Option Corridor (Pink Design) involves the longest length of new construction, is the most expensive option and therefore is ranked Least Preferred from a cost perspective. The Purple West Option Corridor (Purple Design) is the least expensive and is therefore the Preferred option from a cost perspective. Both the Cyan Option Corridor (Pink Design) and Orange Option Corridor (Orange Design) are ranked as Intermediate.

As seen in the summaries above, the cost differential between the single and dual carriageway cross-sections does not change the cost estimate range. As noted earlier in the methodology, in the final compilation of the matrix for Stage 1 assessment, the Economy assessment will present the costs which align with the Environment and Engineering assessments.

7.6.4 Cost Estimate Ranges East of Drumsna Junction (Node J)

The cost estimate ranges for the four Stage 1 Option Corridors to the east of Drumsna Junction are detailed in Table 7.6.4.1 and also provide a ranking based on cost.

Table 7.6.4.1 Cost Estimate Ranges East of Node J at Drumsna Junction

Option Corridor	Scenario Number / Reference Design	Option Comparison Estimate	PAG Score and Preference
Yellow	Scenario 1 (Yellow Design - T1 Single)	C / 2.9Y	PAG Score 3 Intermediate
Green	Scenario 1 (Green Design - T1 Single)	B / 2Y	PAG Score 4 Intermediate
Purple East	Scenario 1 (Purple - T2 Dual)	C / 5.3Y	PAG Score 3 Least Preferred
Blue East	Scenario 1 (Blue - T1 Single)	A / Y	PAG Score 5 Preferred

The comparison of the option corridors to the east of Drumsna shows a significant cost differential between the single carriageway cross-section and the dual carriageway cross-section. The Stage 2 Assessment will compare the associated benefits arising from the implementation of a dual carriageway versus a single carriageway in terms of safety benefits and capacity to inform the selection of the preferred cross-section.

7.6.5 Summary

Overall Corridor Summary to West of Drumsna Junction (Node J)

The Blue West Option Corridor is the Preferred Option from a cost perspective with the Cyan Option Corridor having the most expensive scenario and is the Least Preferred. The Orange and Purple West Option Corridors are ranked as Intermediate overall.

Overall Corridor Summary to East of Drumsna Junction (Node J)

The Blue East Option Corridor is the Preferred Option from a cost perspective with the Purple East Option Corridor having the most expensive scenario and is the Least Preferred. The Green and Yellow Option Corridors are ranked as Intermediate overall.

7.7 Framework Matrix

7.7.1 Introduction

This section presents the outputs of the assessments of the engineering, environment and economy of the option corridors initially in summary matrices for each of these three criteria. Thereafter an overall summary framework matrix is presented to determine which options are carried through to Stage 2 assessment.

7.7.2 Summary Engineering Framework Matrix

The engineering assessment of the Stage 1 Option Corridors examined each of the option corridors under the headings Geometry, Trip Length, Junction Strategy, Constructability and Traffic. The methodology used to assess the option corridors under each heading has been detailed throughout Section 7.3.3. The summary of the process in the determination of their ultimate ranking provided in 7.3.3. The summary tables are provided in Table 7.7.2.1 and Table 7.7.2.2 below.

Table 7.7.2.1 Summary Engineering Scoring Matrix of Option Corridors - West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE OPTION CORRIDOR		BLACK OPTION CORRIDOR
Geometry	7	7	7	7	4		7
Trip Length	3	3	3	3	4		N/A
Junction Strategy	3	3	4	3	1		3
Constructability	2	3	3	3	4		4
Traffic	7	7	6	6	4		4
Scoring							
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Not Significant** or **Neutral**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**4**	**3**	**3**		**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Intermediate**	**Least Preferred**		**N/A**

Table 7.7.2.2 Summary Engineering Scoring Matrix of Option Corridors East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Geometry	7	7	7	4
Trip Length	5	3	3	4
Junction Strategy	3	3	5	2
Constructability	3	2	3	4
Scoring				
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Negative**
Score / Impact Level	**4**	**4**	**5**	**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Least Preferred**

7.7.3 Summary Environmental Framework Matrix

Each of the option corridors were ranked in each of the environmental disciplines in Section 7.5 of this report. The rankings are summarised below Table 7.7.3.1 for the option corridors west of Drumsna Junction (Node J) and Table 7.7.3.2 for the option corridors east of Drumsna Junction (Node J), with respect to their impacts on each environmental discipline as follows: Preferred, Intermediate, and Least Preferred.

The overall ranking for each option corridor in terms of the environment took into consideration the overall number of Preferred, Intermediate and Least Preferred rankings. Subsequently, during the course of the assessment process *Population, Human Health, Material Assets- Non- Agriculture, Biodiversity, Hydrology and Soils and Geology* were identified as being significant disciplines with respect to the N4 Carrick-on-Shannon to Dromod Project specifically. Therefore, these disciplines are shown in italics in the summary tables and are referred to as "key environmental disciplines" in the proceeding text.

7.7.3.1 West of Drumsna Junction (Node J)

Cyan Option Corridor

When totalling all the environmental rankings the Cyan Option Corridor has four Least Preferred and one Preferred ranking. Furthermore, when looking at the key environmental disciplines, the Cyan Option Corridor has two Least Preferred and one Preferred. This has resulted in an overall ranking as Least Preferred for the Cyan Option Corridor.

Orange Option Corridor

When totalling all the environmental rankings, the Orange Option Corridor has three Least Preferred and two Preferred rankings. However, when considering the key environmental disciplines, the Orange Option Corridor has one Least Preferred and two Preferred. This has resulted in an overall ranking as Preferred for the Orange Option Corridor.

Purple West Option Corridor

When totalling all the environmental rankings, the Purple West Option Corridor has four Least Preferred and four Preferred rankings. Also, when considering the key environmental disciplines, the Purple West Option Corridor has two Least Preferred and one Preferred. This has resulted in an overall ranking as Least Preferred for the Purple West Option Corridor.

Dark Green Option Corridor

When totalling all the environmental rankings, the Dark Green Option Corridor has five Least Preferred and four Preferred rankings. When considering the key environmental disciplines, the Dark Green Option Corridor has three Least Preferred and one Preferred. This has resulted in an overall ranking as Intermediate for the Dark Green Option Corridor.

Blue West Option Corridor

When totalling all the environmental rankings, the Blue West Option Corridor has three Least Preferred and eight Preferred rankings. Furthermore, when considering the key environmental disciplines, the Blue West Option Corridor has two Least Preferred and three Preferred rankings. This has resulted in an overall ranking as Preferred for the Blue West Option Corridor.

7.7.3.2 East of Drumsna Junction (Node J)

Yellow Option Corridor

When totalling all the environmental rankings, the Yellow Option Corridor has two Least Preferred and one Preferred ranking. However, when considering the key environmental disciplines, the Yellow Option Corridor has one Least Preferred and one Preferred. This has resulted in an overall ranking as Intermediate for the Yellow Option Corridor.

Green Option Corridor

When totalling all the environmental rankings, the Green Option Corridor has zero Least Preferred and four Preferred ranking. However, when considering the key environmental disciplines, the Green Option Corridor has zero Least Preferred and one Preferred. This has resulted in an overall ranking as Intermediate for the Green Option Corridor.

Purple East Option Corridor

When totalling all the environmental rankings, the Purple East Option Corridor has five Least Preferred and three Preferred ranking. However, when considering the key environmental disciplines, the Purple East Option Corridor has two Least Preferred and one Preferred. This has resulted in an overall ranking as Least Preferred for the Purple East Option Corridor.

Blue East Option Corridor

When totalling all the environmental rankings, the Blue East Option Corridor has zero Least Preferred and ten Preferred rankings. However, when considering the key environmental disciplines, the Blue East Option Corridor has zero Least Preferred and four Preferred. This has resulted in an overall ranking as Preferred for the Blue East Option Corridor.

Table 7.7.3.1 Stage 1 Summary of Environmental Assessment Matrices -Option Corridors West of Drumsna Junction (Node J)

Environmental Discipline	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
*Population**	Intermediate	Intermediate	Preferred	Preferred	Least Preferred		Moderately Positive
*Human Health**	Preferred	Preferred	Intermediate	Intermediate	Least Preferred		Not Significant or Neutral
*Material Assets Non-Agriculture**	Least Preferred	Least Preferred	Intermediate	Intermediate	Preferred		Minor or Slightly Negative
Material Assets Agriculture	Intermediate	Intermediate	Intermediate	Least Preferred	Preferred		Not Significant or Neutral
Air Quality	Intermediate	Intermediate	Preferred	Preferred	Least Preferred		Minor or Slightly Negative
Climate	Intermediate	Intermediate	Least Preferred	Intermediate	Preferred		Moderately Negative
Noise and Vibration	Intermediate	Intermediate	Preferred	Preferred	Preferred		Moderately Negative
Archaeology, Architecture and Cultural Heritage	Least Preferred	Least Preferred	Preferred	Preferred	Intermediate		Not Significant Neutral
Landscape and Visual	Least Preferred	Least Preferred	Intermediate	Intermediate	Preferred		Moderately Negative
*Biodiversity**	Intermediate	Preferred	Least Preferred	Least Preferred	Intermediate		Minor or Slightly Negative
*Hydrology**	Intermediate	Intermediate	Least Preferred	Least Preferred	Preferred		Minor or Slightly Negative
Hydrogeology	Intermediate	Intermediate	Least Preferred	Least Preferred	Preferred		Moderately Negative
*Soils and Geology**	Least Preferred	Intermediate	Intermediate	Least Preferred	Preferred		Major or Highly Negative

Environmental Discipline	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Scoring							
Qualitative Assessment	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**		**Moderately Negative**
Score / Impact Level	**1**	**1**	**1**	**1**	**1**		**2**
Preference	**Least Preferred**	**Preferred**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

**Environmental Disciplines written in italics are considered to be key environmental disciplines in this study area of this particular project*

Table 7.7.3.2 Stage 1 Summary of Environmental Assessment Matrices - Option Corridors East of Drumsna Junction (Node J)

Environmental Discipline	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
*Population**	Intermediate	Intermediate	Preferred	Intermediate
*Human Health**	Preferred	Intermediate	Intermediate	Intermediate
*Material Assets Non-Agriculture**	Least Preferred	Intermediate	Intermediate	Preferred
Material Assets Agriculture	Intermediate	Preferred	Least Preferred	Preferred
Air Quality	Intermediate	Intermediate	Preferred	Intermediate
Climate	Intermediate	Intermediate	Least Preferred	Preferred
Noise and Vibration	Intermediate	Intermediate	Preferred	Preferred
Archaeology, Architecture and Cultural Heritage	Least Preferred	Preferred	Intermediate	Preferred
Landscape and Visual	Intermediate	Intermediate	Least Preferred	Preferred
*Biodiversity**	Intermediate	Preferred	Least Preferred	Preferred
*Hydrology**	Intermediate	Intermediate	Intermediate	Preferred
Hydrogeology	Intermediate	Preferred	Intermediate	Preferred
*Soils and Geology**	Intermediate	Intermediate	Least Preferred	Preferred

Environmental Discipline	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Scoring				
Qualitative assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**
Score / Impact level	**2**	**2**	**2**	**2**
Preference	**Intermediate**	**Intermediate**	**Least Preferred**	**Preferred**

**Environmental Disciplines written in italics are considered to be key environmental disciplines in this study area of this particular project*

7.7.4 Summary Economic Framework Matrix

The cost estimate ranges of the Stage 1 Option Corridors examined each of the option corridors for cost estimates of reuse of the existing cross-section (i.e., Management Option), a Type 1 Single Carriageway and Type 2 Dual Carriageway. The methodology used to assess the option corridors is included in Section 7.6. The summary of the process in the determination of their ultimate ranking is provided in Section 7.6.5. In the final compilation of the economic matrix for Stage 1 assessment, the Economy assessment will only present the costs of the scenario with the cross-section which align with the Environment and Engineering assessments. This has necessitated a comparison of the single carriageway costs versus the dual carriageways where both cross-section types are assessed within an option corridor, as opposed to rankings per cross-section type in Table 7.6.3.1.

The summary tables provided below present the costs which align with the Environment and Engineering assessments.

Table 7.7.4.1 Economy Assessment West of Drumsna Junction (Node J)

Option Corridor	Scenario Number / Reference Design	PAG Score / Preference
Purple West	Scenario 2 (Purple Design – T2 Dual)	3 Intermediate
Dark Green	Scenario 2 (Grey Design – T2 Dual)	3 Intermediate
Cyan	Scenario 2 (Pink Design – T2 Dual)	3 Least Preferred
Orange	Scenario 2 (Orange Design – T2 Dual)	3 Intermediate
Blue West	Scenario 1 (Blue Design – T1 Single)	4 Preferred
Black	Scenario 1 (Black Design- Urban Street)	N/A

Note Purple West was the Preferred dual carriageway option when ranked against the other dual carriageway options in Table 7.6.3.1; however, it is now compared against the Blue West single carriageway and the ranking changes to Intermediate.

Table 7.7.4.2 Economy Assessment East of Drumsna Junction (Node J)

Option Corridor	Scenario Number / Reference Design	PAG Score / Preference
Purple East	Scenario 1 (Purple - T2 Dual)	3 Least Preferred
Green	Scenario 1 (Green Design - T1 Single)	4 Intermediate
Yellow	Scenario 1 (Yellow Design - T1 Single)	3 Intermediate
Blue East	Scenario 1 (Blue - T1 Single)	5 Preferred

7.7.5 Summary Framework Matrix

To determine if option corridors warrant being brought through to Stage 2 for further assessment, each of the option corridors were evaluated under the headings of Engineering, Environment and Economy. These are now compiled together and summarised in a singular matrix in Table 7.7.5.1 and Table 7.7.5.2 for west and east of Drumsna respectively. Based on the findings from those assessments they were then re-tested against the project objectives.

It is worthy to note that although an option corridor may perform well when evaluated in terms of Engineering, Environment and Economy, if they do not meet the Project Objectives following the Stage 1 Assessment they will not function as a useful transport solution and so further studies as part of the Stage 2 assessment would be purposeless.

Table 7.7.5.1 Stage 1 Framework Matrix of Option Corridors West of Drumsna Junction (Node J)

	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLUE WEST OPTION CORRIDOR		BLACK OPTION CORRIDOR
Engineering							
PAG Description	Minor or Slightly Negative	Minor or Slightly Negative	Neutral	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
PAG Score	3	3	4	3	3		3
Ranking	Intermediate	Intermediate	Preferred	Intermediate	Least Preferred		
Environment							
PAG Description	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative		Moderately Negative
PAG Score	1	1	1	1	1		2
Ranking	Least Preferred	Preferred	Least Preferred	Intermediate	Preferred		
Economy (Costs which align with the Environment and Engineering assessments)							
PAG Description	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Not Significant or Neutral		N/A
PAG Score	3	3	3	3	4		
Ranking	Least Preferred	Intermediate	Intermediate	Intermediate	Preferred		
Progress to Stage 2?	YES	YES	YES	YES	NO		YES

Table 7.7.5.2 Stage 1 Framework Matrix of Option Corridors East of Drumsna Junction (Node J)

	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR	BLUE EAST OPTION CORRIDOR
Engineering				
PAG Description	Neutral	Not Significant or Neutral	Slightly Positive	Slightly Negative
PAG Score	4	4	5	3
Ranking	Intermediate	Intermediate	Preferred	Least Preferred
Environment				
PAG Description	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative
PAG Score	2	2	2	2
Ranking	Intermediate	Intermediate	Least Preferred	Preferred
Economy (Costs which align with the Environment and Engineering assessments)				
PAG Description	Minor or Slightly Negative	Not Significant or Neutral	Minor or Slightly Negative	Minor or Slightly Positive
PAG Score	3	4	3	5
Ranking	Intermediate	Intermediate	Least Preferred	Preferred
Progress to Stage 2?	YES	YES	YES	NO

7.7.5.1 West of Drumsna Junction (Node J)

Cyan Option Corridor

The Cyan Option Corridor was ranked as Intermediate in terms of Engineering, Least Preferred in terms of Environment and Least Preferred in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Orange Option Corridor

The Orange Option Corridor was ranked as Intermediate in terms of Engineering, Preferred in terms of Environment and Intermediate in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Purple West Option Corridor

The Purple West Option Corridor was ranked as Preferred in terms of Engineering, Least Preferred in terms of Environment and Intermediate in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Dark Green Option Corridor

The Dark Green Option Corridor was ranked as Intermediate in terms of Engineering, Intermediate in terms of Environment and Intermediate in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Blue West Option Corridor

The Blue West Option Corridor was ranked as Least Preferred in terms of Engineering, Preferred in terms of Environment and Preferred in terms of Economy. As set out in Section 7.1.2 the Management Option was brought through the initial sifting to ensure that an equivalent assessment of it was completed to inform the true viability of the option in more detail than the sifting exercise. Further analysis was undertaken during the Stage 1 Assessment under the three criteria, and this has informed the decision on this option.

It is unsurprising that the Blue West Option Corridor has been identified as Preferred in terms of Environment and Economy as it is the “Management Option” which most closely retains the existing environment. Based on the structure of the Environmental assessment (i.e. testing against the existing environment as a

baseline) the resulting environmental impacts relative to the existing situation would be of a smaller scale than those for new road infrastructure. Similarly, due to the minimal amount of works required to implement the option proposals, the Economic assessment would return a favourable ranking. However, the Engineering assessment is telling in this regard as the Blue West Option Corridor scores poorly under Geometry and Junction Strategy; due to maintaining the existing sub-standard mainline alignment. Whilst the Blue West Option does include for rationalisation of some of the accesses in the rural areas, it does not improve on the existing sub-standard mainline alignment and it does not reduce the congestion in the urban areas, therefore, it does not deliver significant improvement under the project objective of "Safety". Moreover, as it is maintaining the status quo, it does little to provide for the Project Objectives under the criteria of "Accessibility and Social Inclusion", "Integration" or "Physical Activity". The minimal removal of traffic from the town of Carrick-on-Shannon reflects on how little impact this option corridor offers to improve place making and community, provide any meaningful opportunity to realise improved accessibility or sustainable trip making, as can be seen in both the `Population and Human Health assessments which both ranked this option corridor as Least Preferred. It cannot deliver on the project objectives set out for the TEN-T comprehensive network, nor can it provide enhanced connectivity across the River Shannon, nor improve the connectivity to the Northwest Region. The Blue Option Corridor also lacks ability to enhance a safe and healthy environment for the communities along the N4 corridor.

Based on the findings from the Stage 1 assessments, the Blue West Option Corridor does not meet the project objectives sufficiently and does not warrant being brought forward for further assessment in Stage 2.

7.7.5.2 East of Drumsna Junction (Node J)

Yellow Option Corridor

The Yellow Option Corridor was ranked as Intermediate in terms of Engineering, Intermediate in terms of Environment and Intermediate in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Green Option Corridor

The Green Option Corridor was ranked as Intermediate in terms of Engineering, Intermediate in terms of Environment and Intermediate in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Purple East Option Corridor

The Purple East Option Corridor was ranked as Preferred in terms of Engineering, Least Preferred in terms of Environment and Least Preferred in terms of Economy.

When tested against the project objectives following the Stage 1 assessment, it was found to still be feasible as a possible solution to the transport issues identified and therefore, should be progressed to Stage 2 for further assessment.

Blue East Option Corridor

The Blue East Option Corridor was ranked as Least Preferred in terms of Engineering, Preferred in terms of Environment and Preferred in terms of Economy.

Again, it is unsurprising that the Blue East Option Corridor has been identified as Preferred in terms of Environment and Economy as it is the "Management Option" which most closely retains the existing environment. Based on the structure of the Environmental assessment (i.e. testing against the existing environment as a baseline) the resulting environmental impacts would be of a smaller scale than those for new road infrastructure. Similarly, due to the minimal amount of works required to implement the option, the Economic assessment would return a favourable ranking. However, the Engineering assessment is revealing in this regard as the Blue East Option Corridor scores poorly under Geometry and Junction Strategy; due to maintaining the existing sub-standard mainline alignment. Whilst the Blue East Option does include for rationalisation of some of the accesses in the rural areas, it does not improve on the existing sub-standard mainline alignment and it does not deliver significant improvement upon the project objective of "Safety". Moreover, as it is maintaining the status quo, it does little to provide for the Project Objectives under the criteria of "Accessibility and Social Inclusion", "Integration" or "Physical Activity".

Based on the findings from the Stage 1 Assessments, the Blue East Option Corridor does not meet the project objectives and does not warrant being brought forward for further assessment in Stage 2.

7.8 Recommendation

Following the Stage 1 Options assessment is it recommended that all option corridors with the exception of the Blue Option Corridor (the Management Option) are progressed to the Stage 2 assessment for a more detailed analysis in the Option Selection Process.

8 Stage 2 Project Appraisal

8.1 Introduction – Multi Criteria Analysis

The Stage 2 Project Appraisal Matrix (hereafter referred to as Stage 2 PAM) is conducted in accordance with the TII Project Manager's Manual for Major National Roads Projects (PE-PMG-02042)[1], TII Project Appraisal Guidelines (PAG) Unit 7.0 Multi-Criteria Analysis (PE-PAG-02031)[2] and with additional guidance sourced from other TII PAG units as required. As set out in Section 5.1, the term 'alternative' applies to the rail, bus, active travel or demand management proposals whereas the term 'options' includes the road based measures. Both alternatives and options are subject to the appraisal documented in this chapter.

The Stage 2 PAM is the most detailed stage within the overall appraisal process, drawing upon the numerous environmental constraints identified, subsequent environmental analyses, transport modelling, safety and economic assessments. The focus of the Stage 2 PAM is on estimating the likely performance and impact of each of the alternatives and options on the six Common Appraisal Framework (CAF) criteria, namely:

- Economic Appraisal (Section 8.3)
- Safety Appraisal (Section 8.4)
- Physical Activity Appraisal (Section 8.5)
- Accessibility & Social Inclusion Appraisal (Section 8.6)
- Integration Appraisal (Section 8.7)
- Environmental Appraisal (Section 8.8)

Under each of these headings, the TII PAG outlines further sub-criteria under which the alternatives and options should be assessed. These are identified within each of the respective appraisal sections. In addition to assessments against the PAG criteria, the alternatives and options are tested for compatibility with the agreed set of N4 Project Objectives, as detailed in Chapter 1. The ability of a given alternative, option or combination of alternatives and options to achieve the requirements of the Project Objectives remains foremost in the overall appraisal process.

In accordance with PAG Unit 7[2] Each of the six CAF criteria include quantitative and qualitative assessments and each impact is scored based on the seven point scale as below. An integer is to be assigned according to the impact level.

[1] Transport Infrastructure Ireland, 2019. Project Manger's Manual for Major National Road Projects PE-PMG-02042 February 2019. Available from: https://www.tiipublications.ie/library/PE-PMG-02042-01.pdf

[2] Transport Infrastructure Ireland, 2016. Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis. Available from: https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf

Table 8.1.1 PAG Unit 7.0 MCA Seven Point Scale

Assessment Score	Description
7	Major or Highly Positive
6	Moderately Positive
5	Minor or Slightly Positive
4	Not Significant or Neutral
3	Minor or Slightly Negative
2	Moderately Negative
1	Major or Highly Negative

The elements of the alternatives and options which emerge from the Stage 2 PAM will combine to form the overall recommended project option to be taken forward to the Stage 3 Project Appraisal Balance Sheet (PABS). The Preferred Option Corridor identified for the road alternative from the Stage 2 PAM will be further tested by undertaking a pair-wise comparison east and west of Drumsna to test whether the same corridor is identified. Following this, an incremental analysis will be completed to determine the level of intervention most appropriate for the transport solution to be taken froward to the Stage 3 Project Appraisal Balance Sheet (PABS).

A flowchart depicting the Stage 2 Assessment Process is shown in Plate 8.1.1.

Note in the Stage 2 Assessment, the alternatives are assessed individually initially, and a selection of the alternatives has also been included in the assessment of the option corridors. This is a key difference from the Stage 1 modelling of the option corridors as these Stage 2 Option Corridors now include demand management measures which reduce the ability to drive at speed through Carrick-on-Shannon.

The Stage 2 Assessments consider the corridor whilst taking cognisance of the design scenario within the corridor for all criteria except Economy, which assesses all the design scenarios within the corridor, similar to the Stage 1 Assessment.

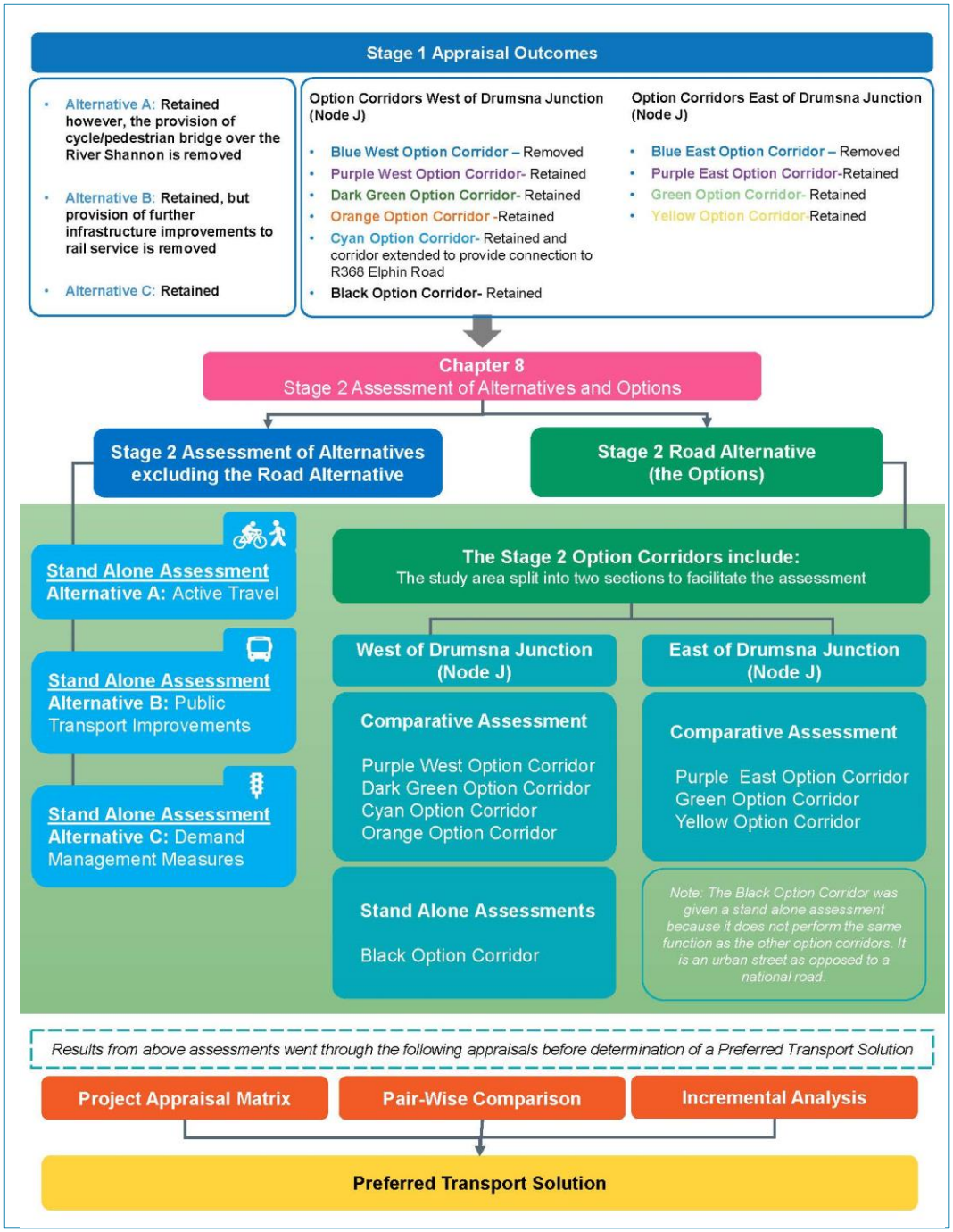

Plate 8.1.1 Stage 2 Assessment Process Flowchart

8.2 Description of Stage 2 Alternatives and Options

More detailed assessments, on-going studies and information received through public consultation resulted in some changes to the alternatives and options carried forward from Stage 1 to Stage 2. These amendments are detailed below.

8.2.1 Stage 2 Alternatives

As noted in the conclusion of the Stage 1 assessment of Alternatives in Section 6.8, the majority of the Stage 1 Alternatives are progressed to Stage 2 with the exception of the additional cycle/pedestrian bridge over the River Shannon and the further improvements to the rail infrastructure and service. Analysis of traffic patterns in the study area has revealed that a considerable number of short distance trips within the Carrick-on-Shannon and Cortober area are made by car, which is a contributing factor to existing congestion on the N4. Improvements to the walking and cycling infrastructure within the town, in addition to enhancements to local bus services would support an increase in sustainable trip making. Measures to reduce the demand for such short trips is also considered in this assessment.

As part of the project appraisal process, these measures are assessed initially as an alternative to building new road infrastructure. Thereafter, these measures could also form part of a wider multimodal transport solution for Carrick-on-Shannon and its environs. Alternatives to be assessed include the following:

- Alternative A: Active Travel (see Figure 8.7.2.0)
    - Development of a comprehensive cycle network
    - Cyclists' facilities – parking, changing areas, e-bike charging
    - Pedestrians' facilities – footpath provision and crossing facilities
    - Permeability for non-motorised use in the area
- Alternative B: Public transport improvements (see Figure 8.7.1.0)
    - Improved parking at railway station with signage and line marking
    - Increase frequency of bus services to 20 minutes/hour at peak
    - Increase in bus services to align with routes proposed in Connecting Ireland Rural Mobility Plan, which was released shortly after the Stage 1 assessment was complete
    - Develop mobility hub in town centre facilitating mode interchange
    - Demand responsive mini-bus services connecting isolated areas
    - Additional bus-stops/furniture on the existing street network
- Alternative C: Demand Management (see Figure 8.7.3.0)
    - Formal pedestrian crossings at existing roundabout junctions
    - Signalisation of the six roundabout junctions in the urban area
    - Reduced junction radii and public realm enhancements
    - 30km/h speed limit on existing N4
    - Parking reduction on Bridge Street
    - Time plated pedestrianisation of Main Street

The above alternatives undergo a Stage 2 Assessment which is documented in this chapter. The alternatives will likely require further testing and consideration at Phase 3 once the Preferred Option Corridor is selected to determine the extent of the proposals to include as part of the overall transport solution for the N4 Carrick-on-Shannon to Dromod Project.

8.2.2 Stage 2 Options

More detailed assessments, on-going studies and information received through public consultation resulted in design changes of the Options from Stage 1 to Stage 2. Changes included mainline and side road realignments, further consideration of rural Active Travel facilities, the introduction of new overbridges and underbridges, new junction layouts and the refinement of earthwork volumes which are summarised as follows:

a) **Design Update 1:** West of Node J, west of the River Shannon, a direct connection was introduced between the two design scenarios within the Cyan Option Corridor and the R368 Elphin Road. This short link road diverges from the R368 at Killukin before crossing over the railway line and connecting to the corresponding design scenarios within the Cyan Option Corridor in the townland of Cortober.

b) **Design Update 2:** Overbridges were added to the designs within the Cyan and Orange Option Corridors to provide better connectivity in Cordrehid and Attirory.

c) **Design Update 3:** North of Carrick-on-Shannon the Grey Design Scenario (dual carriageway cross-section) within the Dark Green Option Corridor was realigned to match the Purple West Design Scenario (dual carriageway cross-section) within the Purple West Option Corridor through Corryolus and Portaneoght providing a more appropriate alignment for dual carriageway. Horizontally, both alignments are identical as far as Dromore, however, both options offer a different solution to cross the R280. The Grey Option Corridor traverses over the R280 to facilitate an appropriate grade separated junction for a dual carriageway, leaving the regional road at a similar level to the existing situation. The Purple West Design Scenario crosses under the R280 at approximately the same level as the existing ground level which then requires the R280 to be elevated, again to facilitate an appropriate grade separated junction for a dual carriageway. Both design scenarios cross over the Castlecara Road at Dromore and then take different paths to re-join the existing N4.

d) **Design Update 4:** A new alignment of the Hartley Road overbridge is proposed for all northern option corridors. Headroom clearance and drainage issues were identified upon further studies of the Stage 1 proposals. To rectify these issues whilst retaining the Stage 1 horizontal alignment would have required a number of significant residential impacts and potential acquisitions at Cloonsheerevagh and Hartley. The Stage 2 proposal realigns the horizontal alignment of the Hartley Road to the rear of these properties from Cloonsheebane to Cloonsheerevagh, avoiding residential landtake, while also addressing the headroom clearance and drainage issues.

e) **Design Update 5:** East of Node J at Drumsna Junction a parallel road was introduced to the Purple Design Scenario (dual carriageway cross-section) within the Purple East Option Corridor to connect the R201 and N4 via the proposed rearrangement of the Drumsna Junction.

f) **Design Update 6:** The junction layout was altered in Aghamore on the Purple East Option Corridor. The Stage 2 proposal gives priority to traffic travelling to/from the residential areas south of the village to/from the N4. A T-junction provided access to the existing agricultural accesses north of the village.

g) **Design Update 7:** The Stage 2 proposals include for the Green and Yellow Design Scenarios to terminate at a roundabout at Faulties. The cross-section of the existing N4 changes from single to dual carriageway by merge lanes currently in the vicinity of Faulties. This current layout is undesirable as it does not clearly differentiate between different cross-sections. The introduction of a roundabout at this location to clearly mark this change would enhance safety. It also improves safety for connectivity to Dromod via the L1601 as it eliminates right turning traffic across opposing traffic and traffic emerging from the L1601.

h) **Design Update 8:** A value engineering exercise was undertaken on each design scenario to reduce and balance the bulk earthworks. This has the potential to reduce costs, carbon emissions due to construction, and the need to import or dispose of construction material among other benefits. Due to the design changes mentioned above, which offer their own benefits, improvements could not be achieved in all design scenarios.

A number of option corridors with the potential for road based solutions have been taken forward to the Stage 2 Preliminary Options. Four option corridors, which are compared relative to each other, are to the west of Node J at Drumsna Junction (Cyan, Orange, Purple West and Dark Green) and three option corridors are to the east of Node J (Purple East, Green and Yellow). Any option from the west can be connected to any option on the east to create the final Preferred Option Corridor, whilst noting that consistency of cross-section is also a consideration. Separately, the Black Option Corridor is also west of Drumsna but is not compared to the other option corridors. Each option corridor for comparative assessment converges at Node J, therefore, the assessment will score, rank and compare the Cyan, Orange, Purple West and Dark Green Option Corridors to the west of Node J at Drumsna Junction, and east of Node J at Drumsna junction the assessment will score, rank and compare the Purple East, Green and Yellow Option Corridors. The option corridors and potential design scenarios utilising differing cross-sections within the options corridors west and east of Node J at Drumsna Junction for comparative assessment are outlined in the table below.

In addition to the above option corridors, the Black Option Corridor is assessed in isolation firstly to understand its costs and benefits. It is also reviewed in consideration with the preferred option thereafter to understand whether it can improve the benefits and provide a better overall transport solution.

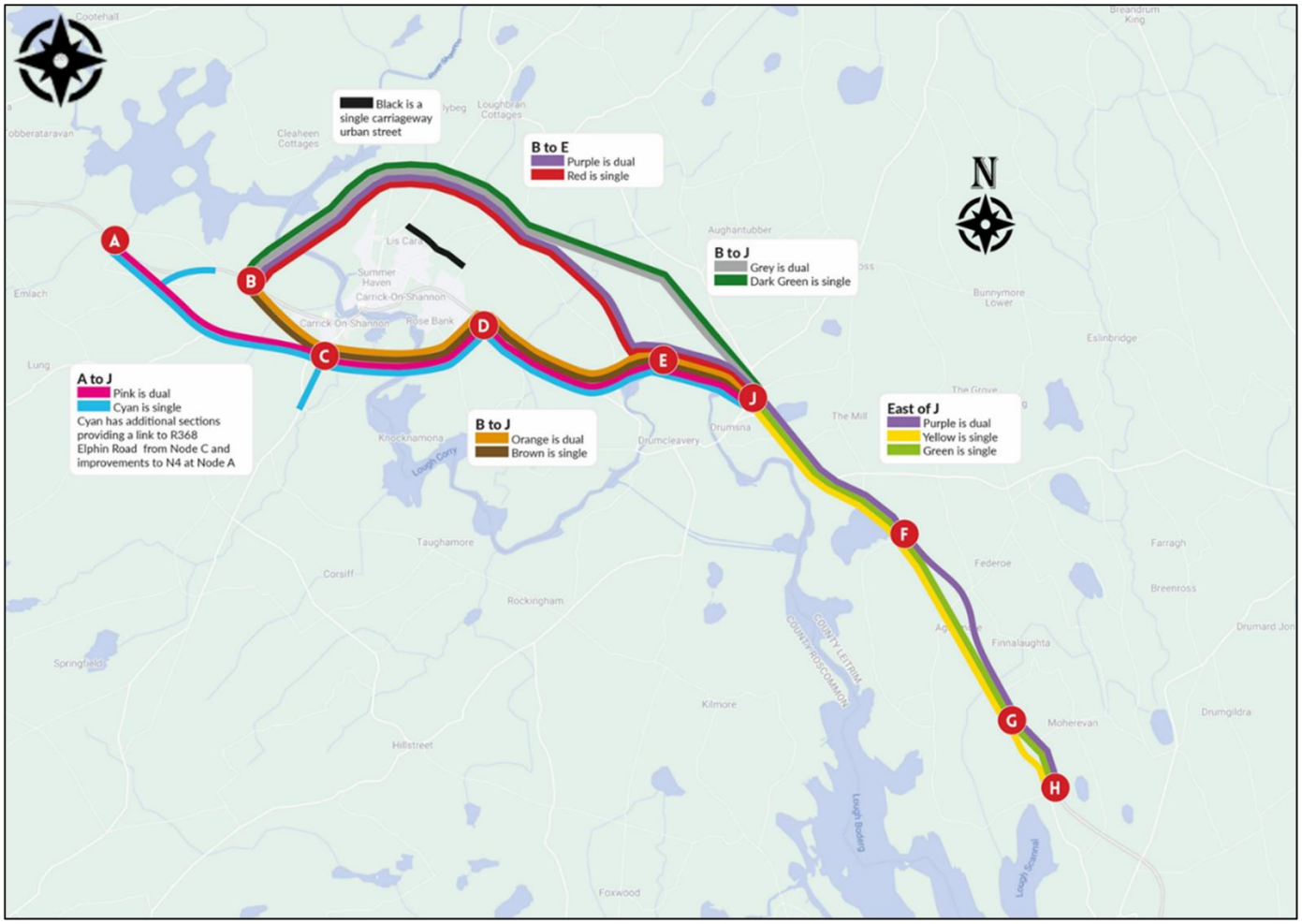

Plate 8.2.1 Stage 2 Option Corridors Schematic

Table 8.2.2 Option Corridors and Design Scenarios West and East of Node J at Drumsna Junction

West of Node J at Drumsna Junction			**East of Node J at Drumsna Junction**		
Option Corridor	**Design Scenario**	**Cross-section**	**Option Corridor**	**Design Scenario**	**Cross-section**
Cyan	Cyan Design Option	Single	Purple East	Purple East Design Option	Dual
	Pink Design Option	**Dual**			
Orange	Brown Design Option	Single	Green	Green Design Option	Single
	Orange Design Option	**Dual**			
Purple West	Red Design Option	Single	Yellow	Yellow Design Option	Single
	Purple West Design Option	**Dual**			
Dark Green	Dark Green Design Option	Single			
	Grey Design Option	**Dual**			
Black	**Black Design Option**	**Urban Street**			

Note: All disciplines (with the exception of the Economy Assessment which assessed both single and dual) assessed the dual carriageway design scenarios West of Drumsna Junction as this was the "worst case scenario" design option in terms of landtake.

The updated Stage 2 Option Corridors are displayed on Figures 8.1.2.0 to 8.1.9.3. A schematic is also presented for ease of reference in Plate 8.2.1.

The transport assessment of the Stage 2 Alternatives identified several demand management measures from Alternative C that could contribute to delivering a substantial reduction in traffic volumes and ease congestion within the environs of Carrick-on-Shannon, all of which align with the Project Objectives. A suite of these

complementary measures from Alternative C were identified and include the following:

- 30km/h speed limit along the existing N4 as indicated by the red line on Figure 8.7.3.0
- New formal pedestrian crossings as part of signalisation of existing junctions
- Signalisation of the six roundabout junctions in the urban area
- Extended signal timings at pedestrian crossings in town to facilitate longer pedestrian/cyclist crossing times

The 'suite of complementary measures' was modelled and combined with each of the Do-Something Option Corridors with the exception of the Black Option Corridor. Therefore, the transport assessment of the Do-Something Option Corridors includes those demand management measures above which contribute to congestion relief and provide improved facilities for vulnerable road users. This is a key difference to the transport modelling undertaken for the Stage 1 Option Corridors.

8.3 Economic Appraisal

8.3.1 Introduction

The economic appraisal of the project is further developed at Stage 2 in accordance with TII PAG Unit 7.0. The Stage 2 Economy appraisal considers the following sub-criteria noting that there are further sub-sections under Transport Efficiency and Effectiveness:

- Transport Efficiency and Effectiveness
    - Engineering
    - Cost Estimate Ranges
    - Cost Benefit Analysis
- Wider Economic Impacts
- Funding Impacts

The measurement of economic impacts within the MCA aims to determine the relative societal gain arising from the implementation of each alternative and/or option. The overall gain to society is not only attributed to monetary value; however, costs are an important part of the economic assessment and in particular the level of spend required to achieve a particular value of gain and whether such can be accomplished in an incremental manner given the funding impacts.

To fully understand how the transport network operates and to enable the assessment of its efficiency and effectiveness, Section 8.3.2 presents an engineering assessment of the Stage 2 Alternatives and Options. It includes an assessment of efficiency of the overall transport network in line with the Project Objectives and ranks alternatives and options accordingly. Factors such as option length and significant structures impact on the overall costs, whilst factors such as traffic

volumes, junction connectivity and delay contribute significantly to the estimation of the benefits of the scheme. It also includes an assessment of the constructability as this is generally related to cost i.e., more complex construction is more expensive. Therefore, as it informs cost estimation both of the construction costs and the benefits, it is a sub-set of the Transport Efficiency and Effectiveness.

In accordance with TII PAG Unit 7.0, the assessment of options under the heading of Transport Efficiency and Effectiveness is generally captured through Cost Benefit Analysis (CBA). As noted in TII Publication PE-PMG-02042, the CBA typically encompasses all options advanced from the Stage 1 (Preliminary Options Assessment), to assess how each could increase overall welfare, after allowing for economic cost. Section 8.3.3 presents the Cost Estimates Ranges which were updated to take account of the design updates as outlined in Section 8.2. The output of the CBA is presented in Section 8.3.3.

The transport user benefits do not capture all of the potential economic benefits of a project. The MCA therefore allows for the identification of any wider economic benefits of a project which is assessed in Section 8.3.4.

The source of funding for the project is outlined in Section 8.3.5 and the summary of the economic assessment is presented in Section 8.3.6.

8.3.2 Transport Efficiency and Effectiveness: Engineering Assessment

An engineering assessment of alternatives and options is required to provide the context for the transport assessment of the alternatives and options as well as to provide a context for the associated cost estimate range of each. A number of criteria have been selected to undertake the assessment based on engineering parameters.

This section details the Stage 2 Assessment of the alternatives and options with respect to the engineering constraints identified in Section 4.2 Engineering of this report.

Section 8.3.2.1 outlines the methodology that was used to carry out the engineering assessment. Section 8.3.2.2 details the engineering assessment of the alternatives and Section 8.3.2.3 details the option corridor engineering assessment. A summary of the engineering assessment is presented in Section 8.3.2.4.

8.3.2.1 Methodology for the Stage 2 Engineering Assessment

Whilst geometry was assessed in the Stage 1 assessment as the on-line Management Option was under consideration, it is assumed that any proposed new infrastructure that will be put in place meets the contemporary design standards for its application in either urban or rural context e.g., Design Manual for Urban Roads and Streets, National Cycle Manual and TII Publications etc. Therefore, the geometry assessment of all alternatives and option corridors would have a Moderately Positive impact over the existing Do-Minimum scenario and would not be

considered a differentiator. Therefore, it is not considered in this Stage 2 engineering assessment.

Methodology for the Engineering Assessment of Alternatives

The engineering assessment criteria for the alternatives have been identified under the following headings: Traffic Impacts and Constructability. The various assessment methodologies employed under each of these headings are outlined in Section 8.3.2.2. The alternatives were scored based on the seven-point scale, under each heading, in line with the TII PAG multi-criteria assessment.

Methodology for the Engineering Assessment of Options

The engineering assessment criteria for the option corridors have been identified under the following headings: Trip Length, Junction Strategy as it relates to costs and traffic distribution, hence Traffic is assessed, and Constructability. The various assessment methodologies employed under each of these headings are outlined in Section 8.3.2.3 below. The option corridors were scored based on the seven-point scale under each heading before a ranking was given as Preferred (P), Intermediate (I) or Least Preferred (LP).

8.3.2.2 Stage 2 Engineering Assessment of Alternatives

Traffic Impacts

The Stage 2 traffic assessment of alternatives is outlined in the Traffic Modelling Report contained in Appendix A.3.2.1. It illustrates how the alternatives perform against the Do-Minimum scenario for the future years of 2030 and 2045 and informs the assessment as follows. Since Stage 1, the transport model was enhanced. The assessment of the three Alternatives examined in Stage 1 was refreshed in Stage 2 with the updated transport model. The results of the updated assessments are presented in this chapter.

Alternative A Active Travel

The Stage 2 transport assessment indicates a 1.5% decrease in private vehicle trips within the study area arising from the active travel measures which is attributed to modal shift from private car to the more sustainable modes of walking and or cycling. This is not considered significant when compared against the project objective of congestion relief; however, it is an improvement on the existing mode share and is considered a neutral impact and has been assigned a PAG Score of 4.

Alternative B Public Transport

For Alternative B Public Transport, the conclusion of the Stage 1 assessment of alternatives was that improvements to the rail infrastructure did not merit inclusion at Stage 2. Alternative B can include improvements to the rail station which will be accomplished without construction of new rail infrastructure such as line markings and signage to delineate parking for cyclists and/or vehicles.

Alternative B will involve an improvement of, and/or new, bus services on the existing street network. This will involve additional signage and possible bus-stops

but will not require land acquisition and significant construction. The bus proposals in Alternative B have been cross-referenced against The Connecting Ireland Rural Mobility Plan, which was released for public consultation shortly after the Stage 1 assessment was complete. This Plan is a major national public transport initiative developed by the National Transport Authority (NTA), with the aim of increasing connectivity, particularly for people living outside our major cities and towns. The proposals seek to provide better public transport access for more people to more places throughout rural Ireland. Connecting Ireland proposes a series of new public transport routes and improvements to existing ones. The proposals in the Plan are very similar to those proposed under Alternative B but the Plan provides Elphin/Strokestown and Elphin/Carrick-on-Shannon as separate services whereas Route 3 in Alternative B provides this route as a through service. A submission was made to the National Transport Authority (NTA) public consultation on the Plan to recommend inclusion of a direct bus link between Carrick-on-Shannon, Elphin and Strokestown.

These enhancements to bus service provision have been tested in the National Transport Authority's (NTA's) Western Regional Model (WRM) before applying the resultant mode shift to the Local Area Model (LAM) for Carrick-on-Shannon. These bus enhancements are as set out in Section 8.2.

The Stage 2 transport assessment indicates less than 1% decrease in private vehicle trips within the study area arising from the improved public transport services. Again, whilst this is considered neutral or not significant when compared with the existing levels of congestion, it is an improvement and has been assigned a PAG score of 4. An array of AADT data points around the study area was selected for analysis of the impact of the bus improvements and is included in the Traffic Modelling Report in Appendix A.3.2.1.

Alternative C Demand Management

The Stage 2 transport assessment indicates a 10% decrease in private vehicle trips arising from the demand management measures outlined in Alternative C in Section 6.1.2.3. This has been assigned a PAG Score of 5.

Summary of Traffic Impact of Alternatives

All the alternatives offer a reduction in the number of private vehicle trips in Carrick-on-Shannon with Alternative C – Demand Management offering the greatest reduction in AADT over the River Shannon Bridge, up to 10% in the Design Year 2030 and Alternative B Public Transport resulting in the least reduction.

Given the significant potential reduction in private vehicles in the urban areas of Carrick-on-Shannon arising from Alternative C, elements of Alternative C were combined with the road based option corridors to further enhance the transport offering. This is in line with the hierarchy of intervention whereby every effort is utilised to reduce trip demand initially, which in turn promotes an uptake on active travel modes, before progressing to new infrastructure. Therefore, the subsequent Stage 2 transport assessment of option corridors includes the demand management measures as set out in Section 8.2.

Alternatives A and B will likely require further testing and consideration at Phase 3 once the Preferred Option Corridor is selected to determine the extent of the active travel proposals and bus improvements to include as part of the overall transport solution for the N4 Carrick-on-Shannon to Dromod Project.

An array of AADT data points around the study area was selected for analysis of the impact of all three alternatives for Year 2030 and Year 2045 and is included in the Traffic Modelling Report in Appendix A.3.2.1. An extract from this is provided below for the data point on the existing N4 River Shannon Bridge.

Table 8.3.1 Traffic Impact Assessment of the Alternatives at Existing River Shannon Bridge

	Alternative A Active Travel	**Alternative B Public Transport**	**Alternative C Demand Management**
Traffic (AADT on River Shannon Bridge)			
Do-Minimum 2030	17,380	17,380	17,380
Year 2030	17,250	17,330	15,650
Change in AADT	-0.7%	-0.3%	-10.0%
Do-Minimum 2045	17,515	17,515	17,515
Year 2045	17,380	17,450	15,860
Change in AADT	-0.7%	-0.3%	-9.4%
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**
Score / Impact Level	**4**	**4**	**5**

These scores are tabulated in the summary table in Section 8.3.2.4.

Constructability of Alternatives

As set out in the Stage 1 Assessment, constructability of the Active Travel Alternatives will be complicated due to the extent of existing residential housing, commercial businesses, farms, local roads and accesses. Disruption to residents and local traffic will need to be minimised throughout the construction period. Detailed construction sequencing and phasing of the works will be assessed as part of any potential Environmental Impact Assessment should elements of these alternatives be included in the preferred transport solution.

The construction impact from Alternative A Active Travel has a Minor or Slightly Negative impact given the scale of the proposed works on new and proposed footways and cycle ways and the potential for numbers of individuals and property owners impacted and has been assigned a PAG Score of 3.

The construction impact from Alternative B Public Transport alternative would have a Not Significant or Neutral impact given the localised scale of the proposed works at implementing bus stops and bus bays. It is anticipated that very few

individuals and property owners would be impacted by the proposed public transport improvements and has been assigned a PAG Score of 4.

The construction impact from Alternative C Demand Management alternative would have a Minor or Slightly Negative impact given the localised nature of the physical construction works and the potential for low levels of individuals impacted by the works. It has been assigned a PAG Score of 3.

These scores are tabulated in the summary table in Section 8.3.2.4 and preferences assigned which are subsequently carried through to the overall summary of Transport Efficiency and Effectiveness.

8.3.2.3 Stage 2 Engineering Assessment of Options

The option corridors for comparative assessment are assessed in two sections, west and east of Node J at Drumsna Junction. The assessment is mindful that any design scenario could be realigned within its corridor and therefore the overall impact of the option is also assessed to identify possible impacts within the 300m wide corridor.

Trip Length

The Trip Length parameter does not measure the length of new construction of a design, it is a measure of the travel distance from a common start point to a common end point.

For West of Drumsna Junction, the measure is from Node O to Node J and for East of Drumsna Junction the measure is from Node J to Node H (east of Node J at Drumsna Junction) with respect to each of the design scenarios. See Figure 8.1.1.0 for node locations.

The Trip Lengths of each design scenario are tabulated and assessed in Table 8.3.2 and Table 8.3.3. Scores were based relative to the existing trip length west and east of Node J at Drumsna Junction respectively. A trip length within ±100m of the existing situation was given a score of 4 (Not Significant or Neutral). A trip length between ±100m and ±500m of the existing situation received a score of 3 or 5 respectively. A score of 2 or 6 was given to an option having a trip length more than ±500m but less than ±1000m of the existing situation. A trip length 1000m greater or less than the existing situation was given a score of 1 or 7. The existing trip lengths are 12,376m west of Node J at Drumsna Junction and 7,876m east of Node J at Drumsna Junction.

Stage 2 Trip Length Assessment of Design Scenarios West of Drumsna Junction (Node J)

By their nature, each of the design scenarios bypassing Carrick-on-Shannon would result in a greater trip length than the existing. The Cyan and Pink Design Scenarios are ranked Preferred as are very close to the existing trip length, while the Purple and Red Design Scenarios are ranked Least Preferred due to the fact that they are approximately one kilometre longer.

Table 8.3.2 Trip Length Assessment of the Design Scenarios West of at Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**	
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design
Cross-section Assessed	Single	Dual	Single	Dual	Single	Dual	Single	Dual
Trip Length								
Trip Length (m)	12,394	12,397	12,476	12,516	13,400	13,343	13,214	13,173
Scoring								
Qualitative Assessment	**Not Significant** or **Neutral**		**Minor** or **Slightly Negative**		**Moderately Negative**		**Moderately Negative**	
Score / Impact Level	**4**	**4**	**3**	**3**	**2**	**2**	**2**	**2**
Preference	**Preferred**		**Intermediate**		**Least Preferred**		**Intermediate**	

Stage 2 Trip Length Assessment of Design Scenarios East of Drumsna Junction (Node J)

The Green and Yellow Design Scenarios are ranked Preferred under this assessment as there is a negligible difference between them. The Purple East Design Scenario is ranked Least Preferred, with a Trip Length approximately 100m longer than the existing as it bypasses the village of Aghamore, but this length differential is not considered significant.

The Black Option Corridor was not scored under this assessment criteria as it does not pass through Nodes O or J. If the Black Corridor alone was to be implemented, the existing N4 mainline and Trip Length through Carrick-on-Shannon would remain as it is currently.

Table 8.3.3 Trip Length Assessment of the Design Scenarios East of at Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design	Green Design	Purple East Design
Cross-section Assessed	Single Carriageway	Single Carriageway	Dual Carriageway
Trip Length			
Trip Length (m)	7,864	7,878	7,982
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutra**l	Trip length approximately 100m longer than the other two options. **Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**3**
Preference	**Preferred**	**Preferred**	**Least Preferred**

Junction Strategy

This assessment was separated into two parts; an at-grade assessment and a grade separated assessment. The assessments consider the number of junctions along each of the design scenarios as it informs the traffic flow and distribution. At-grade junctions will cause delays on the mainline, with the delay increasing as the number of at-grade junctions increases. At-grade junctions also have the potential to increase traffic volumes and delay on the adjoining local road network. However, it is vital to provide sufficient connectivity via junctions to attract traffic from the local networks. Conversely, a higher number of grade separated junctions provides greater connectivity to the mainline with no significant delay experienced by the mainline traffic.

The number of at-grade junctions were counted along each design scenario and a score of 7 was given where there were no junctions which would cause delay i.e., at-grade junctions. This score would be reduced by 1 for every junction causing delay until a score of 1 would be given to a design scenario with six or more at-grade junctions.

Conversely, the number of grade separated junctions were counted along each design scenario and a score of 1 was given where there were no grade separated junctions. In keeping with the at-grade assessment, this score would be increased by 1 for the introduction of every grade separated junction until a score of 7 would be given to a design scenario with six or more grade separated junctions.

Finally, the average score of both sub-assessments determines the overall score for the Junction Strategy assessment. Summaries of the number of junctions west and

east of Node J at Drumsna Junction for each design scenario, along with the Junction Strategy assessments, are tabulated below.

Stage 2 Junction Strategy Assessment of Design Scenarios West of Drumsna Junction (Node J)

Each design scenario aims to reduce the number of junctions onto the national primary route while providing sufficient connectivity to the regional and local network. The Purple and Grey Design Scenarios are the Preferred options under this assessment for west of Node J at Drumsna Junction, as they provide grade separation. It is not envisaged that design scenarios within the Cyan and Orange Option Corridors could cater for grade separated junctions due to the need for the Elphin Link Road to cross above the railway and the proximity to the housing and the floodplain in this area. The Cyan Design Scenario is ranked Least Preferred as it would require the most at-grade junctions with the additional junction added to connect to the R368 Elphin Road.

The Black Option Corridor has been assessed separately as a standalone assessment and the details are provided below in Table 8.3.4. The Black Option Corridor would need to provide sufficient junctions to facilitate connectivity between the R280, the Summerhill Road and the Castlecara Road. It is not envisaged or advisable that grade separation would be provided on this corridor given that this is an urban street. The table below shows how the Black Option Corridor performs.

Table 8.3.4 Junction Strategy Assessment of the Design Scenarios West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**			**Black Option Corridor**
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design		Black Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway		Urban Street
Junction Strategy										
# Signalised / Roundabouts	3	3	2	2	3	2	3	2		3
# Priority / Left In - Left Out	1	0	1	0	0	0	0	0		0
At-Grade Assessment Score	*3*	*4*	*4*	*5*	*4*	*5*	*4*	*5*		4
# Grade Separated	0	0	0	0	0	1	0	1		0
Grade Separated Assessment Score	*1*	*1*	*1*	*1*	*1*	*2*	*1*	*2*		1
Scoring										
Qualitative Assessment	**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**		**Not Significant** or **Neutral**		**Not Significant** or **Neutral**			**Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**3**	**3**	**4**	**3**	**4**	**4**		**3**
Preference	**Least Preferred**		**Intermediate**		**Preferred**		**Preferred**			**N/A**

Stage 2 Junction Strategy Assessment of Design Scenarios East of Drumsna Junction (Node J)

The Purple Design Scenario is the Preferred option east of Node J at Drumsna Junction. The Purple Design Scenario would remove all at-grade junctions from the N4 and offers the greatest opportunity to provide grade separated junctions. Although the Green and Yellow Design Scenarios would reduce the number of direct junctions onto the national primary route, these options do not provide for additional grade separation.

Table 8.3.5 Junction Strategy Assessment of the Design Scenarios East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design	Green Design	Purple East Design
Cross-section Assessed	Single Carriageway	Single Carriageway	Dual Carriageway
Junction Strategy			
# Signalised / Roundabouts	1	1	0
# Priority / Left In - Left Out	2	3	0
At-Grade Assessment Score	*4*	*3*	*7*
# Grade Separated	1	1	2
Grade Separated Assessment Score	*2*	*2*	*3*
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Positive**
Score / Impact Level	**3**	**3**	**5**
Preference	**Intermediate**	**Least Preferred**	**Preferred**

Constructability

Similar to the alternatives, constructability of all of the design scenarios will be complicated due to the extent of existing residential housing, commercial businesses, farms, local roads and accesses dotted along the length of the corridors. Disruption to residents and local traffic will need to be minimised throughout the construction period. Detailed construction sequencing and phasing of the works will be assessed as part of the Environmental Impact Assessment.

There are many factors that influence the constructability of a design scenario. This assessment has been broken into five sub-criteria; total construction length, undesirable lengths, structures and crossings, constructability of River Shannon Bridge, and major utility interferences. The undesirable lengths consist of lengths of on-line construction, cuts and fills larger than 10m, and lengths of construction within a floodplain, all of which bring complexity to the construction phase. Structures and crossings comprise watercourses, rail and road infrastructure crossings for example, bridges and culverts. The constructability of River Shannon Bridge assessment only applies to options west of Node J at Drumsna Junction. The only major utility network assessed as part of the Stage 2 Assessment is the ESBI Network as there is no Gas Networks Ireland infrastructure within the study area.

Constructability of River Shannon Bridge Assessment

Four of the option corridors require a new crossing of the River Shannon, namely the Cyan, Orange, Purple West and Dark Green Option Corridors. A review was undertaken looking at the constructability of a bridge crossing of the River Shannon at these locations.

Within each of these option corridors, both single and dual carriageway design scenarios were considered. Apart from the additional lanes and their overall widths, there is no significant variance between the types of carriageway arrangements when assessing their impact on constructability relative to the corridor arrangements. Hence, this assessment does not differentiate between the two design scenarios as the overall corridor arrangement remains the same at each crossing locations.

Of the four option corridors assessed, both the Purple West and Dark Green Option Corridors share a similar alignment, with a crossing to the north of Carrick-on-Shannon. These two options rank identically when reviewing the constructability of a new bridge crossing to the north. The Cyan and Orange Option Corridors both cross at a similar location to the south of Carrick-on-Shannon but have different approach alignments resulting in some tangible differences.

Plate 8.3.1 Potential Crossing Locations of the River Shannon

The surrounding topography of the northern crossing location comprises relatively flat farmland with no obstructions on the approaches. The river meanders through this area with a channel width of approximately 80m wide at the proposed crossing point. The approach to the southern crossing location is slightly more constrained. A residential development is located to the east and farmlands/camping business to the west, although it is assumed that the some or all of properties will be acquired as part of the works. The river is approximately 150m wide at the proposed southern crossing location. A wooden jetty is located along the western riverbank along with an access spur into the river. There is also an inlet channel located on the eastern bank impacted by the Cyan Option Corridor.

The geology in the region typically comprises of soft alluvium material overlying glacial till over limestone bedrock. The depth to bedrock varies across the proposed bridge sites, typically ranging between 3m to 12m below ground level. There is no driving differentiator between the proposed north and south crossing locations based on the currently available geotechnical information.

The River Shannon has an extensive floodplain along its length. Any crossing of the river will need to provide sufficient capacity to cater for flood events. For the purposes of comparing the options at this conceptual stage, a comparison of the 100-year flood extents has been undertaken at the proposed bridge crossing locations. Overall bridge lengths have been estimated based on a viaduct structure long enough to provide coverage of the 100-year flood event. The Purple West, Dark Green and Orange Option Corridors all share similar overall viaduct lengths of approximately 400m. Due to its skewed alignment on its approach to the River Shannon, the Cyan Option Corridor requires the longest overall length of structure to span the floodplain, measuring in excess of 500m.

The proposed bridge sites, both north and south, benefit from having relatively good access to the N4 for transporting in machinery and materials for bridge construction. The southern options are slightly more favourable as they have good access to both sides of the river, whereas the northern site would rely on the local road network until the corridor earthworks are more established.

The northern options benefit from a good road alignment on the approach to the bridge, with straight horizontal and vertical geometry. Conversely, the southern

options both include horizontal transition curves and vertical crest curves in their current geometrical configurations. This form of geometry is unfavourable for bridge construction. However, it is noted that the alignments currently shown are only conceptual arrangements, and hence there may be scope to alter road alignments locally to provide for a more favourable geometry at the bridge crossing locations at the next phase of the project.

In summary, the main differentiator among the option corridors, when considering constructability of a bridge crossing of the River Shannon, is the presence of river features at the proposed crossing locations and the surrounding topography. It is assumed that the road geometry curves could be altered locally at the proposed bridge locations, particularly for the southern options, to provide for more suitable curves for bridge construction. Hence road geometry is not assessed to be a differentiating factor for this assessment.

The northern options have a narrower and more defined river channel at the crossing location. Additionally, the approach to the river crossing comprises open farmland with no nearby developments or river amenities which might impact on the constructability of the bridge.

The southern crossing location has a wider channel and a number of irregular features which need to be avoided or mitigated against. The presence of the jetty and access spur on the western bank needs to be spanned if these are to be retained. Similarly, the inlet channel on the eastern bank needs to be spanned or potentially filled in. While the road alignment could be locally altered to try to avoid and better span some of these features, their presence and the proximity of the nearby residential development to the east make this potential crossing point less favourable compared to the northern options.

Hence, the Purple West and Dark Green Option Corridors are rated as Preferred with the Cyan and Orange Option Corridors being ranked as Intermediate from a constructability of the new River Shannon Bridge perspective.

Table 8.3.6 Constructability assessment of potential River Shannon crossing

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**	
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway
Constructability								
Approach Topography	4	4	4	4	5	5	5	5
Channel Width	2	2	2	2	4	4	4	4
River Features	2	2	2	2	4	4	4	4
Geology	4	4	4	4	4	4	4	4
Crossing of Floodplain	3	3	2	2	3	3	3	3
Road Alignment	3	3	3	3	3	3	3	3
Accessibility	3	3	3	3	4	4	4	4
Overall Bridge Length	2	2	3	3	3	3	3	3
Scoring								
Score / Impact Level	3	3	3	3	4	4	4	4
Preference	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**	**Preferred**	**Preferred**

Stage 2 Constructability Assessment of Design Scenarios West of Drumsna Junction (Node J)

The Cyan and Pink Design Scenarios are ranked Least Preferred as these design scenarios would require the greatest total length of construction (as opposed to trip length which is assessed separately under traffic benefits) noting that the Cyan and Pink Design Scenarios include for an additional link road of 1,094m in length to connect to the R368 Elphin Road, long sections of on-line and other undesirable construction, the most amount of structures and a high level of interference with existing utilities. The Dark Green and Grey Design Scenarios are ranked Preferred, requiring the least amount of on-line construction and interference with existing utilities.

The Black Option Corridor has been assessed separately as a standalone assessment. The Black Option Corridor scores well under this assessment with only a short section of new construction, few watercourse crossings and no interaction with known existing utilities. Although it is not envisaged that any cuts or embankments larger than 10m would be necessary, it is noted that this alternative would require some significant earthworks to comply with geometry standards, due to the topography within the corridor.

Table 8.3.7 Constructability Assessment of the Design Scenarios West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**			**Black Option Corridor**
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design		Black Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriage-way	Dual Carriage-way		Urban Street
Constructability										
Construction Length including link roads(m)	12,250	12,250	9,245	9,285	10,029	9,972	9,843	9,802		1,120
	Least Preferred	**Least Preferred**	**Preferred**	**Preferred**	**Intermediate**	**Intermediate**	**Inter-mediate**	**Inter-mediate**		**N/A**
'Undesirable' Length										
Length of On-line Construction	4,815	4,815	4,815	4,815	2,000	1,750	525	525		0
Length Cut > 10m	130	130	0	0	480	610	520	560		0
Length of Fill > 10m	0	0	0	0	630	420	730	580		0
Length of Floodplain Crossings	1,428	1,428	1,465	1,466	945	1,202	945	1,202		40

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**			**Black Option Corridor**
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design		Black Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriage-way	Dual Carriage-way		Urban Street
Total 'Undesirable' Length	**6,373**	**6,373**	**6,280**	**6,281**	**4,055**	**3,982**	**2,720**	**2,867**		**40**
	Least Preferred	**Least Preferred**	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**		**N/A**
Structures and Crossings										
# River Shannon Crossings	1	1	1	1	1	1	1	1		0
# Stream Crossings	15	15	12	12	11	10	10	10		6
# Rail Crossings	1	1	0	0	0	0	0	0		0
# Road Overbridges	2	2	2	3	3	4	3	3		0
# Road Underbridges	1	1	1	1	1	1	1	2		0
Total Structures / Crossings	20	20	16	17	16	16	15	16		6

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**			**Black Option Corridor**
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design		Black Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriage-way	Dual Carriage-way		Urban Street
	Least Preferred	**Least Preferred**	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**	**Inter-mediate**		**N/A**
Constructability of River Shannon Bridge										
Constructability of River Shannon Bridge	**Inter-mediate**	**Inter-mediate**	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**	**Preferred**	**Preferred**		**N/A**
Main Utility Crossings										
ESB – 38kV (OH)	2	2	2	2	1	1	1	1		0
ESB – 38kV (UG)	2	2	2	2	0	0	0	0		0
ESB – 110kV	8	8	7	7	4	4	4	4		0
ESB – 220kV	0	0	0	0	0	0	0	0		0
Total Main Utility Crossings	12	12	11	11	5	5	5	5		0

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**			**Black Option Corridor**
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design		Black Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriage-way	Dual Carriage-way		Urban Street
	Least Preferred	**Least Preferred**	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**	**Preferred**	**Preferred**		**N/A**
Scoring										
Qualitative Assessment	**Moderately Negative**		**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**			**Not Significant or Neutral**
Score / Impact Level	***2***	**2**	**3**	**3**	**3**	**3**	**3**	**3**		**4**
Preference	**Least Preferred**		**Intermediate**		**Intermediate**		**Preferred**			**N/A**

Stage 2 Constructability Assessment of Design Scenarios East of Drumsna Junction (Node J)

All three design scenarios interfere with the same 220 kV overhead line and so are indistinguishable under this sub-assessment. As the Green Design Scenario consists wholly of on-line upgrades, this option is ranked Least Preferred. The Purple Design Scenario would require the least amount of on-line construction therefore causing the least disruption, and as such is ranked Preferred.

Table 8.3.8 Constructability Assessment of the Design Scenarios East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design	Green Design	Purple East Design
Cross-section Assessed	Single Carriageway	Single Carriageway	Dual Carriageway
Constructability			
Construction Length (m)	***7,864***	***7,878***	***7,606***
	Least Preferred	**Least Preferred**	**Preferred**
'Undesirable' Length			
Length of On-line Construction	6814	7878	5212
Length Cut > 10m	0	0	0
Length of Fill > 10m	0	0	0
Length of Floodplain Crossings	0	0	0
Total 'Undesirable' Length	***6,814***	***7,878***	***5,212***
	Intermediate	**Least Preferred**	**Preferred**
Structures and Crossings			
# River Shannon Crossings	0	0	0
# Stream Crossings	2	2	2
# Rail Crossings	0	0	0
# Road Overbridges	0	0	3
# Road Underbridges	0	0	0
Total Structures / Crossings	***2***	***2***	***5***
	Preferred	**Preferred**	**Least Preferred**
Main Utility Crossings			
ESB – 38kV (OH)	0	0	0
ESB – 38kV (UG)	0	0	0
ESB – 110kV	0	0	0
ESB – 220kV	1	1	1
Total Main Utility Interactions	***1***	***1***	***1***

Option Corridor	Yellow Option Corridor	Green Option Corridor	Purple East Option Corridor
Design Scenario	Yellow Design	Green Design	Purple East Design
Cross-section Assessed	Single Carriageway	Single Carriageway	Dual Carriageway
	Preferred	**Preferred**	**Preferred**
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**3**
Preference	**Intermediate**	**Least Preferred**	**Preferred**

Traffic

The traffic assessment illustrates how the design scenarios perform against the Do-Minimum scenario for the future years of 2030 and 2045. The criteria assessed was the change in AADT over the River Shannon Bridge. The Do-Minimum scenario (±1%) is given a score of 4 (neutral). A change in AADT of up to ±20% from this scenario received a score of 3 or 5, where a reduction is deemed positive. A change in AADT between ±20% and ±40% from this scenario received a score of 2 or 6. A score of 1 or 7 was given to an option predicting a change in AADT of more than ±40% from this scenario. The final score for the assessment is based on the average change in AADT over the 2030 and 2045 scenarios. The Do-Minimum AADTs across the River Shannon Bridge for the years 2030 and 2045 17,380 and 17,515 respectively.

Stage 2 Traffic Assessment of Design Scenarios West of Drumsna Junction (Node J)

The introduction of any of the option corridors will reduce AADT over the River Shannon Bridge. The Cyan and Pink Design Scenarios are ranked Preferred, providing the greatest reduction. This can be attributed to being of the shorter trip lengths with tie-in points to the existing N4 closer to Carrick-on-Shannon along with the addition of the direct connection to the R368.

The Red and Dark Green Design Scenarios are ranked least Preferred. Although both options would still have a positive impact on reducing AADT over the existing River Shannon Bridge, they are outperformed among the northern options by their respective dual carriageway counterparts, the Purple West and Grey Design Scenarios, as well as being outperformed by all the southern options.

The selection of an option corridor east of Node J will have no impact on AADT over the River Shannon Bridge, and therefore the traffic assessment east of Drumsna Junction is omitted.

As a standalone assessment, the Black Option Corridor would offer an insignificant difference in AADT over the River Shannon Bridge and is given a score of 4 as illustrated in Table 8.3.9. Therefore, the Black Option Corridor will not address the

objectives of relief of congestion over the River Shannon Bridge and was not therefore included in every Do-Something Option as a minimum requirement as per the Demand Management measures in Alternative C.

Table 8.3.9 Traffic Assessment of the Design Scenarios West of Drumsna Junction (Node J) (New Do-Minimum AADTs)

Option Corridor	**Cyan Option Corridor**		**Orange Option Corridor**		**Purple West Option Corridor**		**Dark Green Option Corridor**			**Black Option Corridor**
Design Scenario	Cyan Design	Pink Design	Brown Design	Orange Design	Red Design	Purple West Design	Dark Green Design	Grey Design		Black Design
Cross-section Assessed	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway	Single Carriageway	Dual Carriageway		Urban Street
Traffic										
Year 2030	10,039	10,046	10,550	10,528	11,345	10,821	11,192	10,863		17,398
Change in AADT	*-42.2%*	*-42.2%*	*-39.3%*	*-39.4%*	*-34.7%*	*-37.7%*	*-35.6%*	*-37.5%*		*0.1%*
Year 2045	10,125	10,145	10,600	10,582	11,309	10,882	11,208	10,929		17,497
Change in AADT	*-42.2%*	*-42.1%*	*-39.5%*	*-39.6%*	*-35.4%*	*-37.9%*	*-36.0%*	*-37.6%*		*-0.1%*
Scoring										
Qualitative Assessment	**Major** or **Highly Positive**		**Moderately Positive**		**Moderately Positive**		**Moderately Positive**			**Not Significant** or **Neutral**
Score / Impact Level	**7**	**7**	**6**	**6**	**6**	**4**	**6**	**6**		
Preference	**Preferred**		**Intermediate**		**Least Preferred**		**Least Preferred**			**N/A**

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8.3.2.4 Summary of Stage 2 Engineering Assessment

Summary Engineering Assessment of the Stage 2 Alternatives

All the alternatives offer an improvement in the reduction of the number of private vehicle trips in Carrick-on-Shannon with Alternative C – Demand Management offering the greatest reduction in AADT over the River Shannon Bridge and Alternative B Public Transport resulting in the least reduction.

Given that the construction impacts of both Alternative A and B are assessed as local and are minor and given the minimal reduction in private vehicle trips attributed to Alternatives A and B, then overall Alternative A and Alternative B are assessed as having a Not Significant or Neutral impact.

Overall Alternative C is assessed as having a Minor or Slightly Positive impact given it has significant potential to improve on the overall transport solution when combined with the option corridors whilst having minor negative construction impacts.

Table 8.3.10 Engineering Summary Assessment Matrix of Stage 2 Alternatives

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Traffic Impacts	Not Significant or Neutral 4	Not Significant or Neutral 4	Minor or Slightly Positive 5
Constructability	Minor or Slightly Negative 3	Not Significant or Neutral 4	Minor or Slightly Negative 3
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**
Score / Impact level	**4**	**4**	**5**

Summary Engineering Assessment of the Stage 2 Options

The engineering assessment of the Stage 2 Options has examined each of the option corridors and design scenarios under the headings of Trip Length, Junction Strategy and Constructability. The methodology used to assess the option corridors under each heading has been detailed throughout Section 8.3.2.3. The option corridors were scored based on the seven-point scale before a ranking was given as Preferred, Intermediate or Least Preferred under each heading.

<u>Summary of assessment West of Drumsna Junction</u>

Cyan Option Corridor

The Cyan and Pink Design Scenarios are ranked Preferred under Trip Length. Grade separation at junctions is not deemed feasible at this stage and so the Cyan

and Pink Design Scenarios rank poorly under Junction Strategy, with the Cyan Design Scenario ranked Least Preferred overall. The Cyan and Pink Design Scenarios are both ranked as the Least Preferred options under Constructability with the most total construction length noting that they do include a link to the R368 Elphin Road, joint most on-line upgrade, significant construction within floodplains, the most structures & stream crossings, intermediate River Shannon crossing, and the most utility interference required of all of the options west of Node J at Drumsna Junction. The Cyan and Pink Design Scenarios are ranked Preferred under the Traffic assessment as they offer the greatest reduction in AADT over the existing River Shannon Bridge.

Orange Option Corridor

The Orange Option Corridor scores second only to the Cyan Option Corridor in terms of Trip Length west of Node J at Drumsna Junction. Grade separation within the Orange Option Corridor is not deemed feasible at this stage and so ranks poorly under Junction Strategy. Although the Orange and Brown Design Scenarios would require the shortest amount of new off-line construction, this option would require the most construction within floodplains, a less preferable River Shannon crossing to the northern options and contains a large number of major utility interferences.

Purple West Option Corridor

The Purple West Option Corridor scores well in terms of Junction Strategy, with the Purple West Design Scenario ranked joint preferred. The Purple West Option Corridor is ranked Least Preferred for Trip Length noting that the design scenarios within are approximately 1km longer than the existing situation. Lesser constructability impacts are envisaged along this Option Corridor due to a variety of on-line construction, floodplain crossing, deep cuts and large embankments. The crossing of the River Shannon on this option corridor is Preferred over the southern option corridors.

Dark Green Option Corridor

The Dark Green Option Corridor scores well in terms of Junction Strategy, with the Grey Design Scenario ranked joint preferred. The Dark Green Option Corridor is ranked Intermediate for Trip Length, although neither design scenarios exceed 1km longer than the existing route but noting that they are approximately 800m longer than the southern options. The Dark Green Option Corridor is the Preferred option in terms of constructability west of Node J at Drumsna Junction requiring the least amount of undesirable construction, particularly of on-line upgrades. The crossing of the River Shannon on this option corridor is also Preferred.

Table 8.3.11 Overall Engineering Summary Assessment Matrix of the Stage 2 Option Corridors West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLACK OPTION CORRIDOR
Trip Length	Within 100m longer than the existing route. Not Significant or Neutral (4)	Within 500m longer than the existing route. Minor or Slightly Negative (3)	Approximately 1000m longer than the existing route. Moderately Negative (2)	Within 1000m longer than the existing route. Moderately Negative (2)	N/A
Junction Strategy	Would reduce the number of junctions onto the national primary route. Appears grade separation not suitable, therefore limited to at-grade junctions. Minor or Slightly Negative (3)	Would reduce the number of junctions onto the national primary route. Appears grade separation not suitable, therefore limited to at-grade junctions. Minor or Slightly Negative (3)	Would reduce the number of junctions onto the national primary route. Could include grade separation and therefore reduce delay on the national primary route. Not Significant or Neutral (4)	Would reduce the number of junctions onto the national primary route. Could include grade separation and therefore reduce delay on the national primary route. Not Significant or Neutral (4)	Would require 3 at-grade junctions to provide effective connectivity. Minor or Slightly Negative (3)
Constructability	Would require the most amount of new off-line construction, joint most on-line upgrade, significant construction within the floodplain and the most structures & crossings of all of the options. Moderately Negative (2)	Would require the shortest amount of new off-line construction, but joined longest on-line upgrade, and the longest floodplain crossing. Similar to other options in terms of structures and utility crossings. Minor or Slightly Negative (3)	Would require some sections of deep cuts and high embankments with some on-line construction and floodplain crossings. Similar to other options in terms of structures and utility crossings. Preferred crossing of River Shannon. Minor or Slightly Negative (3)	Would require large sections of deep cuts and high embankments, but a shorter section of floodplain crossing and only minimal length of on-line construction. Similar to other options in terms of structures and utility crossings. Preferred crossing of River Shannon. Minor or Slightly Negative (3)	No on-line works other than to construct junctions. Would require moderately large cuts and embankments. Not Significant or Neutral (4)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR		BLACK OPTION CORRIDOR
Traffic	The preferred option due to tie-in points close to the town and direct connection to the R368. Major or Highly Positive (7)	Scores well due to being a short bypass with tie-in points close to the town. Moderately Positive (6)	Marginally least preferred but would still reduce AADT over the River Shannon Bridge. Moderately Positive (6)	Scores poorly in comparison to the southern options but would still reduce AADT over the River Shannon Bridge. Moderately Positive (6)		Would offer an insignificant / negligible reduction in AADT over the River Shannon Bridge. Not Significant or Neutral (4)
Scoring						
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Not Significant** or **Neutral**
Score / Impact Level	**3**	**3**	**3**	**3**		**4**
Preference – Professional Judgement	**Intermediate**	**Intermediate**	**Intermediate**	**Preferred**		**N/A**

Summary Engineering Assessment East of Drumsna Junction

Purple East Option Corridor

The Purple East Option Corridor is the Preferred option alone in terms of Junction Strategy as it holds the most potential to provide grade separation at junctions. It is ranked Least Preferred in terms of Trip Length as it provides a longer route to bypass the village of Aghamore. Providing this off-line bypass would result in less on-line upgrade construction, although significant on-line works would still be required.

Green Option Corridor

The Green Option Corridor would see the existing mainline upgraded to achieve current geometric standards as well as reducing the number of junctions onto the national primary route. However, as a wholly on-line option, this would require major on-line works which would likely cause significant delays and disruptions during construction. The existing grade separated Drumsna Junction would be maintained but it is envisaged that all other junctions would remain at-grade.

Yellow Option Corridor

The Yellow Option Corridor would also see most of the existing mainline upgraded to achieve current geometric standards as well as reducing the number of junctions onto the national primary route. By providing an off-line section towards the southern end of the study area, the Yellow Option Corridor could accommodate enhanced overtaking sections over both the existing situation and the Green Option Corridor, while reducing the amount of on-line construction required along the corridor. As with the Green Option Corridor the existing grade separated Drumsna Junction would be maintained but it is envisaged that all other junctions would remain at-grade.

Table.8.3.12 Overall Engineering Summary Assessment Matrix of the Stage 2 Option Corridors East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
Trip Length	An insignificant improvement on the existing situation (12m) Not Significant or Neutral (3)	Complete on-line upgrade – negligibly longer than the existing route (2m) Not Significant or Neutral (4)	Creates the longest Trip Length due to the bypass of Aghamore, yet still within 500m of the existing route. Not Significant or Neutral (4)
Junction Strategy	Would reduce the number of junctions onto the national primary route while continuing to use the existing Drumsna junction to aid traffic flow. Minor or Slightly Negative (3)	Would reduce the number of junctions onto the national primary route while continuing to use the existing Drumsna junction to aid traffic flow. Minor or Slightly Negative (3)	Would reduce the number of direct access and junctions onto the national primary route. Has the most potential for grade separated junction which would reduce delay. Minor or Slightly Positive (5)
Constructability	Similar to other options in terms of structures and diversion but proposes less on-line construction due to on off-line section at Faulties. Minor or Slightly Negative (2)	Similar to other options in terms of structures and diversions, but being a completely on-line route has the most proposed on-line construction which would cause disruptions. Minor or Slightly Negative (2)	Similar to other options in terms of structures and diversion but proposes the least amount of on-line construction due to the bypass of Aghamore. Minor or Slightly Negative (3)
Traffic	Traffic is similar across all options		
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Not Significant** or **Neutral**
Score / Impact Level	**3**	**3**	**4**
Preference – Professional Judgement	**Intermediate**	**Least Preferred**	**Preferred**

8.3.3 Transport Efficiency and Effectiveness: Cost

8.3.3.1 Cost Estimates

This section presents the cost estimate range categories of the Stage 2 Alternatives and Option Corridors.

The methodology utilised to carry out the cost assessment of the alternatives and option corridors respectively for Stage 2 is the same as that detailed in Section 6.6.2 and Section 7.6.3 respectively for Stage 1. For ease of reference, the cost range categories are included here again in Table 8.3.13. Costs were categorised into nine ranges, similar to cost ranges set out in Chapter 5 of the National Development Plan but with the inclusion of new categories for costs less than €20M. The costs for each of the option corridors are also quoted in multiples of the lowest cost option corridor in each section, i.e. the cheapest option is given a value of X or Y depending on whether it is west or east of Drumsna respectively and the other option corridors are a multiple of that. The PAG Score rating is also included in the table below, with 1 being the most expensive and 7 being the most financially beneficial.

Table 8.3.13 Cost Range Categories

Category	Cost Range	PAG Score
i	€0 - €1M	7
ii	€1M - €10M	7
iii	€10M+	6
A	€20M - €50M	5
B	€50M - €100M	4
C	€100M - €250M	3
D	€250M - €500M	2
E	€500M - €1BN	1
F	€1BN+	1

Alternative C has increased in cost since the Stage 1 assessment as it now includes for the signalisation of six roundabouts along the existing N4 corridor as well as the narrowing of the street along this corridor where it overlaps by means of the inclusion of the active travel facilities such as the cycle lanes at Stage 2.

For the option corridors to the west of Drumsna Junction, two design scenarios were developed to inform the assessment of what is the appropriate level of intervention required to provide the optimum transport solution refer to Table 8.2.2. These design scenarios were developed using a single carriageway and a dual carriageway cross-section and are costed accordingly. The Black Option Corridor comprises an urban street type intervention.

Table 8.3.14 Costs – Summary Assessment Matrix of Alternatives

Assessment Criteria	**Alternative A: Active Travel**	**Alternative B: Public Transport Improvements (Bus)**	**Alternative C: Demand Management**
Cost Range Category	(iii)	(ii)	(ii)
Scoring			
Qualitative Assessment	Most Expensive **Moderately Positive**	Intermediate cost. However, the operational costs of Public Transport are not considered. **Major** or **Highly Positive**	Expensive **Major** or **Highly Positive**
Score / Impact Level	**6**	**7**	**7**

The cost estimate ranges are presented in Table 8.3.15 and Table 8.3.16 for the option corridors west and east of Drumsna respectively.

Table 8.3.15 Cost Estimate Ranges for Options West of Drumsna Junction (Node J)

Option Corridor	Design Scenario	Cost Range Category / Factor Relative to Lowest	Score Single Carriageway	Score Dual Carriageway	Option Corridor Qualitative Assessment	Option Corridor Preference
Cyan	Cyan – Single	C / 1.4X	3		Moderately Negative	**Least Preferred**
	Pink – Dual	D / 1.7X		2		
Orange	Brown – Single	C / X	3		Minor or Slightly Negative	**Intermediate**
	Orange – Dual	C / 1.4X		3		
Purple West	Red – Single	C / 1.1X	3		Minor or Slightly Negative	**Intermediate**
	Purple – Dual	C / 1.3X		3		
Dark Green	Dark Green – Single	C / 1.2X	3		Minor or Slightly Negative	**Intermediate**
	Grey – Dual	C / 1.3X		3		
Black	Black – Urban Street	(iii)	N/A	N/A	N/A	N/A

The cost estimate range of the Cyan and Orange Option Corridors are higher than the northern bypass options, with earthworks being a significant contributor to the difference. There is a significant deficit in cut material, coupled with a significant length of embankment to be constructed and a significant amount of soft ground to be replaced, all of which require an import of fill on the southern options. The northern options involve the movement of a greater volume of earthworks, but the material can be won locally in the cuts and placed in the embankments, resulting in lower earthworks costs.

The order of magnitude separating the southern two option corridors, namely Cyan Option Corridor versus Orange Option Corridor, is greater than that separating the northern two option corridors, namely the Purple West and Dark Green. This is because the total construction length in the Cyan Option Corridor is approximately 3km longer than the Orange Option Corridor, which also includes an additional link road to connect to the R368 Elphin Road which also includes an additional railway bridge crossing.

In all instances the dual carriageway is more expensive than the equivalent single carriageway in the same option corridor. Therefore, the option corridor ranking is based on the dual carriageway cost as this is the most conservative approach and equivalent to all the environmental assessments undertaken under the Environmental criterion. As all the option corridors are in cost range C, with the exception of the Pink design scenario which is in cost range D, for a length in the order of 12 to 13km, these are ranked Minor or Slightly Negative, with the Cyan Option Corridor being the most expensive and the Dark Green Option Corridor the least expensive, noting that Dark Green Option Corridor is very marginally cheaper than the Purple West Option Corridor.

A comparison of the single carriageway costs in the Cyan, Orange, Purple West and Dark Green Option Corridors shows that the Orange Option Corridor is the least expensive with the Cyan Option Corridor being the most expensive.

Table 8.3.16 Option Comparison Estimates for Options East of Drumsna Junction (Node J)

Option Corridor	Design Scenario	Cost Range Category / Factor Relative to Lowest	Score	Option Corridor Qualitative Assessment	Option Corridor Preference – Professional Judgement
Yellow	Yellow – Single	C / 1.4Y	3	Minor or Slightly Negative	**Intermediate**
Green	Green – Single	B / Y	4	Not Significant or Neutral	**Preferred**
Purple East	Purple – Dual	C / 2.6Y	3	Minor or Slightly Negative	**Least Preferred**

The comparison of the option corridors to the east of Drumsna shows a significant cost differential between the single carriageway and dual carriageway. As the Purple East is twice as expensive as the other option corridors, it is ranked Least Preferred in comparison to the other two.

8.3.3.2 Cost Benefit Analysis

As part of the Stage 2 Economy Appraisal, a Cost Benefit Analysis of each of the traffic model scenarios in Table 8.3.17, was undertaken in accordance with the TII Project Appraisal Guidelines. A key aspect of the Economy Appraisal is the Traffic Modelling Report. The Traffic Modelling Report is included in Appendix A.3.2.1.

Cost estimate ranges to match the traffic model scenarios were prepared to inform the Cost Benefit Analysis for each of the combined options and are shown below in Table 8.3.19. Each of the model runs below include the 'suite of complementary measures' that have been applied to all the Do-Something Scenarios and this is also reflected in the overall costs. The suite of complementary measures are outlined in Section 8.2.2.

An option to the west of Node J, has been paired with an option to the east of Node J at Drumsna. Each of the traffic model scenarios below, with the exception of the Model ID M10 Black Option Corridor, have the above mentioned 'suite of complementary measures' included.

Table 8.3.17 Cost Benefit Analysis Ranking of Options (Includes Demand Management)

Traffic Model Run ID	West of Node J	East of Node J	Cross-Section	Cost Estimate Range	Benefit to Cost Ratio (BCR)
M2	Purple	Purple	Dual Carriageway	D	-Value
M3	Grey	Purple	Dual Carriageway	D	-Value
M4	Orange	Purple	Dual Carriageway	D	-Value
M5	Pink	Purple	Dual Carriageway	D	**Positive Value / W**
M6	Red	Yellow	Single Carriageway	D	-Value
M7	Dark Green	Green	Single Carriageway	D	-Value

Traffic Model Run ID	West of Node J	East of Node J	Cross-Section	Cost Estimate Range	Benefit to Cost Ratio (BCR)
M8	Brown	Green	Single Carriageway	D	-Value
M9	Cyan	Yellow	Single Carriageway	D	**Positive Value / 1.3W**
M10	Black	-	Urban Link Road 50kp/h	(iii)	N/A
M11	Purple & Black	Purple	Dual Carriageway and Street 50km/h	D	-Value
M12	Pink & Black	Purple	Dual Carriageway and Street 50km/h	D	**Positive Value / 1.8W**

Note that negative BCRs are coloured red for clarity.

Analysis of the costs estimate range categories and the associated forecast performance of the transport network, show that options M5 (Pink and Purple dual carriageway), M9 (Cyan and Yellow single carriageway) and M12 (Pink and Purple dual carriageway with Black) all have positive BCR values and represent the best value for money overall.

Whilst the BCR is for the overall option corridor length, this assessment is split to the west and east of Drumsna and is based on the option corridor as opposed to the design scenario within the option corridor. The design scenario within the option corridor becomes relevant in the incremental analysis which is covered in Section 8.9.5. Therefore, the ranking of the BCR of the option corridors is based on the dual carriageway BCR as this is the most conservative approach and equivalent to all the environmental assessments undertaken under the Environmental criterion.

To the west of Drumsna, the Cyan Option Corridor is the only western option corridor which, when combined with an option corridor to the east of Drumsna, offers a BCR greater than 0. Two further models which also utilise the Cyan Option Corridor show similar results with M9 being 30% higher than M5 and M12 at 80% higher than M5.

Therefore, the Cyan Option Corridor is ranked as Not Significant or Neutral (PAG Score 4) and is Preferred and the other option corridors are scored relative to this corridor.

The cost benefit analysis also provides information on the net present value of costs which are useful to compare when a negative BCR is encountered. The Orange Option Corridor to the west of Drumsna is significantly less preferable to the Dark Green and Purple Option Corridors, thus making it Moderately Negative (PAG Score 2) and Least Preferred. The Dark Green and Purple Option Corridors are ranked as Minor or Slightly Negative (PAG Score 3).

To the east of Drumsna, the BCR is lowered when coupled with Purple East versus the Yellow or Green Option Corridor as the Purple East is almost double the cost of the Yellow or Green Option Corridor. Therefore, the Purple East Option Corridor is ranked as Moderately Negative (PAG Score 2) with the others ranked as Minor or Slightly Negative (PAG Score 3).

It should be noted that the software used to undertake the CBA, i.e. TUBA does not calculate collision costs. Therefore, an assessment of potential safety benefits has been undertaken using the Irish version of COBALT (Cost and Benefit to Accidents – Light Touch), a computer program developed by the UK Department for Transport to undertake the analysis of the impact on accidents as part of economic appraisal for a road scheme. The COBALT assessment is based on a comparison of collisions by severity and associated costs across the entire network in 'Without-Scheme' and 'With-Scheme' forecasts, using details of link characteristics, collision rates, casualty costs and projected traffic volumes. This process was undertaken using the opening (2030) and design year (2045) traffic models and collision costs for the entire 30-year appraisal period were calculated.

All of the dual carriageway options (M2, M3, M4, M5, M11 and M12) produced broadly similar positive results. Equally, so do all of the single carriageway options (M6, M7, M8 and M9) with slightly negative monetary benefits due to the similar levels of traffic transferred by each option within each type of cross-section. The marginally negative benefits for each of the single carriageway options can be attributed to how COBALT calculates benefits i.e. it uses a simplistic approach whereby collisions are calculated on the basis of an assumed collision rate which varies across a very minimal range of link types and link speeds.

Whilst there is a negative value for the single carriageway options, the benefits are very small in terms of the difference compared to a 'Without-Scheme' scenario. These results are also over the 30-year appraisal period and as such, the year-on-year differences are marginal. It should be remembered that all of the options involve the introduction of a lower 30km/h speed limit in the town centre which will likely have a positive benefit in terms of improving safety, although this is not quantifiable through COBALT due to the simplicity of the assessment i.e. the lack of an accident rate in COBALT for a link of a lower speed than 60km/h.

The negative benefits associated with the single carriageway options are likely in fact to be offset by a reduction in the number, and severity of, accidents experienced by non-motorised users in the centre of Carrick-on-Shannon, attributed to lower vehicle speeds on the N4 i.e. vehicles will be traveling at 30km/h through the town given the presence of demand management measures.

8.3.3.3 Summary of Transport Efficiency and Effectiveness

As noted in the introduction, there are sub-criteria under Transport Efficiency and Effectiveness namely:

- Engineering
- Cost Estimate Ranges
- Cost Benefit Analysis

The overall Economy assessment is presented in the summary in Section 8.3.6 below and includes the summary of this Transport Efficiency and Effectiveness.

8.3.4 Wider Economic Impacts

In accordance with TII PAG Unit 7.0, the assessment of scheme options under the criterion of Wider Economic Impacts considers the following sub-criteria:

- Competition in the market
- Agglomeration
- Inward Investment
- Labour Supply
- Urban Regeneration

8.3.4.1 Competition in the Market

All option corridors, which have been assessed in combination with elements of Alterative C - Demand Management will significantly enhance market accessibility, fostering economic competition, efficiency, employment and consumer choice. This may be further enhanced in combination with public transport and active travel improvements which will be investigated further once the Preferred Option Corridor is selected. All option corridors are therefore considered to be Minor or Slightly Positive (PAG Score 5) and are ranked equally as Preferred.

8.3.4.2 Agglomeration

The option corridors in combination with components of demand management have demonstrated to significantly improve journey time and journey time reliability along this key strategic corridor. Similarly, all will also greatly improve connectivity at a local and regional level, enhancing links between the northwest and markets on the eastern seaboard.

The provision of an enhanced bus service in the region, will also present significant benefits in strengthening market linkages at a local and regional level. All alternatives and option corridors are considered to be Minor or Slightly Positive (PAG Score 5) and are ranked equally as Preferred.

8.3.4.3 Inward Investment

The improvements in transport infrastructure proposed by all alternatives and option corridors may act a catalyst for attracting inward investment into the study area, fostering sustainable, long-term development.

By enhancing connectivity both within the study area and beyond, the attractiveness of the region to investors across many sectors, including tourism, is likely to increase. All alternatives and option corridors are therefore ranked as Minor or Slightly Positive (PAG Score 5) and are ranked equally as Preferred.

8.3.4.4 Labour Supply

The delivery of the N4 project will ensure strengthened linkages between key labour and employment markets both within the study area, the northwest and the greater Dublin region. Improvements in journey time and journey time reliability will encourage and support investment, tourism and employment, and enhance the economic prospects within the study area. All alternatives and option corridors are therefore ranked as Minor or Slightly Positive (PAG Score 5) and are ranked equally as Preferred.

8.3.4.5 Urban Regeneration

The removal of the traffic from the N4 corridor which currently traverses through Carrick-on-Shannon and Cortober will offer regeneration opportunities in accordance with the place-making project objective. All alternatives and option corridors are therefore ranked as Minor or Slightly Positive (PAG Score 5) and are ranked equally as Preferred.

8.3.5 Funding Impacts

The future funding mechanism for the scheme is not known at this stage. As the N4 corridor forms part of the comprehensive TEN-T network and provides a strategically important link to the northwest, there may be potential to secure non-exchequer EU funding. Where the estimated cost range between option corridors are comparable and noting the uncertainty around the future funding mechanism, it is considered acceptable to rank such option corridors as neutral in this regard. However, a distinction is drawn in the case of those option corridors to the east of Drumsna Junction which compare on-line options with off-line Options, i.e. Yellow and Green versus Purple East. The high cost of this off-line option corridor adds a high degree of additional uncertainty as to its affordability and the potential availability of funding streams to deliver such a costly option. As such, this option corridor is negatively ranked in comparison to the other option corridors to the east of Drumsna.

8.3.6 Summary of Economic Appraisal

An economic summary of the alternatives and options are presented below in Table 8.3.18 to Table 8.3.20.

Table 8.3.18 Stage 2 Economic Summary Assessment Matrix of Alternatives

Assessment Criteria	ALTERNATIVE A ACTIVE TRAVEL	ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS	ALTERNTIVE C REDUCTING DEMAND
Transport Efficiency and Effectiveness			
Engineering	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Minor or Slightly Positive (5)
Cost Estimates	Moderately Positive (6)	Major or Highly Positive (7)	Major or Highly Positive (7)
Overall ranking for Transport Efficiency and Effectiveness	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Moderately Positive (6)
Wider Economic Impacts			
Competition in the market	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Agglomeration	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Inward investment	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Labour Supply	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Urban Regeneration	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Overall ranking for Wider Economic Impacts	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Funding Impacts			
Overall ranking for Funding Impacts	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Qualitative Assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Moderately Positive**
Score / Impact Level	**5**	**5**	**6**

Table 8.3.19 Stage 2 Economic Summary Assessment Matrix of Option Corridors – West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST GOPTION CORRIDOR	DARK GREEN OPTION CORRIDOR		BLACK OPTION CORRIDOR
Transport Efficiency and Effectiveness						
Engineering	Intermediate (3)	Intermediate (3)	Intermediate (3)	Preferred (3)		Not Significant or Neutral (4)
Cost Estimate	Least Preferred (2)	Intermediate (3)	Intermediate (3)	Intermediate (3)		N/A
Cost Benefit Analysis	Preferred (4)	Least Preferred (2)	Intermediate (3)	Intermediate (3)		N/A
Overall ranking for Transport Efficiency and Effectiveness	**Preferred (4)**	**Least Preferred (2)**	**Intermediate (3)**	**Intermediate (3)**		**Not Significant** or **Neutral (4)**
Wider Economic Impacts						
Competition in the market	Preferred (5)	Preferred (5)	Preferred (5)	Preferred (5)		N/A
Agglomeration	Preferred (5)	Preferred (5)	Preferred (5)	Preferred (5)		N/A
Inward investment	Preferred (5)	Preferred (5)	Preferred (5)	Preferred (5)		
Labour Supply	Preferred (5)	Preferred (5)	Preferred (5)	Preferred (5)		Not Significant or Neutral (4)
Urban Regeneration	Preferred (5)	Preferred (5)	Preferred (5)	Preferred (5)		Not Significant or Neutral (4)
Overall ranking for Wider Economic Impacts	**Preferred (5)**	**Preferred (5)**	**Preferred (5)**	**Preferred (5)**		**Not Significant** or **Neutral (4)**

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST GOPTION CORRIDOR	DARK GREEN OPTION CORRIDOR		BLACK OPTION CORRIDOR
Funding Impacts						
Funding Impacts	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)		Not Significant or Neutral (4)
Overall ranking for Funding Impacts	**Preferred (4)**	**Preferred (4)**	**Preferred (4)**	**Preferred (4)**		**Not Significant** or **Neutral (4)**
Scoring						
Qualitative Assessment	Not Significant or Neutral	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative		Not Significant or Neutral
Score / Impact Level	**4**	**3**	**3**	**3**		**4**
Preference - Professional Judgement	**Preferred**	**Least Preferred**	**Intermediate**	**Intermediate**		**Not Significant** or **Neutral**

Table 8.3.20 Stage 2 Economic Summary Assessment Matrix of Option Corridors – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
Transport Efficiency and Effectiveness			
Engineering	Intermediate (3)	Least Preferred (3)	Preferred (4)
Cost Estimate	Intermediate (3)	Preferred (4)	Least Preferred (3)
Cost Benefit Analysis	Intermediate (3)	Preferred (3)	Least Preferred (2)
Overall ranking for Transport Efficiency and Effectiveness	**Intermediate (3)**	**Preferred (3)**	**Least Preferred (3)**
Wider Economic Impacts			
Competition in the market	Preferred (5)	Preferred (5)	Preferred (5)
Agglomeration	Preferred (5)	Preferred (5)	Preferred (5)
Inward investment	Preferred (5)	Preferred (5)	Preferred (5)
Labour Supply	Preferred (5)	Preferred (5)	Preferred (5)
Urban Regeneration	Preferred (5)	Preferred (5)	Preferred (5)
Overall ranking for Wider Economic Impacts	**Minor** or **Slightly Positive (5)**	**Minor** or **Slightly Positive (5)**	**Minor** or **Slightly Positive (5)**
Funding Impacts			
Overall ranking for Funding Impacts	**Not Significant** or **Neutral (4)**	**Not Significant** or **Neutral (4)**	**Minor** or **Slightly Negative (3)**
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Moderately Negative**
Score / Impact Level	**3**	**3**	**3**
Preference	**Intermediate**	**Preferred**	**Least Preferred**

8.4 Safety Appraisal

In accordance with TII PAG Unit 7.0, the Stage 2 Safety appraisal typically considers the following sub-criteria:

- Collision Reduction
- Security

In addition, the safety assessment also incorporates the findings of the Stage F Part 1 Road Safety Audit which has been undertaken on the Stage 2 Alternatives and Option Corridors in accordance with the requirements of the TII PMGs. The Road Safety Audit notes that all alternatives and option corridors appraised at Stage 2 would represent a significant improvement to road safety on this section of the N4. A copy of the Stage 2 Road Safety Audit is contained in Appendix A.8.4.1.

8.4.1 Collision Reduction

As outlined in TII PAG, the Stage 2 safety appraisal typically makes reference to the forecast reduction in vehicle collision and the associated safety benefits that will accrue from each project option. Collision forecasts presented in the Cost Benefit Analysis (CBA) generally comprise of a COBALT analysis, which uses details of road cross-section, collision rates, casualty costs and projected traffic volumes to derive a monetised safety benefit as a result of the interventions delivered by the project options. The monetised safety benefits are added to the other benefits that are derived from time savings etc. to give an overall value of benefits which is then used and detailed in the Economy assessment and ranking.

In the case of the N4 Project however, the COBALT methodology if used solely for the collision prediction analysis and assessment under the Safety criterion presents a number of inherent limitations. These issues are briefly outlined below but are discussed in more detail in the Cost Benefit Analysis report.

- COBALT typically adopts collision rates for various road types from TII PAG (Unit 6.1)[3] to make an assessment of predicted collision reductions and associated cost savings over the scheme appraisal period. These collision rates represent typical values for various road types, but may vary from local (actual) collision rates on the route in question
- The COBALT software uses a link-based approach to collision prediction and does not provide an option to conduct a separate link or junction only analysis. This is particularly pertinent to the collision assessment of the N4 Project, where many of the road based scenarios focus on improving safety by rationalising the number of access points on the scheme and improving the standard of the primary junctions. The fact that COBALT does not take account of junction strategy is considered an inherent deficiency in terms of its suitability for the assessment of the project options

[3] Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 6.1 – Guidance on conducting CBA. Available at: https://www.tiipublications.ie/library/PE-PAG-02020-01.pdf

A qualitative appraisal has therefore been undertaken to comparatively assess each of the alternatives and option corridors with respect to collision reduction as part of the assessment under the Safety criterion. This appraisal has been informed by the Stage F (Part 1) Road Safety Audit which considered the proposed alternatives and option corridors and highlighted the safety concerns associated with each.

The common safety issues associated with the alternatives is that they do not address the sub-standard road alignment issues along the existing N4 corridor. Notwithstanding this, the alternatives all offer safety improvements for non-motorised modes. Alternative A provides improved facilities for vulnerable road users, particularly in the urban areas where the number of collisions with vulnerable road users was highest. The improvements to the public transport offering in Alternative B will reduce the number of vehicles slightly on the road network which will reduce the probability of collisions. The speed reductions proposed as part of the Demand Management Measures in Alternative C will reduce both the likelihood and severity of collisions. Alternatives A and C are slightly preferred as the physical measures to enable safer cycling and walking together with the reduced speeds and pedestrian prioritisation will be more effective in reducing collisions than improved public transport services.

The appraisal of option corridors includes a comparative assessment under the criteria of number of junctions, junction consistency, number of bridges, option length and connectivity with urban centres all of which are intrinsically linked to collision analysis. A score and rating have been assigned to each and the assessment results are given in Table 8.4.1 and Table 8.4.2.

Table 8.4.1 Ranking of Options West of Drumsna Junction (Node J)

Assessment Criteria	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor		Black Option Corridor
	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	6	6	6	6		6
No. of Junctions	4	5	4	4		4
Junction Consistency	5	5	4	5		4
No. of Bridges	5	4	4	4		6
Length	5	5	4	4		6
Connectivity with urban centres	6	5	4	4		7
Scoring						
Qualitative Assessment	**Moderately Positive**	**Moderately Positive**	**Moderately Positive**	**Moderately Positive**		**Major** or **Highly Positive**
Score / Impact Level	**6**	**6**	**6**	**6**		**7**
Preference	**Preferred**	**Preferred**	**Preferred**	**Preferred**		**N/A**

Table 8.4.2 Ranking of Options East of Drumsna Junction (Node J)

Assessment Criteria	Yellow Option Corridor	Green Option Corridor	Purple East Option Corridor
	Single Carriageway	Single Carriageway	Dual Carriageway
Cross-section	4	4	6
No. of Junctions	4	3	6
Junction Consistency	4	4	6
No. of Bridges	5	5	4
Length	4	4	5
Connectivity with urban centres	5	5	4
Scoring			
Qualitative Assessment	**Slightly Positive**	**Slightly Positive**	**Moderately Positive**
Score / Impact Level	**5**	**5**	**6**
Preference	**Preferred**	**Preferred**	**Preferred**

All of the option corridors provide a standard cross-section with appropriate junction forms and geometry. There is a marginal difference of one junction on the option corridors to the west of Drumsna, and the dual carriageway cross-section is preferred over the single carriageway cross-section to the east of Drumsna; however, all the option corridors offer a positive benefit in terms of collision reduction.

8.4.2 Security

Security is concerned with improving the personal security of travellers and their property. The security assessment also takes into account the security of vulnerable road users, such as pedestrians and cyclists.

Security of road users is expected to be significantly improved for all alternatives and each is scored positively in this regard. Additional security is afforded to vulnerable road users in Alternatives A and C due to the improved facilities associated with these measures when compared with Alternative B.

The northern option corridors, Dark Green and Purple Option Corridors, to the west of Drumsna Junction all provide significant lengths of new off-line alignment. The southern option corridors, Orange and Cyan Option Corridors, to the west of Drumsna Junction comprise a length of on-line upgrade as well as new off-line length. Given that the majority of the length of the northern option corridors is on new off-line alignment, the security of the road footprint would be deemed to be more secure than the southern option corridors as it will be fully fenced off and contained without any interface with the general public. An intrinsic element in each of the option corridors to the east of Drumsna Junction is the removal/closure of the existing non-standard junctions and accesses which presently inhibit the safe operation of this strategic route. As the Purple East Option Corridor comprises a

dual carriageway cross-section on a new off-line alignment with grade separated junctions, it is deemed more secure than the single carriageway cross-sections proposed within the Yellow and Green Option Corridors, whereby access is permitted via at-grade junctions. All of the option corridors provide security to vulnerable road users via proposed parallel link roads or alternatively on the re-purposed existing road network.

8.4.3 Summary of Safety Appraisal

In conclusion the proposed alternatives and option corridors would significantly improve road safety. The assessment of the option corridors was split between west and east of Drumsna Junction. The ranking of options led to the Cyan Option Corridor being rated highest to the west of Drumsna Junction and the Purple East Option Corridor being ranked highest in the east.

The tables below present a summary of the assessment of the alternatives and the option corridors from a safety perspective. Alternatives A and C will have safety benefits for NMUs, especially in the urban area. However, the alternatives alone will not address the safety issues within the wider study area, and a road improvement is needed to address the safety issues associated with the sub-standard road alignment and numerous access issues along the existing N4 corridor.

Table 8.4.3 Stage 2 Assessment Matrix of Alternatives for Safety

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Collision Reduction	7	5	7
Security	7	6	7
Scoring			
Qualitative Assessment	**Major** or **Highly Positive**	**Slightly Positive**	**Major** or **Highly Positive**
Score / Impact level	**7**	**5**	**7**

Note that the assessment of the Alternatives in Table 8.4.3 is a stand-alone assessment and is not comparable to the scoring of the Option Corridors in Table 8.4.4. Therefore, a PAG Score of 7 on an Alternative versus a PAG Score of 6 on an Option Corridor does not mean that the Alternative performs better than the Option Corridor.

Table 8.4.4 Stage 2 Assessment Matrix of Option Corridors for Safety West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**	**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Urban Street
Assessment Criteria					
Collision Reduction	6	6	6	6	7
Security	6	6	7	7	7
Scoring					
Qualitative Assessment	**Moderately Positive**	**Moderately Positive**	**Moderately Positive**	**Moderately Positive**	**Major** or **Highly Positive**
Score / Impact Level	**6**	**6**	**6**	**6**	**7**
Preference	**Preferred**	**Preferred**	**Preferred**	**Preferred**	**N/A**

Table 8.4.5 Stage 2 Assessment Matrix of Option Corridors for Safety East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Collision Reduction	5	5	6
Security	6	6	7
Scoring			
Qualitative Assessment	**Moderately Positive**	**Moderately Positive**	**Major** or **Highly Positive**
Score / Impact Level	**6**	**6**	**7**
Preference	**Preferred**	**Preferred**	**Preferred**

8.5 Physical Activity Appraisal

The Physical Activity assessment of the project assesses the nature of physical activity impacts of the various alternatives and options described in Section 8.2 which include impacts on active travel modes, physical recreational activities and on vulnerable groups of road users such as pedestrians and cyclists.

Section 8.5.1 outlines the methodology that was used to carry out the Physical Activity Appraisal of the Alternatives and Options, Section 8.5.2 details the existing environment and Section 8.5.3 details the assessment of the Stage 2 Alternatives and Options. A summary is presented in Section 8.5.4.

8.5.1 Methodology for Physical Activity Appraisal

The Physical Activity Assessment of alternatives and options has been prepared in accordance with the following guidance:

- Transport Infrastructure Ireland (TII) Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (PE-PAG-02031 dated Oct 2016)[4]
- TII Project Appraisal Guidelines for National Roads Unit 13.0 - Appraisal of Active Modes TII (PE-PAG-02036 dated December 2021)[5]

As physical inactivity is a significant factor for chronic diseases, investment in new infrastructure needs to be assessed under the CAF criteria of Physical Activity. The baseline existing environment is first described from the perspective of the existing facilities that are available in the area which promote and encourage physical activity (Section 8.5.2). The alternatives and options are then evaluated to assess the likely additional benefits arising from the implementation of these alternatives and options to those experiencing physical inactivity. The assessment focuses on the benefits both from a physical health perspective and a mental health and well-being perspective. The following two key areas are considered:

- Health – likely positive health outcomes due to increased levels of physical activity
- Recreation – improved wellbeing due to access to high quality facilities for outdoor recreation

The output of the Stage 2 transport assessment is used to inform the Physical Activity assessment.

8.5.2 Existing Facilities for Physical Activity

There are numerous existing facilities within the study area used for physical activity. These comprise dedicated/named routes used for walking and cycling

[4] Transport Infrastructure Ireland, 2016. Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis. Available at: https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf

[5] Transport Infrastructure Ireland, 2021. Project Appraisal Guidelines for National Roads Unit 13.0 - Appraisal of Active Modes TII PE-PAG-02036. Available at: https://www.tiipublications.ie/library/PE-PAG-02036-01.pdf

including Slí na Sláinte, 'A Walk through Carrick-on-Shannon' and the Anthony Trollope Trail, among others. These routes are outlined in the figures below.

Slí na Sláinte is part of an initiative by the Irish Heart Foundation aimed at increasing and encouraging walking and has sign posted routes in communities across Ireland[6]. The Carrick-on-Shannon Slí na Sláinte forms a loop, approximately 5.6 km, from the town centre, out the Summerhill Road, down the Castlecara Road and along the existing N4 through the Riverfront Amenity Park back to the town centre. Refer to Plate 8.5.1 for details.

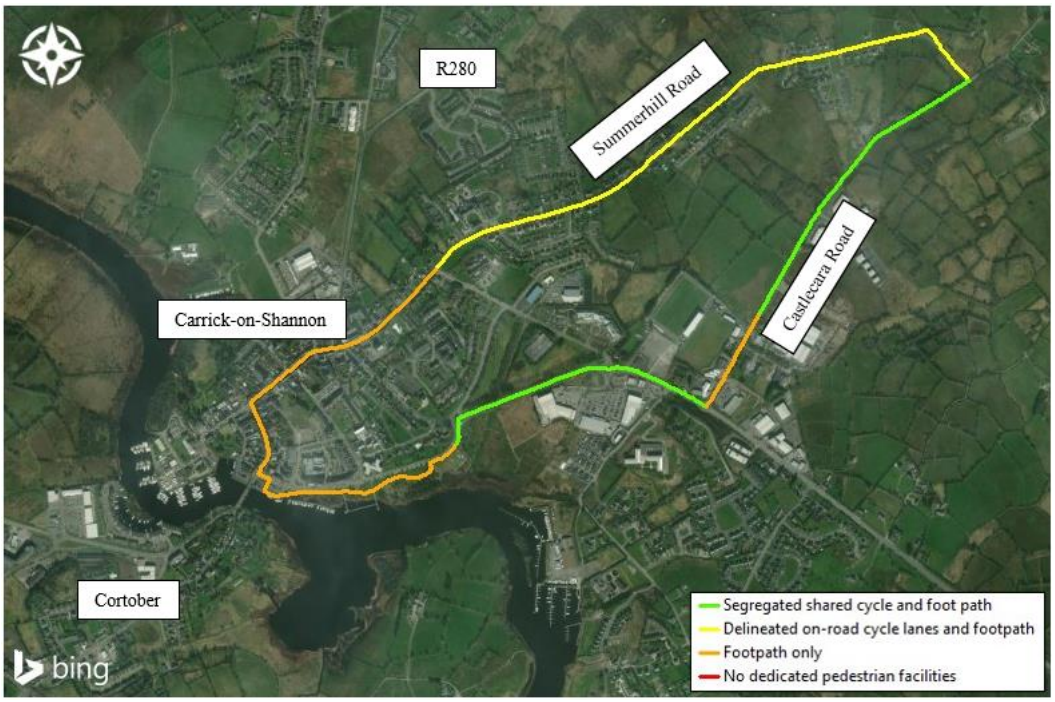

Plate 8.5.1 Irish Heart Foundation Slí na Sláinte Route

The section of the Slí na Sláinte route along the majority of the Castlecara Road and on the existing N4 as far as the inner relief road has a segregated shared cycle and footpath. Along the Summerhill Road from the junction with the Carrick Community School north there are delineated on-road cycle lanes in both directions on the road carriageway and a segregated footpath on at least one side. The width of the carriageway, including the cycle lanes, is not adequate to cater for vehicular and cycle traffic in both directions at the same time. Plate 8.5.2 is a photograph of the Summerhill Road cycle lanes taken by the Project Team during a site visit on 3 September 2021. The line markings are also unclear at times making it difficult to delineate from the vehicular and cycle lanes, raising safety concerns. Note too in Plate 8.5.2 the blue post with the yellow sign; this is a marker for the Slí na Sláinte, spaced every kilometre along the route to aid walkers in keeping track of how far they have walked.

[6] Irish Heart Foundation, 2022. Walking Routes. Available at: https://irishheart.ie/your-health/our-health-programmes/healthy-communities/slainte/walking-routes/

Plate 8.5.2 Summerhill Road Cycle Lanes

Another popular walking/cycling route was identified by some residents of the Hartley area during Public Consultation No. 2 Alternatives and Options as shown on Plate 8.5.3. This route shares facilities with the Slí na Sláinte along the Castlecara Road and the existing N4. There are footpaths on this route along the R280 and for some of the Cootehall/Cartown Road, but there are no pedestrian facilities for approximately 3.5 km from the Cootehall/Cartown Road along the L7414 to the Summerhill Road.

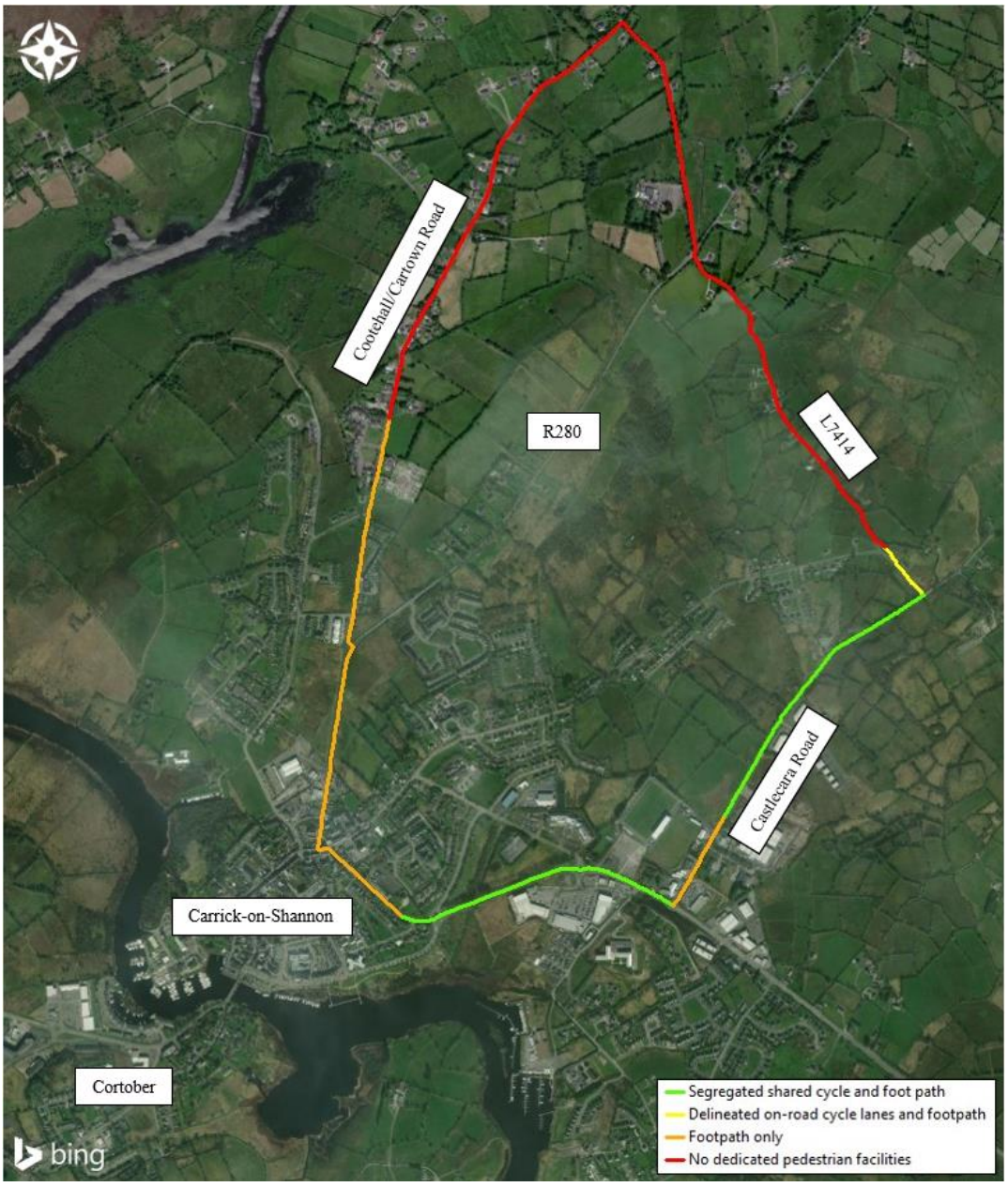

Plate 8.5.3 Popular Walking Route Identified during Public Consultation No. 2

'A Walk through Carrick-on-Shannon' is a sign-posted trail along the main streets of Carrick-on-Shannon which covers a number of historical sites within the town. This route shares a short stretch of cycle lanes with the Slí na Sláinte along the Summerhill Road, but there are no dedicated cycling facilities within the urban areas of Carrick-on-Shannon. Of course, this route is intended for walking and makes use of some of the quieter residential streets to the east and the Riverfront Amenity Park.

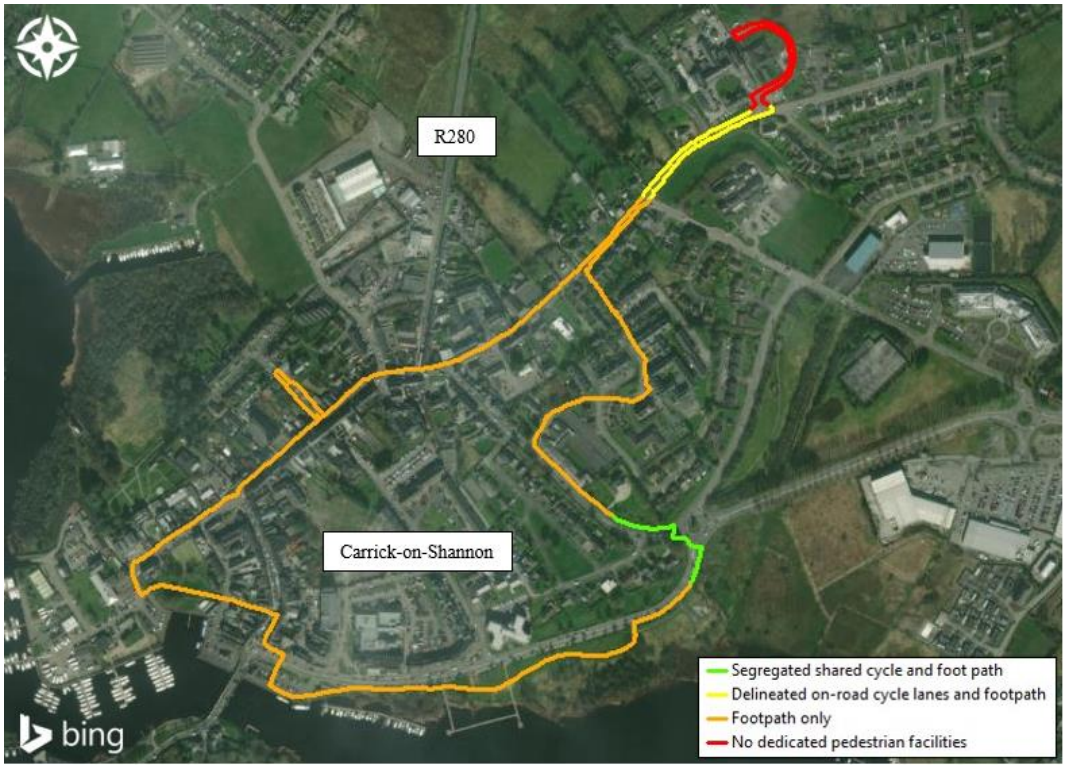

Plate 8.5.4 'A Walk through Carrick-on-Shannon'

The Anthony Trollope Trail shown in Plate 8.5.5 is another popular walking route located around Drumsna. This route is more rural in nature and has no dedicated non-motorised facilities apart from the footpaths within Drumsna Village. This route also crosses a section of the existing N4 in the 100km/h zone, utilising the existing N4 for approximately 150m.

Plate 8.5.5 Anthony Trollope Trail

A known conflict point within Carrick-on-Shannon, the existing River Shannon Bridge has both a narrow carriageway and footpaths raising safety concerns for vulnerable road users. A separate pedestrian bridge was added to the west side of the bridge in 2009. Plate 8.5.6 shows the steel pedestrian bridge attached to the masonry arch bridge from the Cortober side of the river. The pedestrian bridge is accessible from Bridge Street and Quay Road on the Leitrim side, and by the N4 footpath or the amenity park on the Roscommon side.

Plate 8.5.6 River Shannon Pedestrian Bridge

Not all physical activity facilities within the study area are used for walking and cycling or transport. Table 8.5.1 lists some of the other non-walking and cycling facilities and these are shown on Figure 8.5.1.0. The River Shannon is also used for activities such as boating and angling. Carrick-on-Shannon Golf Club is located just west of the study area on the N4 at Usna.

Table 8.5.1 Other Physical Activity Facilities

Category	Facility
Sports Pitches	Páirc Seán mac Diarmuda
	Leitrim GAA Centre of Excellence
	St. Mary's, GAA
	Annduff, GAA
	Bull Field, Cortober
	Shannon Gaels, Cortober & Carrig Town FC, Cortober
	Carrick-on-Shannon RFC
Other	Aura Leisure Centre
	Tennis Courts
	Drumsna Boxing Club
	Carrick-on-Shannon Rowing Club

Existing Footfall Analysis

A footfall analysis undertaken by Leitrim County Council covers the period July 2014 to December 2019 for a survey site on Bridge Street. It indicates an annual average daily pedestrian usage of approximately 858 people. This ranges from low volumes in the winter months of 8,600 per month (287 people daily) in September 2019 to peaks of 58,500 per month (1887 people daily) in the August of 2015.

Similarly, a footfall analysis was undertaken on Main Street, adjacent to the St Marys Church for the period July 2014 to December 2019. It indicates an annual daily pedestrian usage of 1,111. This ranges from low volumes in the winter months of 23,260 per month (750 people daily) in January 2019 to peaks of 43,300 per month (1443 people daily) in August of 2015 and June 2016. This site is located on both the Slí na Slainte and the "A Walk through Carrick-on-Shannon" route and evidences the high usage of pedestrian movements within the town.

8.5.3 Physical Activity Assessment

The Stage 2 Assessment of alternatives, which include Active Travel, public transport improvements and Demand Management, tests whether they have the ability to improve levels of physical activity. The output of the Stage 2 transport assessment of the alternatives in Chapter 6 indicates the following:

- A 1.5% decrease in private vehicle trips within the study area arising from the implementation of the proposed active travel measures. For the purposes of the physical activity assessment, it is assumed that this translates into a 1.5% potential increase on active travel modes.
- A 1% trip reduction within the study area arising from the improved public transport services. For the purposes of the physical activity assessment, it is assumed that this equivalent percentage is now utilising public transport for this trip.
- A 10% trip reduction arising from demand management measures. For the purposes of the physical activity assessment, it is assumed that this translates into an increase on active travel modes as some trips will change modes.

The reduction in private vehicle trips through the urban centre of Carrick-on-Shannon and Cortober is a further differentiator in terms of the assessment of the ability of the options to improve on physical activity. The Stage 2 transport assessment details the volume of traffic over the River Shannon Bridge and along the N4 adjacent to the Riverfront Amenity Park and the level of trip reduction and associated transfer of these trips to either active modes or the proposed option corridor is used as a further indicator for physical activity.

Table 8.5.2 below contains the output of the Stage 2 transport assessment of the option corridors to the west of Drumnsa with a dual carriageway design when coupled with a dual carriageway design to the east of Drumsna. This table references a number of key locations along the existing N4 to show how the option corridors have an impact in terms of reducing traffic numbers. These locations are relevant to this assessment as the existing N4 forms part of the Carrick-on-Shannon

Slí na Sláinte and 'A Walk through Carrick-on-Shannon' trail adjacent to the Riverfront Amenity Park. For the purposes of the physical activity assessment, it is assumed that the change in AADT translates directly to an increase on active travel modes.

Table 8.5.2 AADT Traffic on Existing N4 with Do-Something Options

Location	Do-Minimum 2030 AADT	Option Corridors – West of Drumsna				
		Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Black Option Corridor
		Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Option
N4 adjacent to River Amenity Park at Landmark Hotel	18,147	9,661	10,151	11,140	11,172	17,976
N4 River Shannon Bridge	17,383	10,046	10,528	10,821	10,863	17,398
N4 Cortober West of Station Road	12,970	8,006	7,400	8,544	8,702	12,947

Each of the Do-Something Options also include the Demand Management measures which is evident in the reduction in AADT versus the Do-Minimum scenario in 2030. It is anticipated that some of these shorter trips will be replaced with an increase on active travel modes, whilst others will move out to the bypass.

Based on the above output of the transport assessment, the alternatives and options are assessed under the two criteria of health and recreation to inform the physical activity assessment.

8.5.3.1 Health

This sub-criterion is described as "*Positive health outcomes due to increased levels of physical activity, including reduced risk of premature mortality, as well as lower rates and reduced costs of serious illnesses*" in PAG Unit 13. Therefore, this section will examine what effects each alternative or option will have on increasing levels of physical activity in the study area.

Alternative A will provide improved walking and cycling infrastructure throughout Carrick-on-Shannon and Cortober. This will encourage an uptake in active travel,

particularly for local trips, and will have a positive impact on increasing levels of physical activity within the study area.

Public Transport Improvements, Alternative B, will encourage a slight increase in physical activity as it is likely that there will be some element of walking or cycling to and from trip origins/destinations and the fixed bus stops and the railway station when compared with the same trip by private vehicle.

Measures proposed within the Demand Management Alternative include rationalisation of parking, the provision of Park & Stride (P&S) sites, a car free town centre, traffic calming, provision of a 30km/h zone and new formal pedestrian crossings, among others. Rationalising parking and implementing car free zones will encourage an increase in active travel and public transport, which will see an increase in physical activity. As with the Public Transport Alternative, the use of P&S sites will require some element of walking or cycling to and from trip origins/destinations and the fixed site. Finally, traffic calming measures and new formal pedestrian crossings may encourage an increase in physical activity levels within Carrick-on-Shannon by creating a safer, more pleasant environment for non-motorised road users.

Table 8.5.3 Stage 2 Health Assessment of Alternatives for Physical Activity

	ALTERNATIVE A ACTIVE TRAVEL	**ALTERNATIVE B PUBLIC TRANSPORT**	**ALTERNATIVE C DEMAND MANAGEMENT**
Qualitative assessment	Improved walking and cycling infrastructure create uptake in active travel. **Major** or **Highly Positive**	Slight increase in active travel in order to reach new public transport. **Minor** or **Slightly Positive**	Pedestrianisation of urban realm leaves safer, more pleasant environment for active travel. **Moderately Positive**
Score / Impact level	**7**	**5**	**6**

As noted above, all of the Do-Something Option Corridors include the Demand Management measures and therefore, they will benefit from the above potential 10% increase on active travel modes also.

With reference to the AADT figures shown in Table 8.5.3 above, each of the option corridors to the west of Drumsna Junction (Node J) would reduce through traffic in Carrick-on-Shannon, therefore freeing road space for non-motorised road users. Freeing road space will increase levels of physical activity in the town. The option corridors to the south of the town will see the greatest reduction in through traffic in Carrick-on-Shannon. The Cyan Option Corridor outperforms the Orange Option Corridor in this regard and is deemed to have a Major or Highly Positive impact with the Orange having a Moderately Positive impact. The Purple and Dark Green Option Corridors would see a lesser reduction in through traffic resulting in lesser benefits for physical activity.

The Black Option Corridor would not see any reduction in traffic over the River Shannon Bridge. However, this option corridor would remove Leitrim Village to Dublin traffic along the R280 from the town centre and is given a Minor or Slightly Positive score. It also provides improved permeability facilitating more sustainable trip making within Carrick-on-Shannon resulting in an overall slightly positive impact on access to facilities for outdoor recreation, including existing sports pitches and known walking/cycling routes.

Table 8.5.4 Stage 2 Health Assessment of Option Corridors for Physical Activity West of Drumsna Junction (Node J)

	CYAN OPTION CORRIDOR	**ORANGE OPTION CORRIDOR**	**PURPLE WEST OPTION CORRIDOR**	**DARK GREEN OPTION CORRIDOR**		**BLACK OPTION CORRIDOR**
Qualitive Assessment	Greatest reduction in traffic through Carrick-on-Shannon. **Major** or **Highly Positive**	Significant reduction in through traffic. **Moderately Positive**	Lesser reduction of through traffic in Carrick-on-Shannon. **Minor** or **Slightly Positive**	Lesser reduction of through traffic in Carrick-on-Shannon. **Minor** or **Slightly Positive**		No reduction in through traffic, however, relieves Dublin traffic from Leitrim Town by R280. **Minor** or **Slightly Positive**
Score / Impact Level	**7**	**6**	**5**	**5**		**5**

To the east of Drumsna Junction (Node J), the Yellow and Green Option Corridors roughly follow the existing alignment of the N4 and maintain connectivity across the existing upgraded N4 for the Anthony Trollope Trail, albeit pedestrians will cross at-grade. These option corridors will result in a minor increase in physical activity levels due to enhanced safety measures along the national primary route. The Purple East Option Corridor bypasses the village of Aghamore and has greater potential to provide separate pedestrian and cycling infrastructure along the parallel connector roads within the proposed corridor, which will result in a Moderately Positive impact on physical activity levels in the area. The Purple East Option Corridor facilitates the use of the proposed grade separated Drumsna Junction to cross the N4 as part of the Anthony Trollope Trail, which is an improvement over the provision on the Yellow and Green Option Corridors.

Table 8.5.5 Stage 2 Health Assessment of Option Corridors for Physical Activity East of Drumsna Junction (Node J)

	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
Qualitative Assessment	Enhanced safety measures along N4 leading to slight increase in physical activity **Minor** or **Slightly Positive**	Enhanced safety measures along N4 leading to slight increase in physical activity **Minor** or **Slightly Positive**	Provides new walking and cycling infrastructure in and around the option corridor **Moderately Positive**
Score / Impact Level	**5**	**5**	**6**

8.5.3.2 Recreation

PAG Unit 13 describes this sub-criterion as "*Improved wellbeing due to access to high quality facilities for outdoor recreation*". Therefore, an option or alternative which provides improved facilities to encourage and cater for more physical activity or provides improved access to existing recreational facilities will score positively. Conversely, an option or alternative which adversely impacts existing facilities used for physical activity will score negatively.

Alternative A, Active Travel, will provide enhanced walking and cycling infrastructure throughout Carrick-on-Shannon and Cortober. This may include upgrades to existing infrastructure such as footpaths and cycle lanes/paths along established routes, as well as the introduction of new pedestrian links and streets to increase permeability. These measures will have a Major or Highly Positive impact by providing access to high quality facilities for physical activity in themselves and thus provide opportunities for outdoor recreation within the study area, in turn improving wellbeing. They also will improve access to existing recreation facilities listed above.

Alternative B, Public Transport improvements may have a Minor or Slightly Positive impact on access to high quality facilities such as the existing sports pitches, tennis courts etc. However, implementing this alternative along with Alternative A could make the proposed walking and cycling infrastructure thereunder even more accessible for recreational use.

Alternative C, Demand Management within Carrick-on-Shannon would reduce through traffic in Carrick-on-Shannon, therefore also resulting in positive impacts on access to high quality facilities for outdoor recreation in the town and along the waterfront. Furthermore, the removal of traffic from the town will enable the implementation of the Active Travel measures.

Table 8.5.6 Stage 2 Recreation Assessment of Alternatives for Physical Activity

	ALTERNATIVE A ACTIVE TRAVEL	ALTERNATIVE B PUBLIC TRANSPORT	ALTERNATIVE C DEMAND MANAGEMENT
Qualitative Assessment	Improvement in active travel measures itself provides high-quality recreation space, while also providing increased access to existing recreation facilities. **Major** or **Highly Positive**	Increased public transport creates more access to existing facilities for recreation. **Minor** or **Slightly Positive**	Reduction of through traffic in Carrick-on-Shannon leaves additional space for active travel. **Moderately Positive**
Score / Impact level	**7**	**5**	**6**

As mentioned in Section 8.4.3, each of the option corridors to the West of Drumsna Junction (Node J) would reduce through traffic in Carrick-on-Shannon, therefore resulting in positive impacts on access to high quality facilities for outdoor recreation in the town. In particular, the trip reduction along the N4 adjacent to the Riverfront Amenity Park will facilitate improved access to the waterfront and improved enjoyment of this area due to the decrease in traffic adjacent to it. The parkland and waterfront are a very high-quality recreational space with potential for further placemaking and recreational activities should the traffic congestion adjacent to it be reduced. Again, the Cyan and Orange Option Corridors to the south of the town will see the greatest reduction in through traffic in the town centre and are deemed to have a Moderately Positive impact whilst the Purple and Dark Green Option Corridors will result in lesser benefits from the perspective of improved access to existing recreational facilities.

It should also be noted that some of the option corridors have a negative impact on existing facilities used for outdoor recreation.

The Orange Option Corridor would have a significant adverse impact on Bull Field in Cortober. This is a well-established facility used by local GAA and soccer clubs namely Shannon Gaels and Carrig Town. The Orange Option Corridor is given a Moderately Negative overall score under the recreation assessment due to the negative impact on this facility for outdoor recreation. The Cyan Option Corridor may also impact Bull Field, but to a lesser extent and so is given a Minor or Slightly Negative score.

The Purple and Dark Green Option Corridors would see the L7414 severed in the townlands of Drumlumman/Cornamucklagh. This road forms part of the popular walking route shown in Plate 8.5.3. The L7414 does not currently have any dedicated pedestrian facilities in this area, however the Purple and Dark Green Option Corridors are given a Minor or Slightly Negative score due to the impact on the identified walking route.

The Black Option Corridor would not see any reduction in traffic over the River Shannon Bridge. However, this option corridor would provide improved

permeability within Carrick-on-Shannon resulting in a Minor or Slightly Positive impact on access for all road users to facilities for outdoor recreation, including existing sports pitches and known walking/cycling routes.

Table 8.5.7 Stage 2 Recreation Assessment of Option Corridors for Physical Activity West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLACK OPTION CORRIDOR
Qualitative Assessment	Improves access to facilities for recreation, however minorly impacts the Bull Field. **Minor** or **Slightly Negative**	Although this route reduces traffic and improves access to facilities, it impacts the Bull Field. **Moderately Negative**	Severs the L714 which forms part of a popular walking route. **Minor** or **Slightly Negative**	Severs the L714 which forms part of a popular walking route. **Minor** or **Slightly Negative**	Improves access in and around Carrick-on-Shannon. **Minor** or **Slightly Positive**
Score / Impact Level	**3**	**2**	**3**	**3**	**5**

The option corridors to the east of Drumsna Junction (Node J) are roughly aligned with the existing N4 corridor. As such they offer the same access to outdoor recreation facilities but vary slightly in their impact on existing recreational facilities. The Purple Option Corridor will avoid impacts to the Leitrim GAA Centre of Excellence and Annaduff GAA pitch whereas the Yellow Option Corridor and the Green Option Corridor both impact on these recreation facilities along their road frontage.

Table 8.5.8 Stage 2 Recreation Assessment of Option Corridors for Physical Activity East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
Qualitative Assessment	Additional access to recreation through improved access along existing N4, however this corridor impacts local facilities. **Not Significant** or **Neutral**	Additional access to recreation through improved access along existing N4, however this corridor impacts local facilities. **Not Significant** or **Neutral**	Improved access to facilities on existing N4. **Minor** or **Slightly Positive**
Score / Impact Level	4	4	5

8.5.4 Summary

The alternatives all impact positively on physical activity levels as they all seek to improve the situation for road users such as pedestrians and cyclists by either providing new cycling facilities, enhancements to existing pedestrian and/or cyclist facilities are included, or where congestion is removed to enable a more pleasant environment to encourage greater trip making by walking and/or cycling.

Table 8.5.9 Stage 2 Assessment Matrix of Alternatives for Physical Activity

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT**	**ALTERNATIVE C DEMAND MANAGEMENT**
Health	Improved walking and cycling infrastructure create uptake in active travel. Score - 7	Slight increase in active travel in order to reach new public transport. Score - 5	Pedestrianisation of urban realm leaves safer, more pleasant environment for active travel. Score - 6
Recreation	Improvement in active travel measures itself provides high-quality recreation space, and increased access to existing facilities. Score - 7	Increased public transport creates more access to existing facilities for recreation. Score - 5	Reduction of through traffic in Carrick-on-Shannon leaves additional space for active travel. Score - 6
Scoring			
Qualitative assessment	**Major** or **Highly Positive**	**Minor** or **Slightly Positive**	**Moderately Positive**
Score / Impact level	**7**	**5**	**6**

The option corridors to the West of Drumsna Junction, with the exception of the Black Option Corridor, achieve a significant reduction in traffic levels in the town centre area, where there is a high prevalence of recreation activities along the River Shannon, and in doing so improve access to such facilities and also encourage road users to make trips by walking and/or cycling. The Black Option Corridor offers a more localised improvement to well-being by providing a link in the transport network with dedicated facilities for pedestrians and cyclists, which is particularly relevant given its location in the vicinity of significant existing recreational and education facilities.

Table 8.5.10 Stage 2 Assessment Matrix of Option Corridors for Physical Activity West of Drumsna Junction (Node J)

Assessment Criteria	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Option
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Health	Significant reduction in traffic through Carrick-on-Shannon Score - 7	Significant reduction in traffic through Carrick-on-Shannon, but slightly less than Cyan option Score - 6	Lesser reduction of through traffic in Carrick-on-Shannon Score - 5	Lesser reduction of through traffic in Carrick-on-Shannon Score - 5		No reduction in through traffic, however relief of Dublin Traffic on Leitrim Town by R280 Score - 5
Recreation	Improves access to facilities for recreation, however minorly impacts existing facilities in local area Score - 3	Although this route reduces traffic and improves access to facilities, it impacts existing local facilities Score - 2	Severs the L7414 which forms part of a popular walking route Score - 3	Severs the L7414 which forms part of a popular walking route Score - 3		Improves access to facilities in and around Carrick-on-Shannon Score - 5
Scoring						
Qualitative Assessment	**Minor** or **Slightly Positive**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**		**Minor** or **Slightly Positive**
Score / Impact Level	5	4	4	4		5
Preference	**Preferred**	**Intermediate**	**Intermediate**	**Intermediate**		**N/A**

The option corridors to the east of Drumsna Junction (Node J) again offer opportunity to improve on physical activity by improving safety for cyclists and pedestrians over this section of the N4.

Table 8.5.11 Stage 2 Assessment Matrix of Option Corridors for Physical Activity East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Health	Enhanced safety measures along N4 leading to slight increase in physical activity Score - 5	Enhanced safety measures along N4 leading to slight increase in physical activity Score - 5	Provides new walking and cycling infrastructure in and around the option corridor Score - 6
Recreation	Additional access to recreation through improved access along existing N4, however this corridor impacts existing local facilities Score - 4	Additional access to recreation through improved access along existing N4, however this corridor impacts existing local facilities Score - 4	Improved access to facilities on existing N4 Score - 5
Scoring			
Qualitative Assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Moderately Positive**
Score / Impact Level	**5**	**5**	**6**
Preference	**Intermediate**	**Intermediate**	**Preferred**

8.6 Accessibility and Social Inclusion Appraisal

For the accessibility and social inclusion assessment, options are evaluated in recognition of the likely benefits to those suffering from social deprivation, geographic isolation and mobility and sensory deprivation. Two key areas are considered:

- Deprived Geographical Areas
- Vulnerable Groups

8.6.1 Deprived Geographical Areas

Based on 2016 Pobal HP Deprivation Index census data information at an electoral area division level, the north-eastern part of the study area including Carrick-on-Shannon is *marginally below average* which disimproves further to *disadvantaged* towards Mohill. The area around the N4 within the study area is *marginally above – average* level according to this index, and this trend continues along the N4 towards Sligo, whereby the area around Sligo experiences an improvement in services arising from its proximity to Sligo.

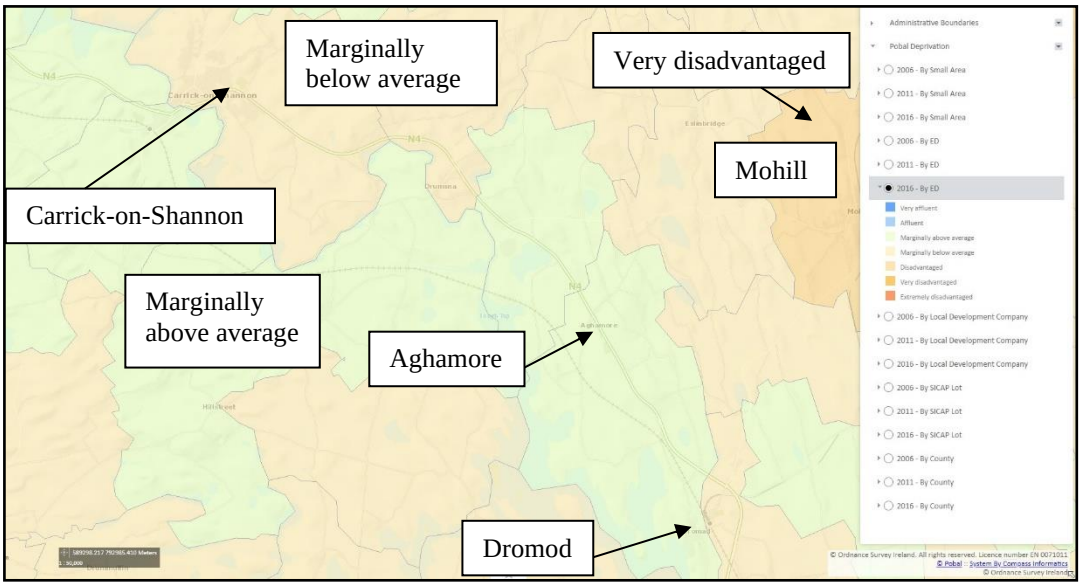

Plate 8.6.1 The 2016 Pobal HP Deprivation Index by Electoral Division

The Stage 2 Assessment of alternatives, which include Active Travel, Public Transport Improvements and Demand Management, tests whether they have the ability to improve accessibility and social inclusion. At a fundamental level, all have the ability to enhance accessibility to key employment, educational, health and social facilities within the study area and offer positives in respect of improved accessibility for deprived areas. However, the degree to which each of these measures achieves tangible benefits is linked to how effective they are in reducing congestion, improving accessibility by public transport to and from geographically deprived areas and making the urban area a safer place for trip making for those

without access to private cars. The Stage 2 transport assessment indicates a 1.5% decrease in private vehicle trips within the study area arising from the active travel measures, a 1% trip reduction within the study area arising from the improved public transport services and a 10% trip reduction arising from demand management measures. Therefore, the demand management measures are Preferred with the active travel and public transport improvements Intermediate.

For the option corridor assessment west of Drumsna Junction, the option corridors are geographically different in that some go north of Carrick-on-Shannon whilst some are south of it. This north/south divide also extends to the deprivation index in that the northern portion of the study area experiences a worse level of deprivation, and the corollary of such is that the northern option corridors offer more opportunities to rectify this imbalance. Therefore, whilst the Purple and Dark Green Option Corridors may intersect a longer length of more disadvantaged area than the Cyan and Orange Option Corridors at the very local level, it is noted that the Cyan and Orange Option Corridors also offer positive improvement on the Do-Minimum scenario. All the option corridors enable Carrick-on-Shannon to become the place at the heart of this area offering a chance for improvement for all and are considered equal.

For the option corridor assessment to the east of Drumsna Junction, the option corridors are not geographically disparate from each other relative to the wider study area. All option corridors will have a similar impact on geographically deprived areas, and all are assigned an impact score of Not Significant or Neutral.

The Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon and provides connectivity between the R280, Summerhill Road, Castlecara Road and onto the N4. This option corridor provides a direct link from within the *disadvantaged* area which offers further benefits in that it will include facilities for vulnerable road users. It is regarded as Major or Highly Positive.

The assessment under this criterion is included in Section 8.6.3.

8.6.2 Vulnerable Groups

An enhancement to the N4 route will improve access along the corridor, thus strengthening connections to key jobs, facilities and social opportunities; however, this enhancement should not only benefit those with access to private vehicles. In consideration of delivering improved accessibility for vulnerable groups along the N4 corridor, such as those without access to private car and those with mobility or sensory impairment, the design of all alternatives and option corridors takes cognisance of the needs of vulnerable road users.

To the west of Drumsna Junction, all options corridors use a new off-line alignment, and all offer significant positive effects for pedestrians and cyclists who would benefit from a reallocation of the existing road space in favour of facilities for vulnerable road users. All of these off-line option corridors remove traffic from the existing N4.

To the east of Drumsna Junction, where option corridors propose to reutilise sections of the existing N4 corridor, significant positive effects could be realised by pedestrians and cyclists who would be better able to utilise appropriate alternative

facilities for active travel as opposed to using the existing N4. Such facilities would also provide greater opportunity to reduce the significant existing severance across the existing N4, which is especially felt by vulnerable road users. All of the option corridors provide for vulnerable road users in a similar manner east of Drumsna Junction and all are assigned an impact score of Minor or Slightly Positive.

As noted above the Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon and will include facilities for vulnerable road users. It is regarded as Major or Highly Positive.

Benefits can be accrued through the provision of improved facilities for vulnerable road users in the urban area also, both in terms of achieving a mode shift to more sustainable transport modes and by the associated health benefits from active travel. All the alternatives seek to deliver on improved facilities for vulnerable road users in and around Carrick-on-Shannon and Cortober which in turn leads to improvements to local connectivity. Furthermore, the provision of additional local bus services would facilitate enhanced connectivity at a local level. Improved connectivity together with improved facilities delivers improved accessibility for vulnerable groups, i.e. those without access to private car and those with mobility or sensory impairment.

The assessment under this criterion is included in Section 8.6.3.

8.6.3 Summary

The assessment of the alternatives is provided in Table 8.6.1 as the impact of the alternatives is over the full study area, whereas the assessment of the options is split for each section and is included in Table 8.6.2 and Table 8.6.3 respectively.

Table 8.6.1 Stage 2 Assessment Matrix of Alternatives for Accessibility and Social Inclusion

Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Deprived Geographical Areas	Potential 1.5% decrease in private vehicle trips within the study area arising from the active travel measures offers positive benefits towards reducing deprivation.	Potential 1% trip reduction within the study area arising from the improved public transport services offers benefits towards reducing deprivation.	Potential 10% trip reduction arising from demand management measures offers positive benefits towards reducing deprivation.
Vulnerable Groups	Neutral to not significant (positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.	Neutral to not significant (positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.	Positive modal shift towards active travel and resultant reduction in private vehicles.
Scoring			
Qualitative assessment	**Minor** or **Slightly Positive**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**
Score / Impact level	**5**	**4**	**5**

Table 8.6.2 Stage 2 Assessment Matrix Option Corridors for Accessibility and Social Inclusion West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Deprived Geographical Areas	The Cyan Option Corridor is situated to the south of the study area, which is a less deprived area than north, but still serves to connect the wider study area. (6)	The Orange Option Corridor is situated to the south of the study area, which is a less deprived area than north, but still serves to connect the wider study area. (6)	The Purple West Option Corridor runs through the northern half of the study area and will connect the north and south. (6)	The Purple West Option Corridor runs through the northern half of the study area and will connect the north and south. (6)		Urban street improvement which will create connectivity between the R280, Summerhill Road, Castlecara Road, and the N4 within a listed "disadvantaged" area. (7)
Vulnerable Road Users	New off-line alignment offers significant positive impact for pedestrians and cyclists by removing traffic from N4, with Cyan having the highest amount of traffic projected to be removed. (7)	New off-line alignment offers significant positive impact for pedestrians and cyclists by removing traffic from N4. (7)	New off-line alignment offers significant positive impact for pedestrians and cyclists by removing traffic from N4. (7)	New off-line alignment offers significant positive impact for pedestrians and cyclists by removing traffic from N4. (7)		Urban street improvement will include new facilities for vulnerable road users. (7)
Scoring						
Qualitative Assessment	**Moderately Positive**	**Moderately Positive**	**Moderately Positive**	**Moderately Positive**		**Major** or **Highly Positive**
Score / Impact Level	**6**	**6**	**6**	**6**		**7**
Preference	**Preferred**	**Preferred**	**Preferred**	**Preferred**		**N/A**

Table 8.6.3 Stage 2 Assessment Matrix of Option Corridors for Accessibility and Social Inclusion East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Deprived Geographical Areas	All option corridors east of Drumsna are geographically similar and are given a neutral impact score. (4)	All option corridors East of Drumsna are geographically similar and are given a neutral impact score. (4)	All option corridors East of Drumsna are geographically similar and are given a neutral impact score. (4)
Vulnerable Road Users	All corridors east of Drumsna Junction serve to positively impact vulnerable road users by creating safer alternative facilities other than the N4. (5)	All corridors east of Drumsna Junction serve to positively impact vulnerable road users by creating safer alternative facilities other than the N4. (5)	All corridors east of Drumsna Junction serve to positively impact vulnerable road users by creating safer alternative facilities other than the N4. (5)
Scoring			
Qualitative Assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**
Score / Impact Level	**5**	**5**	**5**
Preference	**Intermediate**	**Intermediate**	**Intermediate**

8.7 Integration Appraisal

The integration appraisal seeks to analyse the degree to which alternatives and options align with other aspects of Government policy and investment priorities, at local, regional, national and EU level.

The integration assessment focuses on the following key areas:

- Transport integration
- Land use integration
- Geographical integration
- Other government policy integration

8.7.1 Transport Integration

The alternatives do not deliver significant improvements to the operational efficiency of the proposed N4 as they do not remove very significant numbers of private vehicles off the proposed N4 and therefore are considered Not Significant or Neutral in addressing connectivity of the strategic network. However, all of the alternatives offer a positive impact in terms of support for sustainable transport modes as well as better inter-modal connectivity. However, as noted in Section 8.5.1 the degree to which each of these measures achieves tangible benefits is linked to how effective they are in reducing congestion which in turn enables reallocation of road space for sustainable transport modes – thus creating a holistic integrated transport solution. Alternative C offers the most potential in this respect and is considered Minor or Slightly Positive in comparison to Alternatives A and B.

All option corridors, with the exception of the Black Option Corridor, will address an existing deficiency gap in the national primary network and the TENT-T comprehensive road network as all will provide a high-quality road. The improved N4 link also provides a vital link from Dublin and the east of the country to the northwest region. Accordingly, all Option Corridors east and west of Drumsna are ranked as Major or Highly Positive in terms of providing connectivity of the strategic road network. All Option Corridors will provide improved transport infrastructure for use by public transport bus routes which serves to integrate transport modes. The provision of supporting facilities for active travel modes also offers benefits to the overall integration of the ultimate transport solution.

A summary of the Transport Integration assessment for the alternatives and option corridors is provided in Section 8.7.5.

8.7.2 Land Use Integration

The alternatives are considered to have a positive impact in terms of achieving local connectivity. The active travel provisions and the bus enhancements are aimed at catering for short distance trips within the study area and servicing local towns and villages. Similarly, the demand management measures will serve to improve local connectivity. As these alternatives improve the land use and transport integration at

the local level with the most impact seen in the urban areas as opposed to the wider study area, they are considered Not Significant or Neutral.

All option corridors both to the west and east of Drumsna Junction aim to deliver an improved transport corridor that will encourage and support investment, tourism and employment, and enhance the economic prospects within the study area. These objectives are entirely accordant with the objectives of local planning frameworks. As such, all Option Corridors are positively ranked under Land use Integration.

A summary of the Land Use Integration assessment for the alternatives and option corridors is provided in Section 8.7.5.

8.7.3 Geographical Integration

Similar to the Land Use Integration, the alternatives improve geographical integration at the local level as opposed to the wider study area and are considered Not Significant or Neutral.

All the option corridors are considered Major or Highly Positive in terms of realising the goals of the NPF, particularly in relation to the key policy objective of *"Enhanced Regional Accessibility"*.

A summary of the Geographical Integration assessment for the alternatives and option corridors is provided in Section 8.7.5.

8.7.4 Other Government Policy Integration

This assessment considers how the alternatives and option corridors align with the objective of promoting balanced regional development in the context of the National Development Plan (NDP) and National Planning Framework (NPF). This assessment also considers alignment with other Government planning frameworks, including the Regional Spatial and Economic Strategy (RSES), the Climate Action Plan (CAP) and the Future Land Transport Investment Framework.

The alternatives all align with the policies above but as the impact of the active travel and public transport improvements are not significant in the national context, they are considered Not Significant or Neutral. The demand management measures are considered capable of directing more traffic onto the bypass than would otherwise be the case which can offer positive benefits in managing commuting and/or induced demand and delivering a sustainable outcome and as such, is deemed to perform better than Alternatives A and B in the national context, and is considered Minor or Slightly Positive. Demand Management is also ranked as very effective in controlling carbon emissions in the current Climate Action Plan 2023.

As the option corridors are not geographically disparate from each other when considered in the national context of connectivity and all are of comparable lengths, and as they do not comprise significant different construction techniques and will require similar structures, they all are considered Major or Highly Positive with respect to integration with the policy objectives above.

A summary of the Government Policy Integration assessment for the alternatives and option corridors is provided in Section 8.7.5.

8.7.5 Summary

The four individual sub-criteria which comprise the Integration assessment are compiled into a single assessment matrix. The assessment of the alternatives is provided in Table 8.7.1 as the impact of the alternatives is over the full study area, whereas the assessment of the options is split for into sections to the west and east of Drumsna Junction and is included in Table 8.7.2 and Table 8.7.3 respectively.

Table 8.7.1 Stage 2 Assessment Matrix of Alternatives for Integration

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Transport Integration	Alternative A provides positive support for sustainable transport modes, and better inter-modal connectivity. 4	Alternative B provides positive support for sustainable transport modes, and better inter-modal connectivity. 4	Alternative C provides positive support for sustainable transport modes, better inter-modal connectivity. and is more effective at reducing congestion to enable the Active Travel and Public Transport. 5
Land Use Integration	Local connectivity is enhanced. Most improvements seen in urban areas. 4	Local connectivity is enhanced. Most improvements seen in urban areas. 4	Local connectivity is enhanced. Most improvements seen in urban areas. 4
Geographical Integration	Geographical integration is positively impacted, however mainly on a local level as opposed to study area-wide. 4	Geographical integration is positively impacted, however mainly on a local level as opposed to study area-wide. 4	Geographical integration is positively impacted, however mainly on a local level as opposed to study area-wide. 4
Government Policy Integration	Alternative A aligns with government policies outlined above but is not significant in the national context. 4	Alternative B aligns with government policies outlined above but is not significant in the national context. 4	Alternative C aligns with government policies outlined above, and is specifically mentioned in the national context. 5
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**
Score / Impact level	**4**	**4**	**5**

Table 8.7.2 Stage 2 Assessment Option Corridors for Integration for Options to the West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Transport Integration	The Cyan Option Corridor addresses gaps in the national and TENT-T comprehensive road networks, and creates links with Dublin and the rest of the country. 7	The Orange Option Corridor addresses gaps in the national and TENT-T comprehensive road networks and creates links with Dublin and the rest of the country. 7	The Purple West Option Corridor addresses gaps in the national and TENT-T comprehensive road networks and creates links with Dublin and the rest of the country. 7	The Dark Green Option Corridor addresses gaps in the national and TENT-T comprehensive road networks and creates links with Dublin and the rest of the country. 7		The Black Option Corridor addresses gaps in the local road networks and creates links within the urban area. 6
Land Use Integration	An enhancement of economic prospects can be expected with the Cyan Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7	An enhancement of economic prospects can be expected with the Orange Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7	An enhancement of economic prospects can be expected with the Purple West Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7	An enhancement of economic prospects can be expected with the Dark Green Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7		An enhancement of economic prospects can be expected with the Black Option Corridor as it connects the northeast quadrant of the urban area more efficiently , thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Geographical Integration	Geographical integration is positively impacted by the Cyan Option Corridor, particularly with respect to meeting goals set by the NPF. 7	Geographical integration is positively impacted by the Orange Option Corridor, particularly with respect to meeting goals set by the NPF. 7	Geographical integration is positively impacted by the Purple West Option Corridor, particularly with respect to meeting goals set by the NPF. 7	Geographical integration is positively impacted by the Dark Green Option Corridor, particularly with respect to meeting goals set by the NPF. 7		Geographical integration is positively impacted by the Black Option Corridor, particularly with respect to meeting goals set by the NPF. 7
Government Policy Integration	The Cyan Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7	The Orange Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7	The Purple West Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7	The Dark Green Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7		The Black Option Corridor aligns very positively with government policy, especially towards connectivity in the local context. 6
Scoring						
Qualitative Assessment	**Major** or **Highly Positive**	**Major** or **Highly Positive**	**Major** or **Highly Positive**	**Major** or **Highly Positive**		**Moderately Positive**
Score / Impact Level	**7**	**7**	**7**	**7**		**6**
Preference	**Preferred**	**Preferred**	**Preferred**	**Preferred**		**N/A**

Table 8.7.3 Stage 2 Assessment Matrix of Option Corridors for Integration to the East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Transport Integration	The Yellow Option Corridor addresses gaps in the national and TENT-T comprehensive road networks, and creates links with Dublin and the rest of the country. 7	The Green Option Corridor addresses gaps in the national and TENT-T comprehensive road networks, and creates links with Dublin and the rest of the country. 7	The Purple East Option Corridor addresses gaps in the national and TENT-T comprehensive road networks, and creates links with Dublin and the rest of the country 7
Land Use Integration	An enhancement of economic prospects can be expected with the Yellow Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7	An enhancement of economic prospects can be expected with the Green Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7	An enhancement of economic prospects can be expected with the Purple East Option Corridor as it connects the study area and wider areas, thereby encouraging and supporting investment and tourism, in accordance with local planning frameworks. 7
Geographical Integration	Geographical integration is positively impacted by the Yellow Option Corridor, particularly with respect to meeting goals set by the NPF. 7	Geographical integration is positively impacted by the Green Option Corridor, particularly with respect to meeting goals set by the NPF. 7	Geographical integration is positively impacted by the Purple East Option Corridor, particularly with respect to meeting goals set by the NPF. 7

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Government Policy Integration	The Yellow Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7	The Green Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7	The Purple East Option Corridor aligns very positively with government policy, especially towards connectivity in the national context. 7
Scoring			
Qualitative Assessment	**Major** or **Highly Positive**	**Major** or **Highly Positive**	**Major** or **Highly Positive**
Score / Impact Level	**7**	**7**	**7**
Preference	**Preferred**	**Preferred**	**Preferred**

8.8 Environmental Appraisal of Stage 2 Alternatives and Options

8.8.1 Population and Human Health

8.8.1.1 Introduction

This section details Stage 2 Assessment of the alternatives and options with respect to Population and Human Health. This is a broad ranging topic which *"covers the existence, activities and health of people, usually considering people as groups or 'populations'"* (EPA 2015)[7]. Aspects examined in this section primarily relate to potential impacts on socio-economic activities (settlement patterns, population characteristics, activities, and economic) and social well-being and health of people at a community level.

Criteria relevant to the assessment of socio-economic activities include journey characteristics, journey amenity, general amenity, community severance, and economic effects relating to business, tourism and employment and relate to the constraints identified in Section 4.4 and shown with the Stage 2 Option Corridors on Figures 8.8.1.1.0 to 8.8.1.1.5.

Other aspects relevant to Population such as natural amenity, built and natural heritage, ecosystem services, material assets and nuisance are dealt with in the following sections:

- Sections 8.8.2 Material Assets Non-Agriculture
- Sections 8.8.3 Material Assets Agriculture
- Sections 8.8.4 Air Quality
- Sections 8.8.5 Climate
- Sections 8.8.6 Noise and Vibration
- Sections 8.8.7 Archaeological, Architectural and Cultural Heritage
- Sections 8.8.8 Landscape and Visual
- Sections 8.8.9 Biodiversity
- Sections 8.8.10 Hydrology
- Sections 8.8.11 Hydrogeology
- Sections 8.8.12 Soils and Geology

Human health impacts are primarily considered through an assessment of the environmental pathways by which health can be affected such as air, noise, water or soil. Therefore, the health assessment relies on the assessments in the following sections and draws on the findings as necessary to examine whether the effects

[7] Extracted from the Advice Notes for Preparing Environmental Impact Statements (EPA draft September 2015)

arising from any identified impacts may have a health impact and to ensure that the effects which may have a health impact are fully considered:

- Section 8.8.4, Air Quality to identify the predicted air quality values adjacent to the proposed alternatives and options
- Section 8.8.6, Noise and Vibration to identify the predicted noise levels at properties adjacent to the proposed alternatives
- Section 8.8.10, Hydrology to identify areas with any potential impacts on surface water and areas of flood risk
- Section 8.8.11, Hydrogeology to identify areas with any potential impacts on groundwater
- Section 8.8.12, Soils and Geology to identify if there are any areas of contaminated soils

The health assessment also considers health improvement and improvement to services. Other aspects, such as changes in traffic flows which are dealt with in Chapter 3, Traffic Assessment and Intervention Required. The Safety Appraisal in Section 8.4, the Physical Activity Appraisal in Section 8.5 and the Accessibility and Social Inclusion Appraisal in Section 8.6 have also been considered in relation to the assessment of Socio-economic and Health impacts to ensure that the effects of these issues on Population and Human Health have been addressed.

Section 8.8.1.2 outlines the methodology utilised to carry out the assessment, Sections 8.8.1.3 details the alternatives assessment, Section 8.8.1.4 details the options assessment and a summary is presented in Section 8.8.1.5.

8.8.1.2 Methodology

The assessment in relation to Population and Human Health has been split into two aspects, namely socio-economic activities (Population) and local community health (Human Health). The methodology for these two aspects is set out separately below:

Population Assessment Methodology

The methodology for the assessment alternatives with respect to Population is discussed in detail in Section 6.5.1.2 and the methodology for the assessment of options with respect to Population is discussed in detail in Section 7.5.1.2. The methodology and reference documents for these assessments is unchanged at Stage 2.

It's worthy to note, the Stage 2 Population assessment considers the potential effects that the alternatives and options could present at a community level, rather than for individuals or identifiable properties; although effects on individual businesses are discussed. Physical effects on individual properties are addressed for Stage 2 separately in Section 8.8.2 Material Assets Non-Agriculture. However, this assessment does treat the principal communities of Carrick-on-Shannon, Cortober, Jamestown, Drumsna and Aghamore as constraints, along with other named communities or clusters of residential properties. It also takes into account the effect of possible demolitions or acquisitions where these could impact on the wellbeing of the residual community.

The Stage 2 assessment also takes into consideration the proposed design footprint of the Stage 2 Options within the corridors.

Population Assessment Criteria

The Population assessment criteria are described in detail in Section 6.5.1.2 for the alternatives assessment and Section 7.5.1.2 for the options assessment however the five principal assessment criteria can be summarised as follows:

- Journey characteristics (i.e. journey patterns, journey time, reliability, accessibility, and journey connectivity)
- Journey amenity
- Community facilities and general amenity
- Community severance
- Economics (i.e. changes in economic activity)

Human Health Assessment Methodology

The data sources which were used to inform this assessment are the same as those used in the Stage 1 Assessment of Alternatives and Options, as outlined in Section 6.5.1.2 and Section 7.5.1.2 of this document respectively.

The methodology used is also the same as that used in the Stage 1 Assessment of Alternatives and Options, as outlined in Section 6.5.1.2 and Section 7.5.1.2 of this document. The assessment criteria for Human Health are also repeated, i.e., all Alternatives and Options are assessed under both Sub-criterion 1: Health Protection and Sub-criterion 2: Health Improvement and Improving Services.

The details of the changes between the Stage 1 and Stage 2 Alternatives and Options are contained in Section 8.2.

8.8.1.3 Population and Human Health Stage 2 Alternatives Assessment

Population Stage 2 Alternatives Assessment

Alternative A: Active Travel

This alternative comprises improvements to cycling and walking facilities. An improved infrastructure for walking and cycling would facilitate a move to active transportation with benefits for journey patterns, journey amenity and health. Improved pedestrian crossings and footpaths, and a comprehensive cycle network, supported by new signage, road markings and kerbing, will allow for more permeability, providing a positive impact on journey characteristics by allowing pedestrians and cyclists to reach their destinations easily and swiftly. Journey amenity will be improved in terms of greater safety and through the separation of pedestrians and cyclists from vehicles. Cyclist amenity will be enhanced by the proposals for cycle parking. There will be a positive impact for journey characteristics and amenity due to pedestrianisation of key areas, combined with reduced severance with the provision of a new pedestrian and cycle bridge across the River Shannon. Some negative impacts on vehicle traffic flow and general amenity can be expected during construction.

Facilities for active travel could potentially lead to a transference of a proportion of local journeys from private vehicles. This would have economic benefits in other respects by improving the general environmental amenity.

Alternative B: Public Transport Improvements

Alternative B comprises improvements to public transport. The availability of enhanced and frequent public transport, including a minibus service to outlying areas would have a positive impact on journey characteristics and complement investment in active travel, particularly by facilitating journey patterns for people with limited mobility or without access to a private vehicle. The development of a mobility hub and demand-responsive minibus services would be an innovative complementary benefit for journey characteristics, especially if providing a link between Cortober (including the station) and Carrick-on-Shannon to which significant severance currently applies at the R368/N4 junction and crossings of the N4 to the pedestrian bridge across the Shannon. Additional signage and bus stops, along with the improvements to footpaths and pedestrian crossings, would have a positive impact on journey amenity and accessibility of public transport users once in town. Public transport improvements would themselves reduce vehicle demand and support additional active travel. Some negative impacts on vehicle traffic flow and general amenity can be expected during construction.

Increased car parking at the railway station would encourage more use of rail services and have a positive impact on journey characteristics. At present, it can be difficult to find spaces and overflow of parking on to adjacent road is an annoyance for local residents and can present a hazard. Bicycle theft has also been an issue. Therefore, new car parking and cycle facilities would also have a positive impact on journey amenity.

Alternative C: Demand Management

Alternative C involves reducing demand for car trips through Carrick-on-Shannon and is a reduction measure rather than a provision measure. It would not require land development and significant construction. A reassignment of on-street parking/existing traffic lanes to provide walking or cycling facilities would rather have a positive impact on the urban realm and therefore on general amenity in the town. Measures to reduce demand for car trips, such as changes in junction radii, introducing shared pedestrian/cycle/vehicle space, reduced speed limits and parking reductions on some streets, and time restricted vehicle entry, would all have a positive effect by removing unnecessary demand and inducing some transfer of journeys to active travel or public transport. The negative impact on vehicle journey time and driver journey amenity must be considered, but as informing a strategic decision through a comparison with the positive impact for general amenity and the journey amenity of pedestrians and cyclists.

A key consideration will be to avoid reduction in business activity in the town centre. The creation of Park and Stride sites will have a positive impact in this respect. In general, businesses in Carrick-on-Shannon have performed better than in some other rural towns, although there has been a gradual replacement of traditional shops by cafes and services. These enterprises would benefit from environmental enhancements made possible by reduced car use but are also dependent on customer access and accessible car parking.

Table 8.8.1.1 Population Stage 2 Scoring Matrix of Alternatives

Assessment Criteria	ALTERNATIVE A ACTIVE TRAVEL	ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS	ALTERNATIVE C DEMAND MANAGEMENT
Journey Characteristics	More connectivity through continuous pedestrian and cycle paths and crossings between parts of Carrick-on-Shannon and outlying area. **PAG Score 7**	Potential for improved connectivity between town and hinterland, with particular benefits between Carrick-on-Shannon and Cortober. **PAG Score 6**	Easier local necessary car journeys, and incentive to transfer to walking or cycling. **PAG Score 6**
Journey Amenity	Improved journey amenity by providing pedestrian crossings and cycle facilities and lanes, especially at roundabout junctions. **PAG Score 7**	Improved safety in some cases. Reduced time spent in congestion. Social inclusion benefits. **PAG Score 5**	Improved safety due to reduced traffic. **PAG Score 5**
General Amenity	Improved physical health and quality of life. **PAG Score 6**	Links to active travel with benefits for health. **PAG Score 5**	More agreeable environment and more walking and cycling with health benefits. **PAG Score 6**
Community Severance	Reduced severance at key locations. **PAG Score 7**	Reduced severance through direct connections, but mostly in relation to transfer from walking. **PAG Score 5**	Reduced severance at junctions due to transfer of a proportion of traffic. **PAG Score 5**
Economic	Positive impact as access and parking to shops and businesses can be easier and more direct than by car. Permits brief stops at shops with particular benefits for Main and Bridge Street. **PAG Score 7**	Positive impact on businesses on Main and Bridge Street in particular. **PAG Score 6**	Balance between improved environment conducive to business and retail and maintaining vehicle access and parking. **PAG Score 6**
Scoring			
Qualitative Assessment	**Major** or **Highly Positive**	**Minor** or **Slightly Positive**	**Moderately Positive**
Score / Impact Level	**7**	**5**	**6**

Human Health Stage 2 Alternatives Assessment

The Alternatives which have been considered feasible for this project comprise of public transport proposals and measures to improve active travel and demand management measures. The aim of these proposals is to encourage a shift away from private car usage, therefore reducing the number of private vehicles on the section of the N4 under consideration. This has the potential to relieve existing and forecast capacity issues in the study area. A description of the Stage 2 Alternatives is provided in Section 8.2 and can be categorised as follows:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

Sub-criterion 1: Health Protection

Alternative A: Active Travel

As outlined in Section 8.8.1.2, the new pedestrian crossing bridge over the River Shannon has been discounted following the Stage 1 Assessment. This was the only measure within Alternative A which was considered to have the potential to give rise to human health impacts, albeit the impacts were classified as Not Significant or Neutral in the Stage 1 Alternatives Assessment (Section 6.5.1.3).

Thus, in the absence of any new pedestrian crossing bridge, Alternative A will likely result in a Not Significant or Neutral impact on human health and has a PAG score of 4.

Alternative B: Public Transport Improvements

Alternative B will involve an improvement and/or new bus services on the existing street network. This will involve additional signage and possible bus-stops but will not require land acquisition or significant construction. As outlined in Section 8.8.1.2, the rail service improvements aspect of Alternative B has been disregarded following the Stage 1 Assessment.

The noise, air quality, soils and water assessments all consider this to be Not Significant or Neutral and as such it is also Not Significant or Neutral from a protection to human health perspective and given a PAG score of 4.

Alternative C: Demand Management

Alternative C will involve measures to reduce the need to make a trip by car in the first instance. A such, it will be a reduction measure as opposed to a provision measure with a reassignment of on-street parking/existing traffic lanes to provide walking or cycling facilities or urban realm, which will not require land acquisition and significant construction.

The noise, air quality, soils and water assessments all consider this to be Not Significant or Neutral and as such it is also Not Significant or Neutral from a protection to human health perspective and given a PAG Score of 4.

Sub-Criterion 2: Health Improvement and Improving Services

Alternative A: Active Travel

The improved pedestrian and cyclist facilities which are proposed under Alternative A are likely to give rise to health improvements through increased opportunities for exercise and recreation. In addition, Alternative A has the potential to result in a modal shift in the Carrick-on-Shannon and Cortober areas. This modal shift has the potential to reduce dependence on private vehicle use in the vicinity of these towns, and subsequently reduce levels of traffic and vehicular related accidents.

Alternative A is likely to require limited construction and thus, construction-related effects on services and health are not likely to be significant.

A Minor or Slightly Positive impact is therefore identified (PAG Score 5).

Alternative B: Public Transport Improvements

The extensive public transport improvements proposed under Alternative B are likely to give rise to many socio-economic benefits which, by extension, are likely to improve the health of the population in the study area.

Accessibility to businesses and community facilities in Carrick-on-Shannon, Cortober and the wider study area along with the Business Parks in both towns will be better facilitated by an improved public transport network and the resulting reduction in congestion. This all translates into an increased potential for economic prosperity for the study area and the Western Region, which in turn will play a part in reviving the Irish economy.

An increase in economic prosperity in an area is likely to result in future increases in employment and subsequently reduced unemployment, which can lead to improved overall health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality.

Alternative B is likely to require limited construction and thus, construction-related effects on services and health are not likely to be significant.

A Minor or Slightly Positive impact is therefore identified (PAG Score 5).

Alternative C: Demand Management

Alternative C involves the introduction of measures to reduce the demand for car trips through Carrick-on-Shannon.

These measures (refer to Section 8.2) which include enhanced pedestrian facilities- i.e., new pedestrian crossings, periodic pedestrianisation of Main Street and public realm enhancement have the potential to give rise in a modal shift in the town. There is likely to be an increased number of people who choose to walk rather than depend on private vehicular use throughout the town, in particular for localised journeys. An increase in the number of people choosing to walk and thus engage in exercise is likely to give rise to the improved health of the local population.

This modal shift, in addition to the other demand management measures proposed under Alternative C- such as traffic calming measures and reduced parking have the potential to reduce dependence on private vehicle use in the town, and

subsequently reduce levels of traffic and vehicular related accidents. Alternative C is likely to require limited construction and thus, construction-related effects on services and health are not likely to be significant.

A Minor or Slightly Positive impact is therefore identified (PAG Score 5).

The overall assessment of the Stage 1 Alternatives, in terms of Human Health is presented in Table 8.8.1.2 below.

Table 8.8.1.2 Summary of Assessment Matrix of Alternatives for Human Health

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Protection of Human Health	Not Significant or Neutral **PAG Score 4**	Not Significant or Neutral **PAG Score 4**	Not Significant or Neutral **PAG Score 4**
Health improvement and improving services	Minor or Slightly Positive **PAG Score 5**	Minor or Slightly Positive **PAG Score 5**	Minor or Slightly Positive **PAG Score 5**
Scoring			
Overall Qualitative Assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**
Score / Impact Level	**5**	**5**	**5**

8.8.1.4 Population and Human Health Stage 2 Options Assessment

Population Assessment of the Stage 2 Options - West of Drumsna Junction (Node J)

Black Option Corridor with the Black Design Option- Single Carriageway Urban Street

The Black Option Corridor provides a connection from the L3408 Castlecara Road to the R280 Leitrim Road which would take a proportion of traffic out of the eastern half of the town centre, away from Scoil Mhuire (national school) and locations where congestion regularly occurs, namely at the Carrick Shopping Centre Roundabout, the Relief Road/Dublin Road roundabout, the Dublin Road/Leitrim Road junction and outside Páirc Seán Mac Diarmada during matches.

It is likely to improve access to St Mary's GAA at Cill Tochairt (Kiltoghert) while adding to traffic at the entrance to the pitch. The road here is also part of the Slí na Sláinte walking route. The median line passes through a gap in residential properties in Drummagh, although the corridor includes around seven residential properties. The corridor also includes parts of Oaklands Estate and Ros Airgid on the edge of the Liscara Estate. It would require a junction with the R280 beside one residential property (of three) which offers self-catering accommodation.

Cyan Option Corridor with Pink Design Option-Dual Carriageway

The Cyan Option Corridor provides a positive impact in terms of journey characteristics as would ensure journey time reliability whilst retaining accessibility and connectivity to the town and onwards to Sligo or Dublin. The Pink Design Option - Dual Carriageway commences at Node A at Cloongownagh and heads southeast, crossing existing access to a farm in the vicinity of Ch 11+200 and potentially impacting directly on one residential property at Ch. 11+600. It continues to a roundabout junction providing access to the existing N4 and the minor road L5078 along which there are a number single residential properties. The corridor includes lands used by Carrick Quads (and house) for which a significant impact could occur.

The Cyan Option Corridor subsequently follows the railway line, but with the centreline being to the north of the line. The corridor includes McLoughlin Transport Services, CD Carrick Commercials and LVDC Centre, the Bull Field playing fields (including GAA and Carrick Town FC) and the Midland & Western Livestock Market (occasional). The significance of impacts here would depend on the degree to which the playing fields and businesses are physically impacted.

The corridor then follows the railway line to the south. In Cortober, the corridor introduces potential social severance at the R368 Elphin Road on the edge of the community before the railway line and station. To the east, it includes a now disused *eir* depot, the residential estates of Glenpatrick and Sli An Iarainn, with semi-detached properties (on either side of the Elphin Road) and a two property semi-detached house closest to the corridor centreline. To the west, the corridor includes O'Dowd's Fireplaces showroom and a residential property on the R368, as well as

Carrick-on-Shannon Railway Station and yard, part of the grounds of an electricity substation, a disused oil depot, and 18 private residential properties on the R370 Frenchpark Road plus the Shannon Gael estate. The corridor also includes the Carrick Poultry business.

A roundabout located adjacent to the Glenpatrick residential estate provides a new connection and link to the R368 Elphin Road. This affords the opportunity for high sided vehicles to avoid the current low bridge (a positive impact given the frequency of minor collisions with HGVs at that location). The corridor provides relief from severance on Station Road, Cortober. In this location there is a small grocery shop, a parochial hall (accessed by Shannon View Road) and numerous residences, including an established bed and breakfast. Traffic is also removed from numerous roadside residences to the west of the railway line, with some corresponding environmental benefit. This transfer of traffic represents a moderately positive impact on general amenity, while noting that a slight economic impact is possible from loss of passing trade for local businesses .

The Cyan Option corridor then crosses the River Shannon at Cordrehid in an area that is of high amenity value. Given the open landscape and the proximity of Butler's Marina, this section is well used by boaters, kayakers and anglers; although there is no riverside walking access. Two private moorings have been cut from the river here, one of which serves the Carrick Camping facility which has recently closed (Spring 2020).

On the east bank of the river, the median line of the corridor passes closest to the relatively new Glas na hAbhainn estate where eight properties would front onto the option with a further three being adjacent from the gable end. The corridor then heads east, taking a route just below the residential estates of Cnoc na Sí and Ard na Sí to which environmental effects such as noise and visual would be relevant to residential amenity (see Section 4.9 Noise and 4.10 Landscape & Visual). Two bed and breakfast enterprises are located in these estates along with three more adjacent to the existing N4, although any economic impacts due to the environmental effects of the Cyan Option are likely to be imperceptible. The centreline would impact directly on one residential property just before it meets the existing N4 just before the 50km speed limit and town boundary for Carrick-on-Shannon.

There are two residential properties on the L7426 (south) local road close to the junction with the N4, a farm and one private property on the L7426 (north), another private property backing onto the corridor from the L3656 and approximately 12 more along the N4 (see Section 4.5 Material Assets). The corridor would need to address two existing junctions for Jamestown, of which the L3656 is the principal access. The option corridor continues to follow the existing N4 beside the River Shannon near Jamestown. This section of the river is unnavigable by boats but is popular for kayaking and angling and so a continued impact on amenity would apply, including also during construction. Overall, though, the negative impacts for river use are slight given the level of use and somewhat balanced by positive visual impacts which the views of the river views provide for the journey amenity of road users of the N4. The corridor to the south includes the Oak Meadows and Grange residential estates in Drumsna which consist of c.25 properties, together with 5 others. At Node J at Drumsna Junction, the Cyan Option Corridor would need to

maintain access into Drumsna village and for the R299 to Leitrim Village and Drumshanbo.

In summary, for the Cyan Option Corridor, significant impacts could result given the number of community facilities and businesses, depending on the road design and precise location of the median line selected within the corridor. Most relevant in this regard are the river crossing, the Carrick Town FC pitch and Bull Field changing rooms, Midland and Western Livestock, CD Carrick Commercials and McLoughlin Transport.

Orange Option Corridor with Orange Design Option - Dual Carriageway

The Orange Option Corridor provides a positive impact in terms of journey characteristics as would ensure journey time reliability whilst retaining accessibility and connectivity to the town and onwards to Sligo or Dublin. In Cortober, the corridor borders the car parking for the Mulvey Centre (retail and entertainment) and is close to a small estate of residential apartments (Hawthorn Crescent). The median line of the corridor falls to the east of the railway line and includes the Midland & Western Livestock Market (occasional), the Bull Field playing fields (including GAA and Carrick Town FC), CD Carrick Commercials and LVDC Centre, McLoughlin Transport Services and the King & Moffat business. The centreline of the corridor would directly impact on the Bull Field playing fields, the Midland & Western Livestock Market and CD Carrick Commercials. Two private properties also fall within the corridor on the west side of the existing N4.

The corridor introduces potential social severance at the R368 Elphin Road on the edge of Cortober at the railway line and station. To the east, the corridor includes an *eir* depot, the residential estates of Glenpatrick and Sli An Iarainn, and, closest to the median line, ten semi-detached properties (on either side of the Elphin Road) and a two-property semi-detached house. To the west, it includes O'Dowd's Fireplaces showroom and a residential property on the R368, as well as Carrick railway station and yard, part of the grounds of an electricity substation, a disused oil depot.

The Orange Option Corridor crosses the River Shannon at Cordrehid in an area that is of high amenity value, and just to the north of the Cyan crossing. Given the open landscape and the proximity of Butler's Marina, this section is well used by boaters and kayakers and is used for some angling, but there is no riverside walking access. Two private moorings have been cut from the river here, one of which serves the Carrick Camping facility, which is located directly on the centreline, but which closed in 2020. The proposed centreline crossing intercepts inlet channels to constructed basins for mooring on both banks making the bridge width much longer. A residential property also falls within the corridor.

On the east bank of the Shannon, the median line of the Orange Option corridor passes closest to the relatively new Glas na hAbhainn estate where eight properties would front onto the option with a further three from the gable end. The corridor takes a route just below the residential estates of Cnoc na Sí and Ard na Sí to which environmental effects such as noise and visual would be relevant to residential amenity (see Section 8.8.6 Noise and Vibration and Section 8.8.8 Landscape and Visual). Two Bed and Breakfast establishments are located in these estates along with three more beside the N4, although any economic impacts due to the

environmental effects of the Orange Option Corridor are likely to be imperceptible. The median line of the corridor impacts directly on one residential property before it meets the existing N4 just before the town boundary. Subsequent potential impacts are as per the Cyan Option Corridor.

Purple West Option Corridor with Purple West Design Option- Dual Carriageway

The Purple West Option Corridor has a significant positive impact in connecting with the R280 to Leitrim village and Drumshanbo, and is also used by some traffic, including HGVs, to access Sligo using the R284. From the tie-in with the existing N4 north of Carrick-on-Shannon, the corridor crosses the River Shannon and would continue above the floodplain of the river to the east. The river here, and more especially the Boyle River and Eidin Lake, is well used for boating, kayaking, and angling. The crossing location at Corryolus is less visible than the alternative crossings to the south in the Orange Option Corridor and Cyan Option Corridor, but a 1km section of the road would be elevated above the river (see Section 8.8.6 Noise and Vibration and Section 8.8.8 Landscape and Visual). There is no riverside access, but a potential significant impact given the visibility of a section of the road combined with the attraction of the undisturbed wetland character of the floodplain. Journey amenity for users of the road would be positive due to views of the river, but comparable to the southern crossing.

At Hartley, 27 residential properties (including one farm) fall within the Purple West Option Corridor. Social severance is likely here along with possible physical severance. Hartley Lodge Guest House is located beside (west) of the corridor. The R280 would likely be connected at a junction beside one residential property and close to the Cartown nightclub (occasional events). No significant issues arise at the L7410.

The L3408 Castlecara Road is crossed at a rather rural location, although the corridor does include four residential properties (one being a farm). Castlecara Road is part of the southern route of the Kingfisher Cycle Trail. The option continues southwards, passing to the rear of a line of 11 residential properties (for an assessment of the environmental effects of Noise and Vibration please see Section 8.8.6 Noise and Vibration). One isolated house is located close to (west of) the median line of the corridor. The corridor also includes farm buildings and a connecting access track to the north. The corridor crosses the L7426 (north) where it includes three residential properties and a farm.

The Purple West Option Corridor presents a potential impact at Jamestown due to proximity of the corridor to the unnavigable section of the River Shannon where there is some kayaking and angling activity. The effect is accentuated in comparison with the Orange Option Corridor by the likelihood of a junction at this location, but partly compensated by the positive effect on journey amenity for users of the N4. Subsequent impacts for the corridor are as for Orange prior to any consideration of design characteristics.

Dark Green Option Corridor with Grey Design Option -Dual Carriageway

The impacts of the Dark Green Option Corridor, prior to any consideration of design characteristics, are the same as the Purple Option Corridor until after the L3408 Castlecara Road. The L3408 Castlecara Road is crossed at the same rural location

as for the Purple Option Corridor, although the corridor includes four residential properties (one being a farm). Castlecara Road forms a section of the Kingfisher Cycle Trail southern route.

The option continues southwards, crossing low intensity grazing land. The Dark Green Option Corridor includes five residential properties (including a farm) on the L7426 and one isolated residential property. The corridor joins the existing N4 just to the north of Node J.

Population Assessment of the Stage 2 Options - East of Drumsna Junction (Node J)

Green Option Corridor

The Green Option Corridor represents an on-line upgrade of the existing N4 single carriageway and links with the Dromod-Roosky Bypass. The corridor passes beside Drumgilra Lough to the west and Gortconnellan Lough to the east where there is some angling. It bisects an on-road heritage trail east of Drumsna which follows the L7428, L7429 and L7430 around Gortconnellan Lough taking in locations that inspired the writings of author Anthony Trollope who was postmaster in the village in the 1940s. The first of these roads is served by the R299 overbridge. To the south, Annaduff Church of Ireland is located off the former spur of the N4 (L3630), beside a regularly visited memorial to country musician Tom Dunphy who died in a road accident here in 1975.

Only part of the grounds of the Masonite plant are included in the corridor, but this is followed by another five residential properties with a further five to the north. In Drumsna, three properties and parts of the Oak Meadows estate and The Grange estate fall within the corridor. A further 15 residential properties are included in the corridor after the Masonite plant, seven of which are beside the road and four off a parallel access road.

The Green Option Corridor would continue to pass through the village of Aghamore in the wider community of Annaduff. The location is subject to a reduced speed limit and has a crossing island, but the routing of the corridor through the village means that physical severance, at one level or another, would continue to apply due to the presence of community facilities including St. Mary's Church and cemetery and Annaduff National School which is located just 100m to the east on the L3470 just outside the corridor. The village also includes a guest house. The prominent Top of the Hill pub is currently not in operation.

The corridor includes 5 residential properties just to the south of Aghamore, three of which are on a parallel access road. These are followed by a further 4 properties and a farm. Annaduff GAA and Leitrim GAA Centre of Excellence fall within the corridor along with at least four other properties and farm buildings. To the south, the corridor includes part of the premises of a milling business, McDonogh Feeds, beside the N4, and takes in 2 private properties on the L1475.

The corridor includes junctions with the R201 to Mohill and R299 to Drumsna and Leitrim Village.

In the Stage 2 Green Option Corridor a new roundabout junction with the L1601 to Dromod, provides a slight improvement for journey amenity for vehicles joining or leaving this road but reduce the free traffic movement on the N4 itself.

Yellow Option Corridor- Yellow Design Option – Single Carriageway

Potential impacts by the Yellow Option Corridor are similar to the Green Option Corridor, except at the southern end of the corridor at Fernaught before the Dromod-Roosky Bypass. At this location, the Yellow Option Corridor diverts from the line of the existing N4 between Nodes G and H slightly to the west. This brings the corridor down the hill from the existing N4 and would deny southbound drivers the current elevated view of the Shannon lakes (see Section 4.11 Landscape & Visual) which would represent a slight negative effect on journey amenity. The Yellow Option Corridor would, however, minimise any impact on McDonogh Feeds and avoids impacts on residential properties on the L1475.

In the Stage 2 Yellow Option Corridor a new roundabout junction with the L1601 to Dromod, provides a slight improvement for journey amenity for vehicles joining or leaving his road but reduce the free traffic movement on the N4 itself.

Purple East Option Corridor with Purple East Design Option-Dual Carriageway

The Purple East Option Corridor east of Drumsna Junction follows a similar route to that of the Green Option Corridor, but follows the line of the existing N4 taking in 2 private properties on the L1475 as well as McDonogh Feeds at Node G. The Purple East Option Corridor includes the same properties and community facilities as the former options between here and Aghamore.

Physical severance is avoided in the middle of Aghamore village, providing relief from the severance associated with the current high traffic volumes for the church. However, social severance, and possible physical severance, could apply to Annaduff National School given that the bulk of residences from which many students would live are to the east of the corridor off the L4370. After Aghamore, the corridor sweeps away to the east between Nodes F and J. This takes the corridor away from Leitrim GAA Centre of Excellence (if not the Annaduff GAA building). However, the reconfiguring of side and access roads in the vicinity of Aghamore as part of the Stage 2 Purple East Option offers some relief to this.

Table 8.8.1.3 Stage 2 Population Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Journey Characteristics	Significant Positive Connectivity with R368. Longer journeys due to detours south of Carrick-on-Shannon on link roads beside N4.	Moderate Positive Would improve journey amenity over this corridor length.	Significant Positive Would connect with the R280 and so with Leitrim village and Drumshanbo, potentially reducing some traffic on the R299.	Significant Positive Would connect with the R280 and so with Leitrim village and Drumshanbo, potentially reducing some traffic on the R299.		Significant Positive effect of connection between R280, Summerhill, Castlecara Road, N4 and retail centres.
Journey Amenity	Slightly Positive Reduced congestion at N4/R365 and at existing bridge. Improved safety due to link roads. Significant positive avoidance of delay.	Slightly Positive Reduced congestion at existing bridge. Improved safety due to link roads. Significant positive avoidance of delay.	Slightly Positive bridge view. Significant positive avoidance of delay.	Slightly Positive bridge view. Significant positive avoidance of delay.		Moderately Positive Transfer of R280 traffic and reduced congestion at R280/Main Street junction.
General Amenity	Moderately Negative River crossing. River at Jamestown. Bull Field pitch. Proximity to residential estates.	Moderately Negative River crossing. Mooring Facilities. River at Jamestown. Bull Field pitch. Proximity to residential estates.	Moderately Negative crossing of River Shannon. Slightly Negative at river Jamestown.	Moderately Negative river crossing.		Slightly Positive Connectivity to Gaescoil and proximity to residential estates in Summerhill. Increased traffic at St Mary's GAA on Castlecara Road.
Community Severance	Slightly Negative Social severance due to combined effect of the existing railway embankment and new road in Cortober. Some relief from physical severance due to traffic relief in Cortober.	Moderately Negative Social severance due to combined effect of the existing railway embankment and new road in Cortober.	Slight-Moderate Negative social (& possible physical) severance Hartley.	Slight-Moderate Negative social (& possible physical) severance Hartley.		Minor or Slightly Negative Elysian Meadows.

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Economic	Slightly Negative Businesses in Cortober east and west of railway line.	Slightly Negative Businesses in Cortober east and west of railway line.	Neutral Proximity to Cartown Nightclub.	Slightly Negative Businesses.		Improved accessibility for businesses on Castlecara Road.
Scoring						
Qualitative Assessment	**Minor** or **Slightly Negative**	**Moderately Negative**	**Not Significant** or **Neutral**	**Minor** or **Slightly Positive**		**Moderately Positive**
Score / Impact Level	**3**	**2**	**4**	**4**		**6**
Preference	**Intermediate**	**Least Preferred**	**Preferred**	**Preferred**		**N/A**

Table 8.8.1.4 Stage 2 Population Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Journey Characteristics	Slightly Positive Single carriageway for through traffic. No change to good access for Drumsna, R201 or Masonite. Extended journey for L7464 and roadside residents.	Sightly Positive Single carriageway for through traffic. No change to access for Drumsna, R201 or Masonite. Extended journey for L7464 and roadside residents.	Moderately Positive Dual carriageway design. Short diversion for R299, L7429 & L7661. Slight diversions for local properties. Avoidance of Aghamore.
Journey Amenity	Moderately Positive Improved safety for local and through traffic in Aghamore. Positive impact of L7472 & L1475 connection to roundabout with Dromod. Loss of visual amenity for southbound drivers.	Slightly Positive Improved safety for local and through traffic in Aghamore. Possible inferior outcome for access to L3470 from N4/Option.	Neutral Improved access to local roads, R201, Masonite and Annaduff. Safer access to roadside properties, school, churches and sports facilities.
General Amenity	Neutral	Neutral	Slightly Negative Impact on Gortconnellan Lough and Trollope Trail and walking routes, but new crossings proposed for latter.
Community Severance	Major Negative Continued physical and social severance Aghamore, but safer access to community facilities.	Major Negative Continued physical and social severance Aghamore, but safer access to community facilities.	Moderately Positive Relief from severance Aghamore.
Economic	Neutral	Slightly Negative McDonogh Feeds	Slightly Negative McDonogh Feeds
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Minor** or **Slightly Negative**	**Moderately Positive**
Score / Impact Level	**4**	**3**	**6**
Preference	**Intermediate**	**Least Preferred**	**Preferred**

Human Health Stage 2 Options Assessment

Sub-criterion 1: Health Protection

The results of the noise and vibration, air quality, soils and water assessments have informed the health assessment as these are the environmental pathways by which health can be affected.

Noise

As detailed in Section 8.8.6 the assessment of potential noise impacts and ranking of option corridors is based primarily upon property counts, a review of the likely requirement for mitigation measures based on the indicative noise footprint for each option corridor and changes in traffic flows. The potential noise and vibration impacts associated with the construction phase of each option corridor will be of a non-permanent duration (i.e., less than 7 years). Whilst there will be varying impacts associated with each, the construction phase will be undertaken using standard road construction techniques and will be controlled by the implementation of construction noise and vibration limits. As such, for the purposes of ranking option corridors, the noise assessment focused on longer terms operational impacts only.

In terms of vibration, road traffic along normal well-maintained surfaces, in line with the proposed option corridors, generates very low levels that are normally not perceptible to building occupants. Therefore, it was assumed that all option corridors will have a comparable low vibration impact during their operational phase and vibration was not assessed further nor included in this health assessment.

A summary of the noise assessment is included in Table 8.8.1.5 and Table 8.8.1.6.

Air

As detailed in Section 8.5.4, the air quality assessment is based on the number of sensitive receptors in proximity to each option corridor and the projected traffic volumes accessing the corridors during the operational phase. The construction phase is assessed through the consideration of the number of sensitive properties located in proximity to the likely construction works where dust impacts may be experienced. Sensitive receptor locations are defined in the NRA, 2011 Guidelines as residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. In addition, planning applications give an indication to the potential number of future sensitive receptors adjacent to the option corridors.

The number of existing and potential sensitive receptors in proximity to each option corridor determined the air quality impacts. The zone of interest for the assessment is 0-50m from each indicative design fenceline within each option corridor. This is an offset from the edge of the indicative design fenceline within each option corridor and assumes that properties within the potential design fenceline would be acquired and would therefore not be counted as receptors.

A summary of the air quality assessment is included in Table 8.8.1.5 and Table 8.8.1.6.

Soils

Potential health impacts due to soils relate to the disturbance of contaminated lands and radon.

Soil Contamination

As detailed in Section 8.8.12, a number of sites of potential areas of contamination have been identified in the study area West of Drumsna Junction. The results of the soils assessment with respect to contaminated lands are included in Table 8.8.1.5. The soils assessment does not apply to the options East of Drumsna Junction.

Radon

The area of Roscommon and Leitrim within the study area is in a low radon area. As such the potential human health impact of the option corridors with regards to radon is not considered further as it is not considered significant.

Water

Potential health impacts due to water relate to water quality and flooding.

Water quality

In terms of surface water, as detailed in Section 8.8.10, the Irish Water Carrick-on-Shannon Public Water Supply abstraction is located in the River Shannon circa 1 km upstream of N4 Carrick-on-Shannon Bridge. This is a large abstraction that supplies well over 50% of Leitrim's water supply and is considered to be of regional importance and its attribute importance is therefore very high.

In terms of groundwater, as detailed in Section 8.8.11, there are no discharge and emissions licensed facilities identified within any of the option corridors. A number of abandoned and historical quarries and pits have been identified within the option corridors West of Drumsna Junction (Node J), however, the potential for the contamination of groundwater from these quarries is expected to be insignificant and therefore with regard to groundwater contamination all the option corridors are considered not significant or neutral.

As such the health assessment in relation to the potential to impact on flooding only considered the hydrolgical assessment as the hydrogeological assessment was not significant or neutral.

Flooding

In terms of groundwater flooding, there are no areas of historic groundwater flooding within any of the option corridors. Therefore, with regard to groundwater flooding all the option corridors are considered not significant or neutral.

Floodplains and flood risk areas were assessed in the hydrological assessment detailed in Section 8.8.10 and are included in this human health assessment.

As such the health assessment in relation to the potential to impact on water quality only considered the hydrological assessment as the hydrogeological assessment was not significant or neutral.

Sub-criterion 2: Health improvement and Improving Services

The option corridors have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance and could contribute to improving the health and wellbeing of socio-economically deprived communities. They can facilitate transport of goods and people in a timely, reliable and efficient manner. The full economic benefit will be realised once the full extents of the preferred transport solution is completed. Accessibility to businesses and community facilities in Carrick-on-Shannon, Cortober and the wider study area along with the Business Parks in both will be better facilitated by the project and the resulting reduction in congestion. It will also bring with it benefits to business and public facilities in Carrick-on-Shannon town centre by reducing noise and air pollution. This all translates into an increased potential for economic prosperity for the Western Region, which in turn will play a part in reviving the Irish economy.

The human health assessment presented in Table 8.8.1.5 and Table 8.8.1.6 includes an assessment on how the option corridors would impact on the socio-economics of the community and improve access to services such as hospitals or recreational facilities as this will have an impact on the health of a community.

Opportunities for health improvements and improved access to services due to the option corridors were identified and each option corridor scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes
- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents
- Potential for improved public transport and an improved environment for cycling and walking within Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in the health benefits

Table 8.8.1.5 Stage 2 Human Health Summary Assessment Matrix for the Options West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Sub-criterion 1: Protection of Health Assessment						
Noise	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3		Moderately Negative PAG Score 2
Air	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3		Moderately Negative PAG Score 2
Soils (contaminated land assessment)	Major or Highly Negative PAG Score 1	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3		Moderately Negative PAG Score 2
Water Supply	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2	Major or Highly Negative PAG Score 1	Major or Highly Negative PAG Score 1		Not Significant or Neutral PAG Score 4
Flood risk	Major or Highly Negative PAG Score 1	Major or Highly Negative PAG Score 1	Major or Highly Negative PAG Score 1	Major or Highly Negative PAG Score 1		Minor or Slightly Negative PAG Score 3
Sub-criterion 1: Summary of Overall Protection of Health Assessment						
Overall Protection of Health Assessment	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2		Moderately Negative PAG Score 2
Sub-criterion 2: Summary of Overall Health Improvement and Improving Services Assessment						
Health improvement and improving services	Moderately Positive PAG Score 6	Moderately Positive PAG Score 6	Minor or Slightly Positive PAG Score 5	Minor or Slightly Positive PAG Score 5		Minor or Slightly Positive PAG Score 5

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Overall Human Health Scoring for Options West of Drumsna Junction						
Overall Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**		**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**	**4**		**4**
Preference - Professional Judgement	**Preferred**	**Preferred**	**Intermediate**	**Intermediate**		**N/A**

Table 8.8.1.6 Stage 2 Human Health Summary Assessment Matrix of Options East of Drumsna (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Sub-criterion 1: Protection of Health Assessment			
Noise	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3
Air	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2
Soils (contaminated land assessment)	Major or Highly Negative PAG Score 1	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3
Water Supply	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2	Moderately Negative PAG Score 2
Flood risk	Not Significant or Neutral PAG Score 4	Not Significant or Neutral PAG Score 4	Minor or Slightly Negative PAG Score 3
Sub-criterion 1: Summary of Overall Protection of Health Assessment			
Overall Protection of Health Assessment	Moderately Negative PAG Score 2	Minor or Slightly Negative PAG Score 3	Minor or Slightly Negative PAG Score 3
Sub-criterion 2: Summary of Overall Health Improvement and Improving Services Assessment			
Health improvement and improving services	Minor or Slightly Positive PAG Score 5	Minor or Slightly Positive PAG Score 5	Minor or Slightly Positive PAG Score 5

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Overall Human Health Scoring for Options East of Drumsna Junction (Node J)			
Overall Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**
Preference - Professional Judgement	**Intermediate**	**Preferred**	**Preferred**

8.8.1.5 Summary

Summary Population Assessment of Stage 2 Alternatives

With respect to Alternative A: Active Travel, the Stage 2 Population assessment has determined that this measure could have a Major or Highly Positive effect among all five criteria assessed. Alternative B: Public Transport Improvements could have a Minor or Slightly Positive effect with Alternative C: Demand Management having a Moderately Positive effect.

Summary Population Assessment of Stage 2 Options

West of Drumsna Junction (Node J)

The more northern design options are slightly more preferable with the Purple West Option Corridor and the Dark Green Option Corridor being Preferred while the southern design options, the Cyan Option Corridor and Orange Option Corridor being Intermediate and Least Preferred respectively. This is primarily due to the fact that the more northern design options are more remote and are further away from populated areas, but this situation would change if the area were to become a Blueway. The Black Option Corridor was found to have a Moderately Positive impact.

East of Drumsna Junction (Node J)

The Purple East Option Corridor is Preferred while the Green Option Corridor is Least Preferred. The Yellow Option Corridor is ranked as Intermediate. The preference in this section is for the option which is providing the greatest relief from severance at Aghamore while also providing improved access and safety for local road users.

Summary Human Health Assessment of Stage 2 Alternatives and Options

The assessment of Alternatives found that all three of the proposed alternatives are likely to result in a neutral effect on health protection- i.e., there is not likely to be any pathways where other impacts- such as emissions to air, soil or water will impact human health. With regards health improvements, all three alternatives are likely to result in Minor or Slightly Positive impacts on human health through improved accessibility, economic prosperity and subsequent health improvements.

The assessment of options identified oopportunities for health improvements and improved access to services due to the option corridors and each option corridor was scored depending on their ability to provide for the following:

- Economic growth and development of tourism which can result in improved socio-economic status and can have a positive impact on health outcomes
- Increased employment and reduced unemployment, particularly long-term unemployment, can lead to improved health. If this is achieved, there will also be benefits in terms of social health including decreased social inequality
- Opportunities for a potential decrease in road traffic accidents

- Potential for improved public transport and an improved environment for cycling and walking within the Carrick-on-Shannon along roads previously occupied by heavy traffic leading to an overall increase in the health benefits

All of the proposed options are likely to give rise to Not Significant or Neutral impacts on human health.

8.8.2 Material Assets Non-Agriculture

8.8.2.1 Introduction

This section details the Stage 2 Assessment of the alternatives and options with respect to the Material Assets Non-Agriculture constraints identified in Section 4.5 Material Assets Non-Agriculture of this report.

The Stage 2 alternatives and options are described in Section 8.2. The Material Assets Non-Agriculture constraints are presented with the option corridors on Figures 8.8.2.1.0 to 8.8.2.13.3.

Section 8.8.2.2 outlines the methodology utilised to carry out the assessment of alternatives, Section 8.8.2.3 details the assessment and a summary is presented in Section 8.8.2.5.

8.8.2.2 Methodology

The assessment of Material Assets Non-Agriculture is conducted in the context of the constraints identified in Section 4.5 of this report and the following alternatives proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

For the Stage 2 Assessment, there are eight Option Corridors, five of which are to the west of Node J at Drumsna Junction (Purple West, Dark Green, Black, Orange and Cyan) and three which are to the east of Node J (Purple East, Green and Yellow). The option corridors are assessed in two sections; one west of Drumsna (Node J) and the second is east of Drumsna (Node J). The cross-section of a potential road-based solution within these corridors has not yet been determined. However, a fenceline has been developed for each option corridor within which a road design could sit. This fenceline represents the expected ‘worst-case’ scenario with respect to landtake.

For this assessment, the potential impacts on the following were assessed:

- The following property types:
  - Residential properties
  - Commercial and industrial properties
  - Amenity Spaces (Recreation, Tourism and Leisure)
  - Proposed developments
- The infrastructure for both public and private utilities/service providers

The assessment of each alternative and option includes both a quantitative and qualitative assessment. Each potential impact on Material Assets Non-Agriculture is quantified and then the level of impact and its significance assigned for each impact as listed below. Following this an overall assessment of the cumulative

impacts for the alternative is completed and scored based on the seven-point scale in Table 8.1.1.

Assessment Methodology for Material Assets Excluding Utilities and Services

For the purposes of assessing direct impacts on properties, the extents of the works required for each alternative were considered.

For the options, the indicative fenceline developed for each option corridor was regarded to include all lands required for the construction and operation of new road infrastructure. This included a potential design and a buffer of 10m from the edge of the earthworks associated with the mainline and a buffer of 3m from the edge of the earthworks associated with the sideroads. Properties within the corridors were also identified as the cross-section is undetermined and the design is not finalised at Stage 2 and could still potentially move anywhere within the corridor.

Level of Impact

The potential impact of the alternatives and options on non-agricultural properties was assessed according to the significance criteria detailed in Table 8.8.2.1.

Table 8.8.2.1 Criteria for Assessing the Significance of Impact on Non-Agricultural Properties

Significance Level / Degree of Impact	Definition
Major or Highly Negative	A non-agricultural property of national or regional importance is fully required and will be removed
Moderately Negative	A non-agricultural property or other material asset is fully required and may result in the demolition or acquisition of a dwelling or, where acquisition of a property results in loss of employment and total or partial loss of the business
Minor or Slightly Negative	Part of a non-agricultural property or other material asset is required
Not Significant or Neutral	An impact on a property which is currently occupied by a public right-of-way, e.g. a road or the non-agricultural property

With respect to the alternatives, the level of impacts for residential, commercial/industrial and amenity properties have been considered under three categories:

- All properties considered as full acquisitions are Major or Highly Negative or Moderately Negative impacts depending on the significance of the asset
- Any property holding partially impacted, depending on the extent of the landtake these impacts vary from Minor or Slightly Negative to Not Significant or Neutral. An impact on a property which is currently occupied by a public right-of-way, e.g. a road on a non-agricultural property, is considered to be Not Significant or Neutral

This assessment has been carried out and the number of affected properties, and a synopsis of the impacts, are presented in Section 8.8.2.3.

With respect to the options, the level of impacts for residential, commercial/industrial and amenity properties have been considered under three categories:

- All properties fully within the fenceline are considered as full acquisitions and are Major or Highly Negative or Moderately Negative impacts depending on the significance of the asset
- Any property holding partially within the fenceline is considered to require partial landtake. Depending on the extent of the landtake these impacts vary from Minor or Slightly Negative to Not Significant or Neutral
- An impact on a property which is currently occupied by a public right-of-way, e.g. a road, or the non-agricultural property and all properties that lie within the corridor but outside the fenceline were also included in this assessment as the cross-section is undetermined and the design may need to be realigned within the corridor. In this event, it could potentially have a direct impact on these properties. These impacts are considered to be Not Significant or Neutral.

This assessment has been carried out and the number of affected properties and a synopsis of the impacts are presented in Section 8.8.2.5.

Assessment Methodology for Utilities and Services Infrastructure

The locations of existing utilities were requested from the relevant utility service providers. At this stage of the assessment of Alternatives, it is difficult to consider all utilities that are impacted by alternatives or options.

There are considerable numbers of low voltage ESB lines, servicing every home and business in the study area. These services were not assessed as part of this assessment, as they are considered to be a minor constraint and could be readily diverted where necessary. The ESB services that have been assessed (see bullet list below) are considered to be the major utilities for this service provider and pose more significant constraints for the project.

Similarly, there are numerous small diameter foul, combined and surface water sewers and watermains throughout the study area that have not been considered as part of this assessment, as they are considered to be a minor constraint and could be readily diverted where necessary. The assessment has been carried out based on the larger diameter, more critical services, as detailed in the bulleted list below, as these pose more significant constraints for the Project.

In summary, as a preliminary assessment of the Alternatives, impacts on larger utilities and services were assessed. The following utilities and services were considered for the assessment:

- ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)
- ESB High Voltage Underground Lines (HV UG)
- ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)
- ESB Substations
- Irish Water watermains with pipe diameter greater than 300mm

- Irish Water foul or combined sewers with pipe diameters greater than 300mm
- Water/wastewater treatment plants
- Telecoms Antennas
- Eir underground services
- E-Net services
- BT services – BT were contacted however it is their policy to not provide electronic data for large swathes of areas however, they did confirm that there are BT fibre optic cables within the N4 study area. BT services are present within the N4 study area at the following locations:
    - Leitrim Leisure Centre
    - Rosebank Retail Park
    - Along the railway line
    - At the train station

In addition, the existing waste facilities, within the study area have been identified in Section 4.5 Material Assets Non-Agriculture Constraints. The methodology described above for Material Assets Non-Agriculture excluding utilities and services assessment was also used for the assessment of waste facilities. The extents of the works for each alterative and the footprint of each option was examined against these constraints identified and any waste facility within this footprint was assessed as an impact.

Level of Impact

The potential impact of the alternatives and options on utilities and services infrastructure was assessed according to the significance criteria detailed in Table 8.8.2.2.

Table 8.8.2.2 Criteria for Assessing the Significance of Impact on Utilities and Services Infrastructure

Significance Level / Degree of Impact	Definition
Major or Highly Negative Profound	Removal of a service or utility that is of national or regional importance
Moderately Negative	Major diversion of High Voltage ESB lines (38kV, 110kV or 220kV) or fibre optic telecoms
Minor or Slightly Negative	Minor diversion of High Voltage ESB lines (38kV, 110kV or 220kV) or fibre optic telecoms
Not Significant or Neutral	The diversion of low and medium voltage ESB network, telecommunications or water supply or foul sewer services

This assessment, the assessment of the alternatives has been carried out and is presented in Section 8.8.2.3. The assessment of the options is presented in Section 8.8.2.5.

8.8.2.4 Material Assets Non-Agriculture Stage 2 Alternatives Assessment

Three alternatives are proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

Alternative A: Active Travel

Alternative A will involve the addition of cycle facilities and walking facilities on the existing street network. This will involve additional road markings, signage and possible kerbing to delineate the space required for such facilities and will not require land acquisition and significant construction. None of the proposals impact on private properties or interact with major utilities or services identified.

Therefore, Alternative A: Active Travel is considered to be Not Significant or Neutral from a Material Assets Non-Agriculture perspective and given a PAG score of 4.

Alternative B: Public Transport Improvements

Alternative B will involve an improvement and/or new bus services on the existing street network. This will involve additional signage and possible bus-stops but will not require land acquisition or significant construction.

As such Alternative B: Public Transport Improvements will have no impacts on Material Assets Non-agriculture as there is no direct impact on a material asset including utilities/services and is considered to be Not Significant or Neutral and given a PAG scoring of 4.

Alternative C: Demand Management

Alternative C will involve measures to reduce the need to make the trip by car in the first instance. Accordingly, it will be a reduction measure as opposed to a provision measure with a traffic calming, reduced junction radii, pedestrian crossings on the existing road network, alteration of speed limits, reduction in on street parking and time plated pedestrianisation of existing streets (i.e. streets that are only pedestrianised within certain hours on particular days). None of which will require land acquisition or significant construction.

As such Alternative C: Demand Management will not have a significant impact on Material Assets Non-agriculture and is considered to be Not Significant or Neutral, and given a scoring of 4.

Summary

The overall assessment of the Stage 2 alternatives, in terms of Material Assets Non-Agriculture is presented in Table 8.8.2.3 below. The impact level of all three alternatives has been assessed as Not Significant or Neutral.

Table 8.8.2.3 Summary Material Assets- Non-Agriculture Stage 2 Alternatives Assessment Table

Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Material Assets Non-agriculture excluding Utilities and Services	The only measure for this alternative that may impact on Material Assets Non-Agriculture is the provision of a new pedestrian / cycle facility across the River Shannon west (upstream) of the existing bridge. However, any landtake potentially associated with this crossing would be from public lands and as such is considered not significant or neutral.	No direct impact on a material asset expected.	No direct impact on a material asset expected.
Utilities and Services	No direct impact on utilities / services expected.	No direct impact on utilities / services expected.	No direct impact on a material asset expected.
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

8.8.2.5 Material Assets Non-Agriculture Stage 2 Options Assessment

Material Assets Non-Agriculture, Excluding Utilities and Services- Options West of Drumsna Junction (Node J)

The impacts on properties are quantified for each option corridor West of Drumsna Junction (Node J) in Table 8.8.2.4.

Table 8.8.2.4 Identification of Property Impacts – West of Drumsna Junction (Node J)

Assessment Criteria	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor		Black Option Corridor
	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design
Residential Acquisitions	6	6	2	0		0
Residential Partial Landtake	17	17	20	15		2
Residential Properties within the Corridor*	123	117	29	28		21
Commercial / Industrial Acquisitions	1	1	0	0		0
Commercial / Industrial Partial Landtake	2	4	0	0		0
Commercial / Industrial Properties within the Corridor*	3	3	0	0		0
Amenity Acquisitions	0	2	0	0		0
Amenity Partial Landtake	5	2	0	0		0
Amenity within the Corridor*	1	1	1	1		0
Proposed Development Full Impact	1	1	0	0		0
Proposed Development Partial Impact	2	1	0	0		0

**These are properties (all types) outside of the footprint of the potential design but within the option corridor.*

Cyan Option Corridor with Pink Design Option

The Cyan Option Corridor requires six full residential property acquisitions, none of these properties are of national or regional importance and as such these impacts

are moderately negative. This option corridor requires a further possible partial landtake from 17 residential properties and these impacts are minor or slightly negative. There are 123 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires the full acquisition of one commercial/industrial property (moderately negative), partial landtake from two commercial/industrial properties (minor or slightly negative) and there are three additional commercial/industrial properties within the corridor but outside the fenceline which is considered not significant or neutral.

There are no amenities wholly enclosed within the fenceline but there is possible landtake from five amenities which are considered minor or slightly negative and there is one amenity within the corridor but outside the fenceline which is considered not significant or neutral.

There is one planning application fully within the fenceline which is considered moderately negative and two planning applications partially within the fenceline which is considered minor or slightly negative.

As a result, this Cyan Option Corridor is considered to be Moderately Negative (2) and is ranked as Least Preferred.

Orange Option Corridor with Orange Design Option

The Orange Option Corridor is similar to that of the Cyan Option Corridor and requires six full residential property acquisitions, none of these properties are of national or regional importance and as such these impacts are moderately negative. The option has a further partial landtake from 17 residential properties which is minor or slightly negative. There are 117 additional residential properties within the corridor but outside the fenceline resulting in a not significant or neutral impact.

This option would require the full acquisition of one commercial/industrial properties resulting in a moderately negative impact, the partial landtake from four commercial/industrial properties which is minor or slightly negative and there are three additional commercial/industrial property within the corridor but outside the fenceline which is a not significant or neutral impact.

There is full landtake from two amenities (moderately negative) and partial landtake from two amenities (minor or slightly negative). There is one amenity within the corridor but outside the fenceline resulting in a not significant or neutral impact.

There is one planning application fully within the fenceline which is considered moderately negative and one planning application partially within the fenceline which is considered minor or slightly negative.

As a result, the Orange Option Corridor is considered to be Moderately Negative (2) and is ranked as Least Preferred.

Purple West Option Corridor with Purple West Design Option

The Purple West Option Corridor requires the full acquisition of two residential properties, neither of these properties are of national or regional importance and as such these impacts are moderately negative. There is partial landtake from 20

residential properties which is minor or slightly negative and there are 29 additional residential properties within the corridor but outside the fenceline resulting in a not significant or neutral impact.

There are no impacts on commercial/industrial properties or planning applications, to the west of Drumsna Junction, on the Purple West Option Corridor. There are no amenities within the fenceline nor the possible landtake from an amenity either. There is one amenity within the corridor but outside the fenceline resulting in a not significant or neutral impact. Should a Blueway be developed along the river, this option corridor could impact it.

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as Intermediate.

Dark Green Option Corridor with Grey Design Option

The Dark Green Option Corridor has no impacts on commercial/industrial properties or planning applications. It does not require the full acquisition of any residential properties and as such the impact is minor or slightly positive. There is partial landtake from 15 residential properties which is minor or slightly negative and there are 28 additional residential properties within the corridor but outside the fenceline, resulting in a not significant or neutral impact. There are no amenities within the fenceline nor the possible landtake from an amenity. There is one amenity within the corridor but outside the fenceline (not significant or neutral). Should a Blueway be developed along the river, this option corridor could impact it.

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as the Preferred Option Corridor.

Black Option Corridor with the Black Design

The Black Option Corridor is the rural link road located to the north of Carrick-on-Shannon Town. It has no impacts on commercial/industrial properties, planning applications or amenities and requires no full acquisition of a residential property, all of which are not significant or neutral impacts. It does require partial landtake from two residential properties which is a minor or slightly negative impact and there are 21 residential properties within the corridor but outside the fenceline (not significant or neutral).

As a result, this option corridor is considered to be Minor or Slightly Negative (3). This option corridor is not compared to the other option corridors and as such has not been ranked with a preference.

The assessment matrix of these impacts for each option corridor is presented in Table 8.8.2.5 below.

Table 8.8.2.5 Assessment Matrix of Material Assets Non-Agriculture, excluding Utilities and Services – West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Residential	There are 6 Moderately Negative, 17 Minor or Slightly Negative and 123 Not Significant or Neutral impacts associated with this option corridor	There are 6 Moderately Negative, 17 Minor or Slightly Negative and 117 Not Significant or Neutral impacts associated with this option corridor	There are 2 Moderately Negative, 20 Minor or Slightly Negative and 29 Not Significant or Neutral impacts associated with this option corridor	There are 15 Minor or Slightly Negative and 28 Not Significant or Neutral impacts associated with this option corridor		There are 2 Minor or Slightly Negative and 21 Not Significant or Neutral impacts associated with this option corridor
Commercial / Industrial	There is 1 Moderately Negative, 2 Minor or Slightly Negative and 3 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative, 4 Minor or Slightly Negative and 3 Not Significant or Neutral impacts associated with this option corridor	There are 0 commercial / industrial impacts associated with this option corridor	There are 0 commercial / industrial impacts associated with this option corridor		There are 0 commercial / industrial impacts associated with this option corridor
Amenity	There are 5 Minor or Slightly Negative and 1 Not Significant or Neutral impacts associated with this option corridor	There are 2 Moderately Negative and 2 Minor or Slightly Negative and 1 Not Significant or Neutral impact associated with this option corridor.	There is 1 Not Significant or Neutral impacts associated with this option corridor	There is 1 Not Significant or Neutral impacts associated with this option corridor		There are 0 amenity property impacts associated with this option corridor
Proposed Development	There are 1 Moderately Negative and 2 Minor or Slightly Negative impacts associated with this option corridor	There are 1 Moderately Negative and 1 Minor or Slightly Negative impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor		There are 0 proposed development impacts associated with this option corridor

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Overall Assessment	There are 8 Moderately Negative, 26 Minor or Slightly Negative and 127 Not Significant or Neutral impacts associated with this option corridor	There are 10 Moderately Negative, 24 Minor or Slightly Negative and 121 Not Significant or Neutral impacts associated with this option corridor	There are 2 Moderately Negative, 20 Minor or Slightly Negative and 30 Not Significant or Neutral impacts associated with this option corridor	There are 15 Minor or Slightly Negative and 29 Not Significant or Neutral impacts associated with this option corridor		There are 2 Minor or Slightly Negative and 21 Not Significant or Neutral impacts associated with this option corridor
Scoring						
Overall Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**3**	**3**		**3**
Preference - Professional Judgement	**Least Preferred**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

Utilities and Services West of Drumsna Junction (Node J)

The assessment for the number of conflicts with utilities and services for each Option Corridor West of Drumsna Junction (Node J) is presented in Table 8.8.2.6 below. These impacts range from crossing of the option corridor to diversions in kilometres of service ducts and pipelines. Please note that due to the availability of additional data between the Stage 1 and 2 assessments, there are a great deal more ESB impacts numerated than at Stage 1

Table 8.8.2.6 No. of Utilities and Services Conflicts - West of Drumsna Junction (Node J)

Assessment Criteria	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor		Black Option Corridor
	Pink Design	Orange Design	Purple Design	Grey Design		Black Design
ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)	4 No. 110kV 1 No. 38kV Total = 5	4 No. 110kV 1 No. 38kV Total = 5	3 No. 110kV 1 No. 38kV Total = 4	3 No. 110kV 1 No. 38kV Total = 4		0 No.
ESB High Voltage Underground Lines (HV UG)	2 No. 38kV	2 No. 38kV	0 No.	0 No.		0 No.
ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)	20 No.	21 No.	9 No.	12 No.		2 No.
ESB Substations	None	None	None	None		None
Irish Water watermains with pipe diameter greater than 300mm	0m length	0m length	694m length	536m length		97m length
Irish Water foul or combined sewers with pipe diameters greater than 300mm	0m length	0m length	0m length	0m length		0m length
Water / wastewater treatment plants	None	None	None	None		None
Licenced waste facilities	None	None	None	None		None
Telecoms Antenna	None	None	None	None		None
Eir underground services	5790m length	5696m length	3003m length	1905m length		99.7m length
ENet	70m length	68m length	0m length	0m length		0m length

Cyan Option Corridor

The Cyan Option Corridor has five conflicts with High Voltage Overhead lines two of which are long skewed crossings. In addition, there are two conflicts with High Voltage Underground lines. These are considered to be moderately negative in significance.

Furthermore, there are 20 conflicts with medium voltage ESB lines and a relatively short length of Eir Underground services and as such these impacts are considered to be not significant or neutral.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the long skewed ESB crossings.

Orange Option Corridor

The Orange Option Corridor has five conflicts with High Voltage Overhead Line crossings, two of which are long skewed crossings. In addition, there are two conflicts with a High Voltage Underground lines, these are considered to be moderately negative in significance.

There are 21 conflicts with medium voltage ESB lines and a relatively short length of Eir Underground services and as such these impacts are also considered to be not significant or neutral.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the long skewed ESB crossings.

Purple West Option Corridor

The Purple West Option Corridor has four conflicts with High Voltage Overhead Line crossings. This includes an angle tower near the centreline of the Purple West Corridor. These are considered to be moderately negative in significance.

There are nine conflicts with medium voltage ESB lines and a relatively short length of Irish Water watermains with pipe diameter greater than 300mm and Eir Underground services and as such these impacts are also considered to be minor or slightly negative.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the change in direction of one of the High Voltage Overhead crossings.

The proposed junction between the Purple West Option Corridor and the R280 results in a realignment of the R280 to the south of the junction which impacts on the corner of one Licensed Waste Facility W0064 (CoS Landfill, Ballynamoney) on the R280.

Dark Green Option Corridor

The Dark Green Option Corridor has four conflicts with High Voltage Overhead Line crossings. This includes an angle tower near the centreline of the Dark Green Corridor. These are considered to be moderately negative in significance.

There are 12 conflicts with medium voltage ESB lines and a relatively short length of Irish Water watermains with pipe diameter greater than 300mm and Eir Underground services and as such these impacts are also considered to be minor or slightly negative.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Intermediate due to the difficulty associated with the change in direction of one of the High Voltage Overhead crossings.

The proposed junction between the Purple West Option Corridor and the R280 results in a realignment of the R280 to the south of the junction which impacts on the corner of one Licensed Waste Facility W0064 (CoS Landfill, Ballynamoney) on the R280.

Black Option Corridor

The Black Option Corridor is a standalone option which will have little impact on the surrounding area's utilities. This option corridor has two conflicts with medium voltage ESB network and conflicts with a relatively short length of Irish Water watermains with pipe diameter greater than 300mm and Eir Underground services and as such these impacts are also considered to be not significant or neutral.

As a result, this option corridor is considered to be Not Significant or Neutral (4). This option corridor is not compared to the other option corridors and as such has not been ranked.

Table 8.8.2.7 Assessment Matrix of Utilities and Services – Options West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Utilities and Services	There are 7 Moderately Negative and 20 Not Significant or Neutral impacts associated with this option corridor	There are 7 Moderately Negative and 21 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative and 9 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative and 12 Not Significant or Neutral impacts associated with this option corridor		There are 3 not significant or Neutral impacts associated with this option corridor
Licenced Waste Facilities	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor	There is 1 licenced waste facility impact associated with this option corridor	There is 1 licenced waste facility impact associated with this option corridor		There are 0 Licenced waste facilities impacts associated with this option corridor
Scoring						
Qualitative Assessment	Includes a single long skewed ESB crossing **Moderately Negative**	Includes a single long skewed ESB crossing **Moderately Negative**	Includes an angle tower / change in direction of HV line **Moderately Negative**	Includes an angle tower / change in direction of HV line **Moderately Negative**		**Not Significant** or **Neutral**
Score / Impact Level	**2**	**2**	**2**	**2**		**4**
Preference - Professional Judgement	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**		**N/A**

Overview - West of Drumsna Junction (Node J)

In the overall ranking of the option corridors for west of Drumsna Junction (Node J) in terms of Material Assets Non-Agriculture the number of property acquisitions were considered to be more significant than conflicts with utilities as these utilities can be diverted as part of the works i.e. a moderate negative on sub-criterion Properties is considered more impactful than a moderate negative on Services and Utilities. Therefore, the Preferred Option Corridor - west of Drumsna Junction is the Dark Green Option corridor and the Orange and Cyan Option Corridors are determined to be the least preferred options. Table 8.8.2.8 summarises the order of ranking for the option corridors in west of Drumsna Junction (Node J).

Table 8.8.2.8 Summary Material Assets-Non-Agriculture Assessment Matrix of Option Corridors West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Properties	Moderately Negative	Moderately Negative	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
Services and Utilities	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative		Not Significant or Neutral
Scoring						
Overall Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**3**	**3**		**3**
Preference - Professional Judgement	**Least Preferred**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

Material Assets Non-Agriculture, Excluding Utilities and Services - East of Drumsna Junction (Node J)

The impacts on properties are quantified for each option corridor in East of Drumsna Junction (Node J) in Table 8.8.2.9.

Table 8.8.2.9 Identification of Property Impacts – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
	Yellow Design	Green Design	Purple Design
Residential Acquisitions	5	4	14
Residential Partial Landtake	36	39	26
Residential Properties within the Corridor*	49	50	51
Commercial / Industrial Acquisitions	0	0	1
Commercial / Industrial Partial Landtake	3	6	3
Commercial / Industrial Properties within the Corridor*	0	0	0
Amenity Acquisitions	0	0	0
Amenity Partial Landtake	2	2	0
Amenity within the Corridor*	0	0	2
Proposed Development Full Impact	0	0	0
Proposed Development Partial Impact	0	0	0

**These are properties (all types) outside of the footprint of the potential design but within the option corridor.*

Yellow Option Corridor

The Yellow Option Corridor requires the full acquisition of five residential properties, none of these properties are of national or regional importance and as such these impacts are moderately negative. This option corridor requires a further possible partial landtake from 36 residential properties and these impacts are minor or slightly negative. There are 49 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires the partial landtake from three commercial/industrial properties which are minor or slightly negative and there are no additional commercial/industrial property within the corridor but outside the fenceline.

There are no amenities fully within the fenceline but there is possible partial landtake from two amenities, minor or slightly negative. There are no amenities

within the corridor but outside the fenceline. Lastly, there are no planning applications directly impacted by the Yellow Option Corridor.

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as Intermediate.

Green Option Corridor

The Green Option Corridor requires the full acquisition of four residential properties, none of these properties are of national or regional importance and as such these impacts are moderately negative. This option corridor requires a further possible partial landtake from 39 residential properties and these impacts are minor or slightly negative. There are 50 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires no full acquisition of a commercial/industrial property but does require partial landtake from six commercial/industrial properties of minor or slightly negative impact rating and there are no additional commercial/industrial properties within the corridor but outside the fenceline so these impacts are not significant or neutral.

There are no amenities fully within the fenceline but there is possible partial landtake from two amenities of minor or slightly negative impact. There are no amenities within the corridor but outside the fenceline. There are no planning applications directly impacted by the Green Option Corridor.

As a result, this option corridor is considered to be Minor or Slightly Negative (3) and is ranked as Preferred.

Purple East Option Corridor

The Purple East Option Corridor requires the full acquisition of 14 residential properties, none of these properties are of national or regional importance and as such these impacts are moderately negative. This option corridor requires a further possible partial landtake from 26 residential properties and these impacts are minor or slightly negative. There are 51 additional residential properties within the corridor but outside the fenceline and these impacts are not significant or neutral.

This option corridor requires the acquisition of one commercial/industrial property which is considered moderately negative and the partial landtake of three further commercial/industrial properties which is considered minor or slightly negative. No other commercial/industrial properties are within the Option Corridor. No amenities are within the fenceline or are considered to be possible landtake from an amenity. However, there are two amenities within the corridor but outside the fenceline considered not significant or neutral. There are no planning applications directly impacted by the Purple East Option Corridor.

As a result, this option corridor is considered to be Moderately Negative (2) and is ranked as Least Preferred.

The assessment matrix of these impacts for each option corridor is presented in Table 8.8.2.10 below.

Table 8.8.2.10 Assessment Matrix of Material Assets Non-Agriculture excluding Utilities and Services – East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Residential	There are 5 Moderately Negative, 36 Minor or Slightly Negative and 49 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative, 39 Minor or Slightly Negative and 50 Not Significant or Neutral impacts associated with this option corridor	There are 14 Moderately Negative, 26 Minor or Slightly Negative and 51 Not Significant or Neutral impacts associated with this option corridor
Commercial / Industrial	There are 3 Minor or Slightly Negative impacts associated with this option corridor	There are 6 Minor or Slightly Negative impacts associated with this option corridor	There is 1 Moderately Negative and 3 Minor or Slightly Negative impacts associated with this option corridor
Amenity	There are 2 Minor or Slightly Negative impacts associated with this option corridor	There are 2 Minor or Slightly Negative impacts associated with this option corridor	There are 2 Not Significant or Neutral impacts associated with this option corridor
Proposed Development	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor	There are 0 proposed development impacts associated with this option corridor
Overall Assessment	There are 5 Moderately Negative, 41 Minor or Slightly Negative and 49 Not Significant or Neutral impacts associated with this option corridor	There are 4 Moderately Negative, 47 Minor or Slightly Negative and 50 Not Significant or Neutral impacts associated with this option corridor	There are 15 Moderately Negative, 29 Minor or Slightly Negative and 53 Not Significant or Neutral impacts associated with this option corridor
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Moderately Negative**
Score / Impact Level	**3**	**3**	**2**
Preference - Professional Judgement	**Intermediate**	**Preferred**	**Least Preferred**

Utilities and Services - East of Drumsna Junction (Node J)

The assessment for the number of conflicts with utilities and services for each Option Corridor East of Drumsna Junction (Node J) is presented in Table 8.8.2.11 below. These impacts range from crossing of the option corridor to diversions of kilometres of service ducts and pipelines.

Table 8.8.2.11 No. of Utilities and Services Conflicts – East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
	Yellow Design	Green Design	Purple Design
ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)	1 No. 220 kV	1 No. 220 kV	1 No. 220 kV
ESB High Voltage Underground Lines (HV UG)	None	None	None
ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)	20	20	22
ESB Substations	None	None	None
Irish Water water mains with pipe diameter greater than 300mm	5023m length	5659m length	3391m length
Irish Water foul or combined sewers with pipe diameters greater than 300mm	None	None	None
Water / wastewater treatment plants	None	None	None
Licenced waste facilities	None	None	None
Telecoms Antenna	None	None	None
Eir underground services	9100m length	10781m length	11061m length
ENet	None	None	None
BT services	None	None	None

The Purple East, Green, Yellow and Blue East Option Corridors are in conflict with the following services and utilities:

- High Voltage Overhead Line crossings, which are considered to be moderately negative impacts particularly as there is a 220kV Overhead crossing of all the options near Aghamore
- Irish Water watermains with pipe diameter greater than 300mm which are considered to be not significant or neutral impacts. The lengths of each conflict are relatively similar ranging from circa 3.4km to 7.4km

- Eir Underground services which are considered to be not significant or neutral impacts. The lengths of each conflict are relatively similar ranging from circa 9.1km to 14.7km

Based on the assessment of utilities and services and licenced waste facilities there is no distinguishable difference among the options west of Drumsna Junction (Node J) and so they are all deemed 'Intermediate'.

Overview East of Drumsna Junction (Node J)

In the overall ranking of the option corridors for East of Drumsna Junction (Node J) in terms of Material Assets Non-Agriculture the number of property acquisitions are weighted more heavily than conflicts with utilities as utilities can be diverted as part of the works. Table 8.8.2.13 below summarises the order of ranking for the route options east of Drumsna Junction (Node J).

Table 8.8.2.12 Assessment Matrix of Utilities and Services – East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Utilities and Services	There is 1 Moderately Negative and 22 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 22 Not Significant or Neutral impacts associated with this option corridor	There is 1 Moderately Negative and 24 Not Significant or Neutral impacts associated with this option corridor
Licenced waste facilities	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor	There are 0 Licenced waste facilities impacts associated with this option corridor
Scoring			
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**
Score / Impact Level	**2**	**2**	**2**
Preference - Professional Judgement	**Intermediate**	**Intermediate**	**Intermediate**

Table 8.8.2.13 Summary Material Assets-Non-Agriculture Assessment Matrix of Option Corridors – East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Properties	Minor or Slightly Negative	Minor or Slightly Negative	Moderately Negative
Services and utilities	Moderately Negative	Moderately Negative	Moderately Negative
Scoring			
Overall Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Moderately Negative**
Score / Impact Level	**3**	**3**	**2**
Preference - Professional Judgement	**Intermediate**	**Preferred**	**Least Preferred**

8.8.2.6 Summary

The overall assessment of the Stage 2 alternatives, in terms of material assets non-agriculture is presented in Table 8.8.2.3. The impact level of all three alternatives has been assessed as Not Significant or Neutral.

The overall ranking preferences for the option corridors west and east of Drumsna Junction (Node J), in terms of Material Assets Non-Agriculture are shown in Table 8.8.2.8 and Table 8.8.2.13 respectively.

It has been determined that the Preferred Option Corridor west of Drumsna Junction (Node J) is the Dark Green Option Corridor in relation to Material Assets Non-Agricultural. The Purple West is ranked as Intermediate, and the Cyan and Orange Option Corridors are Least Preferred from a Material Assets Non-Agricultural perspective.

East of Drumsna Junction (Node J) the Green Option Corridor is the Preferred Option Corridor as it has the lowest number of residential acquisitions. The Yellow Option Corridor is considered as Intermediate, and the Purple East Option Corridor is Least Preferred as it has the most amount of residential property acquisitions.

8.8.3 Material Assets-Agriculture

8.8.3.1 Introduction

This section details the Stage 2 Assessment of the alternatives and options described in Section 2 with respect to the Material Assets-Agriculture constraints identified in Section 4.6 Material Assets-Agriculture of this report. The Stage 2 options, and the Material Assets-Agriculture constraints are presented in Figures 8.8.3.1.0 to 8.8.3.3.5.

Section 8.8.3.2 outlines the methodology that was used to carry out the study, Section 8.8.3.3 details the Stage 2 Assessment of alternatives while Section 8.8.3.4 contains the Stage 2 Assessment of the options. A summary is presented in Section 8.8.3.5.

8.8.3.2 Methodology

The data sources which were used to inform this Stage 2 Assessment are the same as those used in the Stage 1 alternatives and options assessments outlined in Section 6.5.3.2 and Section 7.5.3.2 respectively.

The Stage 2 methodology used is also the same as that used in the Stage 1 assessment of alternatives and options, as outlined in Section 6.5.3.2 and Section 7.5.3.2 respectively.

Following the Stage 1 assessment of the alternatives, the improvement to rail service element of the public transport alternative was discounted and as such does not make up part of this Stage 2 Assessment. The new pedestrian crossing bridge over the River Shannon has also been discounted.

Similarly, some changes to the road-based options have been made to those assessed at Stage 1. The Cyan Option Corridor has changed slightly since the Stage 1 assessment. At Stage 2 an additional tie back to the R368 (Elphin Road) south of the railway bridge and a new roundabout junction are provided connecting the N4 and the R368. This has resulted in an additional area of corridor to be considered as part of this Stage 2 Assessment. The Stage 1 on-line management option i.e. the Blue Option has been discounted due to not meeting the Project Objectives and therefore is excluded from the Stage 2 Assessment.

The only change in assessment approach from the Stage 1 assessment relates to the assessment of the options. The Stage 1 assessment focused on a 300m wide Option Corridor; however, the Stage 2 Assessment also assesses the landtakes of the provisional Design Fenceline – adding another layer of detail to the comparison of the Landtake Criterion.

The criteria set out in section 3.1.5 of the 2016 PAG Guidelines[2] (i.e. farm size, farm types, landtake, severance and viability) are used to assess each alternative and option from a qualitative and quantitative perspective and scored according to the PAG seven point scale listed in Table 8.1.1.

8.8.3.3 Material Assets- Agriculture Stage 2 Assessment of Alternatives

Alternative A: Active Travel

Alternative A (Active Travel) comprises improvements to cycling facilities by developing a comprehensive cycle network and providing cycle parking, changing areas and e-bike charging facilities. The provision of a new pedestrian and cycle bridge has been excluded from this alternative. Pedestrian facilities will be improved through provision of improved crossings and footpaths and non-motorised areas within the town. While Alternative A extends outside the urban areas of Carrick-on-Suir and Cortober, it will have minimal impacts on agriculture, requiring very little landtake to allow for improvements to cycling and walking facilities along the existing road network. This alternative is assessed as Not Significant or Neutral i.e. PAG score 4.

Alternative B: Public Transport Improvements

Alternative B comprises improvements to the public transport system by improving parking at the Carrick-on-Shannon railway station, linking nearby urban settlements with increased bus services, developing a mobility hub in the town centre to facilitate interchange with other modes of transport and provision of a mini-bus service to connect more remote areas. The improvement to rail service element of the public transport alternative has been excluded from this alternative. Alternative B will have minimal impacts on agriculture, requiring very little to no landtake to allow for improvements to the public transport system and will be mainly located in urban centres. This alternative is assessed as Not Significant or Neutral i.e. PAG score 4.

Alternative C- Demand Management

Alternative C includes measures to reduce demand for private car journeys such as reduced speed limits, providing new pedestrian crossings at junctions, traffic calming, reducing parking areas on certain streets and limiting vehicular access to certain times of the day. Alternative C will have minimal impacts on agriculture, requiring very little landtake to allow for measures to reduce vehicular traffic and these measures will mainly be located in urban centres. This alternative is assessed as Not Significant or Neutral i.e. PAG score 4.

Summary Alternatives Assessment

The size of affected farms is approximately 25ha on average (as per CSO data for the study area[8]). The PAG score for this criterion for all three alternatives is 2 (moderately negative) on the basis that the effects on smaller farms will be proportionately higher.

[8] Central Statistics Office (December 2012), Census of Agriculture 2010 – Final Results. Available from: https://www.cso.ie/en/media/csoie/releasespublications/documents/agriculture/2010/full2010.pdf [Accessed on 04/08/2020]

There is a very low proportion of dairy and equine farms in the study area (based on CSO data[8] and on-site survey). The PAG score for the farm type criterion for all three alternatives is 3 (Minor or Slightly Negative).

All three alternatives will have minimal impacts on landtake. Any landtake that will occur will, in many instances, be confined to urban and non-agricultural land. The PAG score for the landtake criterion for all three alternatives is 4 (Not Significant or Neutral).

The potential for all three of the alternatives to cause severance will be very small due to the limited landtake, and their relevant locations- adjoining existing roads and within urban settings. The PAG score for the Severance (with mitigation) Criterion for all three alternatives is 4 (Not Significant or Neutral).

The baseline viability is low-medium due to the medium agricultural potential of agricultural land (see section 4.6.3.2 Soil Types and section 4.6.3.3 Agricultural Land of the Constraints Report Chapter) and low percentage of high-sensitive enterprises (dairy and equine) in the study area. In addition, many of the alternatives will be located within urban settings. The PAG score for the viability criterion for all three alternatives is 4 (Not Significant or Neutral).

In summary, the effects of the alternatives on agriculture will be neutral overall due to the location of the alternatives, which is mainly in urban centres and along existing road infrastructure, and the limited potential for landtake.

Having assessed the combined criteria (farm size, farm type, landtake, severance (with mitigation) and viability) and assessed the qualitative aspects of the alternatives the overall impact assessment, using the PAG seven-point scale, is Not Significant or Neutral i.e. 4 for each of the three alternatives. The assessment results are summarised in Table 8.8.3.1.

Table 8.8.3.1 Material Assets- Agriculture Assessment Matrix of Stage 2 Alternatives

Assessment Criteria	ALTERNATIVE A ACTIVE TRAVEL	ALTERNATIVE B PUBLIC TRANSPORT	ALTERNATIVE C DEMAND MANAGEMENT
Farm size	25 ha (based on CSO statistics for the study area). **PAG Score 2**	25 ha (based on CSO statistics for the study area). **PAG Score 2**	25 ha (based on CSO statistics for the study area). **PAG Score 2**
Farm type	Mainly low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total). **PAG Score 3**	Mainly low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total). **PAG Score 3**	Mainly low – medium sensitivity – mainly beef / sheep farms (97 – 98% of total). **PAG Score 3**
Landtake and impact on farm yards	Very low landtake impacts associated with development along existing road network and within urban areas. **PAG Score 4**	Very low landtake impacts associated with development along existing road network and within urban areas. **PAG Score 4**	Very low landtake impacts associated with development along existing road network and within urban areas. **PAG Score 4**
Severance Impacts	Very low severance impacts associated with development along existing road network and within urban areas. **PAG Score 4**	Very low severance impacts associated with development along existing road network and within urban areas. **PAG Score 4**	Very low severance impacts associated with development along existing road network and within urban areas. **PAG Score 4**
Impacts on Viability	Viability is low-medium throughout study area and low within urban areas. **PAG Score 4**	Viability is low-medium throughout study area and low within urban areas. **PAG Score 4**	Viability is low-medium throughout study area and low within urban areas. **PAG Score 4**
Scoring			
Qualitative Assessment	Alternatives located mainly in urban centres and along existing road infrastructure and the limited potential for landtake. **Not Significant** or **Neutral**	Alternatives located mainly in urban centres and along existing road infrastructure and the limited potential for landtake. **Not Significant** or **Neutral**	Alternatives located mainly in urban centres and along existing road infrastructure and the limited potential for landtake. **Not Significant** or **Neutral**
Overall Score / Impact Level	**4**	**4**	**4**

8.8.3.4 Material Assets- Agriculture Stage 2 Assessment of Options

Assessment of Options West of Drumsna Junction (Node J)

The assessment matrix of options West of Drumsna Junction (Node J) are presented in Table 8.8.3.2. There are three options which follow an alignment north of Carrick-on-Shannon: the Black Option Corridor with the Black Design, the Purple West Option Corridor with the Purple West Design and the Dark Green Option Corridor with the Grey Design.

The Black Option Corridor is the shortest corridor. It is 1.2km in length all of which is off-line. There are no farm yards within the corridor. The landtake of the 150m wide corridor is approximately 14ha and the severance impact will be low due to the short off-line length (1.2km). The baseline farm viability is low-medium. The landtake of the Black Design Fenceline is approximately 5ha of which 50% is poor quality land (peats and alluvial soils). This Option is assessed as Not Significant or Neutral i.e. PAG score 4.

The Cyan Option Corridor is the longest overall (11.9km), however it is on-line for 5.3km. The area of agricultural land within the corridor is 267ha, adjusted to 208ha to take into account the on-line section. There is 50ha within the corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation'* i.e. 19% of the agricultural landtake. The area of poor quality land (peats and alluvial soils) is 105ha i.e. 39% of the agricultural landtake. This corridor impacts on two highly sensitive enterprises (a dairy farm and agri-tourism enterprise). There are 8 farm yards within the corridor, three of which are high sensitivity (two adjoining poultry yards and a mushroom facility). The landtake of the Pink design is approximately 57ha and there are 2 medium sensitivity farm yards within the fenceline. Approximately 22% of the agricultural landtake of the Pink Design Fenceline is classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' - which is reflective of the entire corridor. Approximately 38% of the Pink Design Fenceline is poor-quality land (peats and alluvial soils) which is similar to the entire corridor. The Pink design has an impact at the edge of one highly sensitive dairy enterprise and severs the access road between two parts of the agri-tourism enterprise; however with mitigation the link between the two parts of this holding could be maintained. This option is assessed as Minor or Slightly Negative i.e. PAG score 3.

The Orange Option Corridor is 9.3km long. It is on-line for 4.8km. The area of agricultural land within the corridor is 200ha, and when adjusted by 50% to allow for a lower expected landtake on the on-line sections the landtake is 148ha. There is 48ha within the corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' i.e. 24% of the agricultural landtake. The area of poor-quality land (peats and alluvial soils) is 85ha i.e. 43% of the agricultural landtake. It affects one high sensitivity enterprise (dairy farm) and there are 6 medium sensitivity farm yards within the corridor. The landtake of the Orange design is approximately 45ha and there are 2 medium sensitivity farm yards within the fenceline. Approximately 17% of the agricultural landtake of the Design Fenceline is classified as '*Lands principally occupied by agriculture, with*

significant areas of natural vegetation' - which is slightly lower than the entire corridor. Approximately 41% of the Orange Design Fenceline is poor-quality land (peats and alluvial soils) which is similar to the entire corridor. The Orange design has a large impact on one highly sensitive dairy enterprise. This option is assessed as Minor or Slightly Negative i.e. PAG score 3

The Purple West Option Corridor is 10.8km long and is on-line for 2kms. With a similar landtake to the Cyan Option Corridor, the Purple corridor has the second highest landtake of agricultural land when adjusted for on-line sections. The area of agricultural land within the corridor is 236ha and 214ha when adjusted for the on-line section. There is 63ha within the corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' i.e. 27% of the agricultural landtake. The area of poor-quality land within the corridor (peats and alluvial soils) is 71ha i.e. 30% of the agricultural landtake. There are no highly sensitive enterprises and 5 farm yards within the corridor. The landtake of the Purple Design Fenceline is approximately 63ha and there are no farm yards within the fenceline. Approximately 22% of the agricultural landtake of the Design Fenceline is classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' - which is similar to the entire corridor. Approximately 26% of the agricultural landtake of the Design Fenceline is classified as poor-quality land (peats and alluvial soils) which is also similar to the entire corridor. This option is assessed as Minor or Slightly Negative i.e. PAG score 3.

The Dark Green Option Corridor is 10.6km long and is off-line for its entirety. This corridor has the highest landtake of agricultural land i.e. 239ha - compared to Cyan, Purple and Orange. There is 93ha within the corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' i.e. 39% of the agricultural landtake. The area of poor quality land within the corridor (peats and alluvial soils) is 119ha i.e. 50% of the agricultural landtake. There are no highly sensitive enterprises and 6 farm yards within the corridor. The landtake of the Grey Design Fenceline is approximately 61ha and there are no farm yards within the fenceline. Approximately 34% of the agricultural landtake of the Grey Design Fenceline is classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' - which is reflective of the entire corridor. Approximately 29% of the agricultural landtake of the Design Fenceline is classified as poor-quality land (peats and alluvial soils) which is lower than the entire corridor. This option is assessed as Minor or Slightly Negative i.e PAG score 3.

There are two options which follow an alignment south of Carrick-on-Shannon; the Cyan Option Corridor and Pink design and Orange Option Corridor and Orange design.

Comparison of Options West of Drumsna Junction (Node J)

Farm Size Criterion

All options West of Node J will affect farms of a relatively small size (25ha as determined from CSO statistics) compared to the national average (32.7ha). Therefore, the PAG score for all options West of Drumsna Junction (Node J) is 2

or Moderately Negative on the basis that impacts will be proportionately higher on smaller farms.

Farm Type Criterion

Within the entire study area there is a low percentage of highly sensitive farming enterprises (e.g. dairying and equine). There is a dairy enterprise, an agri-tourism enterprise, poultry houses and a mushroom production facility within the Cyan and Orange Option Corridors and no high sensitivity enterprises within the Purple West, Dark Green and Black Option Corridors. The PAG score for the farm type criteria is 3, 3, 4, 4 and 4 for Cyan, Orange, Purple West, Dark Green and Black options respectively. Options to the north of Carrick-on-Shannon have the most favourable impact on highly sensitive enterprises. The Orange option will have the highest magnitude impact on one dairy farm and is least favoured for this criterion.

Landtake Criterion

The Black Option is assessed as a standalone option. Based on the low landtake and short overall length the impacts due to landtake is assessed a Not Significant or Neutral i.e. PAG score 4.

When the four option corridors (Cyan, Orange, Purple West and Dark Green) are compared the Dark Green has the highest landtake. Cyan and Purple have similar landtakes[9] (87% and 90% of the Dark Green) and therefore rank second highest for landtake. The landtake of the Orange Option Corridor is 62% of the Dark Green. When the provisional design fencelines are compared the Purple has the highest landtake. The landtake of the Grey design is similarly high - 97% of the Purple design. The Pink and Orange designs have 90% and 71% respectively of the Purple landtake design.

The Cyan Option Corridor affects the highest number of yards (i.e. 8) compared to 6 for Orange and Dark Green and 5 for Purple. The Pink and Orange designs each affect 2 medium sensitivity farm yards – the other designs affect no farm yards.

Higher areas of poor quality land is desirable from an agricultural perspective. The corridors with the highest areas of peat and alluvial soils are the Dark Green and Cyan Option Corridors (119ha and 105ha). Purple and Orange Option Corridors have the lowest areas of peat and alluvial soils (71ha and 85ha). The areas of poor quality land for the design fencelines are 22ha, 18.5ha, 17.5ha and 16ha respectively for the Pink, Orange, Grey and Purple designs. Large areas of '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' (as derived from Corine data) indicate non-intensively farmed areas which is also desirable from an agricultural point of view. The corridor with the highest areas of natural vegetation is the Dark Green with 93ha followed by Purple West with 63ha. The Cyan and Orange Option Corridors have the lowest areas of natural vegetation (50ha and 48ha respectively).

In conclusion the landtake PAG scores for the four options is 2, 3, 2 and 2 for Cyan, Orange, Purple West and Dark Green options respectively. In comparison to the other options Orange has the most favourable landtake impact.

[9] Land-take excludes forestry, water, urban and mining land

Severance (with mitigation) Criterion

The Black is assessed as a standalone option. Based on the short overall length the impact from severance is assessed a slight negative - Not Significant or Neutral i.e. PAG score 4.

When the four options (Cyan, Orange, Purple West and Dark Green) are compared for the severance criteria the Dark Green has the longest length off-line (10.6km) and therefore will have the highest severance impact. The Purple West Option has the next longest length off-line (81% of Dark Green). The Cyan option has the third longest length off-line (56% of Dark Green) and the Orange option has the shortest off-line length (48% of Dark Green). The Orange and Pink designs will have a high severance impact on highly sensitive enterprises, however along their entire length their severance impacts are lower due to shorter lengths off-line. The severance (with mitigation) PAG scores for the four options is 2, 3, 2 and 2 for Cyan, Orange, Purple West and Dark Green options respectively. In comparison to the other options Orange has the most favourable severance impact because it has the shortest off-line length.

Viability Criterion

The Black is assessed as a standalone option. Based on the low–medium sensitivity of the baseline environment and low overall impacts this criterion is assessed a slight negative – Not Significant or Neutral i.e. PAG score 4.

When the four options (Cyan, Orange, Purple West and Dark Green) are compared for the Viability Criterion options north of Carrick-on-Shannon will affect a lower number of highly sensitive enterprises and this combined with the low – medium sensitivity of the baseline environment and higher areas of poor quality land along the Purple and Grey designs mean that the Purple and Dark Green options are favoured for this criterion. The viability PAG scores for the four options is 3, 3, 4 and 4 for Cyan, Orange, Purple West and Dark Green options respectively. Overall, the viability of agriculture along all options is relatively low.

Overall PAG score- Options West of Drumsna Junction (Node J)

Having examined the criteria farm size, farm type, landtake, severance with mitigation and viability for each of the five options West of Node J the overall PAG scores for each option are as follows:

Black Option Corridor with Black Design

This Option has no impact on highly sensitive enterprises. Overall soil quality is low - medium. It has a low landtake. There is slightly lower viability farming north of Carrick-on-Shannon (less highly sensitive enterprises). The overall PAG score for this option is 4 with an impact that is Not Significant or Neutral.

Cyan Option Corridor with Pink Design

The baseline viability along this option is generally low–medium. Although there is a higher number of highly sensitive enterprises along the Cyan (and Orange) option, the number of these enterprises is very low along the entire option. The Cyan option has the lowest area of poor quality soil within the design fenceline

(along with Orange option). It has a relatively high landtake and highest number of farm yards impacted. It has a mid-range severance impact. The overall PAG score for this option is 3 with an impact that is Minor or Slightly Negative. Compared to Orange, Purple and Dark Green options this is Intermediate.

Orange Option Corridor with Orange Design

The baseline viability along this option is generally low–medium. Although there is a higher number of highly sensitive enterprises along the Orange (and Cyan) options, the number of these enterprises is very low along the entire option. It has the lowest area of poor quality soil within the design fenceline (along with the Cyan option). It has the lowest landtake and a low number of farm yards are affected. It has the lowest severance impact. This option will have the highest impact on one dairy farm. The overall PAG score for the Orange Option is 3 with an impact that is Minor or Slightly Negative. Compared to the Cyan, Purple West and Dark Green options this is Preferred.

Purple West Option Corridor with Purple Design

There are no highly sensitive enterprises along the Purple West Option. The baseline viability of agriculture is slightly lower north of Carrick-on-Shannon. It has a relatively high landtake and affects the lowest number of farm yards. It has the highest landtake within a design fenceline and a relatively high area of poor quality land (which is desirable from an agricultural point of view). It has a high severance impact. The overall PAG score for this option is 3 with an impact that is Minor or Slightly Negative. Compared to the Cyan, Orange and Dark Green options this is Intermediate.

Dark Green Option Corridor with Grey Design

There are no highly sensitive enterprises along the Dark Green Option. The baseline viability of agriculture is slightly lower north of Carrick-on-Shannon. It has the highest corridor landtake, relatively high design landtake and affects a relatively low number of farm yards. It has a relatively high area of poor quality land (which is desirable from an agricultural point of view). It has the highest severance impact. The overall PAG score for this option is 3 with an impact that is Minor or Slightly Negative. Compared to Cyan, Orange and Purple West options this is Least Preferred.

Table 8.8.3.2 Material Assets- Agriculture Stage 2 Scoring Matrix of Options West of Drumsna Junction (Node J)

Option Corridor	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Black Option Corridor
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Urban Street
Assessment Criteria					
Assessment Criterion 1 – Farm Size	25 ha (based on CSO statistics for the study area). **PAG Score 2**	25 ha (based on CSO statistics for the study area). **PAG Score 2**	25 ha (based on CSO statistics for the study area). **PAG Score 2**	25 ha (based on CSO statistics for the study area). **PAG Score 2**	25 ha (based on CSO statistics for the study area). **PAG Score 2**
Assessment Criterion 2 – Farm type	Mainly low – medium sensitivity – mainly beef / sheep farms (97–98% of total based on CSO data for study area). Some high sensitivity farms at western end of the corridor. **PAG Score 3**	Mainly low – medium sensitivity – mainly beef / sheep farms (97–98% of total based on CSO data for study area). Some high sensitivity farms at western end of the corridor. **PAG Score 3**	Mainly low – medium sensitivity – mainly beef / sheep farms (97–98% of total based on CSO data for study area). **PAG Score 4**	Mainly low – medium sensitivity – mainly beef / sheep farms (97–98% of total based on CSO data for study area). **PAG Score 4**	Mainly low – medium sensitivity – mainly beef / sheep farms (97– 8% of total based on CSO data for study area). **PAG Score 4**

Option Corridor	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Black Option Corridor
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Urban Street
Assessment Criterion 3(a) – Landtake within Corridor (Poor quality land = peats & alluvial soils as derived from Teagasc Soils data)[10] (Areas with significant areas of natural vegetation is derived from Corine 2018 data)	• Corridor agri landtake = 267ha adjusted to 208ha for on-line sections • 5.3km (44%) of entire length (6.6km off-line) • 8 farm yards / facilities within corridor (3 of which are high sensitivity) • 105ha of poor quality land (39%). 50ha of land with significant areas of natural vegetation (19%)	• Corridor agri landtake = 200ha adjusted to 148ha for on-line sections • 4.8km (52%) of entire length (4.5km off-line) • 6 medium sensitivity farm yards / facilities within corridor (plus severance of a highly sensitive entrance lane) • 85ha of poor quality land (43%). 48ha of land with significant areas of natural vegetation (24%)	• Corridor agri landtake = 236ha adjusted to 214ha for on-line sections • 2km (19%) of entire length (8.8km off-line) • 5 farm yards / facilities within corridor • 63ha of poor quality land (27%). 71ha of land with significant areas of natural vegetation (30%)	• Corridor agri landtake = 239ha adjusted to 239ha for on-line sections • 0km of entire length (10.6km off-line) • 6 farm yards / facilities within corridor (no high sensitivity yards) • 119ha of poor quality land (50%). 93ha of land with significant areas of natural vegetation (39%)	• Corridor agri landtake = 14ha • 0km of entire length (1.2km off-line) • No farm yards / facilities within corridor (no high sensitivity yards) • 9ha of poor quality land (56%). No land with significant areas of natural vegetation

[10] Teagasc (2021), Irish Soil Information System. Available from http://gis.teagasc.ie/soils/ [Accessed: October 2021]

Option Corridor	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Black Option Corridor
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Urban Street
Assessment Criterion 3(b) – Landtake within Design Fenceline	• 57ha of agri land. • 5.3km (44%) of entire length (6.6km off-line) • 2 medium sensitivity farm yards / facilities within fenceline • 22ha of poor quality land (38%). 13ha of land with significant areas of natural vegetation (22%) **Landtake PAG Score 2**	• 45ha of agri land • 4.8km (52%) of entire length (4.5km off-line) • 2 medium sensitivity farm yards / facilities within fenceline (plus severance of a highly sensitive entrance lane) • 18.5ha of poor quality land (41%). 8ha of land with significant areas of natural vegetation (17%) **Landtake PAG Score 3**	• 63ha of agri land • 2km (19%) of entire length (8.8km off-line) • No farm yards / facilities affected • 16ha of poor quality land (26%). 14ha of land with significant areas of natural vegetation (22%) **Landtake PAG Score 2**	• 61ha of agri land. • 0km of entire length (10.6km off-line) • No farm yards / facilities within fenceline. • 17.5ha of poor quality land (29%). 21ha of land with significant areas of natural vegetation (34%) **Landtake PAG Score 2**	• 5ha of agri land. • 0km of entire length (1.2km off-line) • 2.6ha of poor quality land (50%) **Landtake PAG Score 4**
Assessment Criterion 4 – Severance (with mitigation)	6.6km off-line **PAG Score 2**	4.5km off-line **PAG Score 3**	8.8km off-line **PAG Score 2**	10.6km off-line **PAG Score 2**	1.2km off-line **PAG Score 4**
Assessment Criterion 5 – Viability	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly higher along southern options. **PAG Score 3**	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly higher along southern options. **PAG Score 3**	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly lower along northern options. **PAG Score 4**	Expected overall impact is likely to be slight adverse. Expected impacts on a low number of highly sensitive enterprises. Viability slightly lower along northern options. **PAG Score 4**	No impact on highly sensitive enterprises. Overall soil quality is low - medium. Lowest landtake. Site visit would indicate lower viability farming north of Carrick-on-Shannon. **PAG Score 4**

Option Corridor	Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor	Black Option Corridor
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Urban Street
Scoring					
Qualitative Assessment	Higher impact on highly sensitive enterprises – but number of these is very low overall. Lower areas of poor quality land south of Carrick-on Shannon – but overall soil quality is medium. Relatively high landtake. Relatively low severance impact. Highest impacts on yards. Viability is slightly higher on the south side of Carrick-on-Shannon. (Rank No 2) **Minor** or **Slightly Negative**	Higher impact on highly sensitive enterprises – but number of these is very low overall. Lower areas of poor quality land south of Carrick-on Shannon – but overall soil quality is medium. Lowest landtake and severance impact. High impact on one dairy farm. Viability is slightly higher on the south side of Carrick-on-Shannon. (Rank No 1) **Minor** or **Slightly Negative**	No impact on highly sensitive enterprises. Overall soil quality is low - medium. Slightly lower viability farming north of Carrick-on-Shannon. Highest design landtake. Relatively high severance impact. (Rank No 3) **Minor** or **Slightly Negative**	No impact on highly sensitive enterprises. Overall soil quality is low - medium. Slightly lower viability farming north of Carrick-on-Shannon. Highest corridor landtake. Highest severance impact. (Rank No 4) **Minor** or **Slightly Negative**	No impact on highly sensitive enterprises. Overall soil quality is low - medium. Lowest landtake. Site visit would indicate lower viability farming north of Carrick-on-Shannon. **Not Significant** or **Neutral**
Overall Score / Impact Level for the Option	**3**	**3**	**3**	**3**	**4**
Preference	**Intermediate**	**Preferred**	**Intermediate**	**Least Preferred**	**N/A**

Stage 2 Assessment of Options East of Drumsna Junction (Node J)

There are three Option Corridors east of Drumsna Junction (Node J):

1. The Yellow Option Corridor with the Yellow Design (single carriageway)
2. The Green Option Corridor with Green Design (single carriageway)
3. The Purple East Option Corridor with Purple East Design (dual carriageway)

The Yellow Option Corridor with Yellow Design

The Yellow Option Corridor is 7.9km and it is on-line for 6.9km. There are 11 farm yards within the corridor, none of which are of high sensitivity. The landtake of the option corridor is 132ha after discounting the on-line section by 50%. The landtake of the Yellow Design Fenceline is 34ha and there are two farm yards affected by it. There is 51ha within the option corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' (22% of the option corridor). The area of poor-quality land (peats and alluvial soils) is 41ha (18% of the option corridor). Approximately 13% of the Yellow Design Fenceline is classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' (which is lower than the option corridor) and 24% is poor quality land (which is slightly higher than the option corridor).

The Green Option Corridor with Green Design

The Green option corridor is 7.9km and all of which is on-line. There are 11 farm yards within the option corridor, none of which are of high sensitivity. The landtake of the Green Design Fenceline is 29ha and there are two farm yards affected by it. The landtake of the option corridor is 117ha after discounting the area of agricultural land by 50% because it is all on-line. There is 51ha within the option corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' (22% of the option corridor). The area of poor-quality land (peats and alluvial soils) is 41ha (18% of the option corridor). Approximately 16% of the Green Design Fenceline is classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' (which is lower than the option corridor) and 24% is poor-quality land (which is slightly higher than the option corridor).

The Purple East Option Corridor with Purple East Design

The Purple East Option Corridor is 8km and it is on-line for 6.2km. There are 10 farm yards within the option corridor, none of which are high sensitivity. The landtake of the option corridor is 148ha after discounting the on-line section by 50%. The landtake of the Purple East Design Fenceline is 53ha and there are three farm yards affected by it. There is 52ha (21% of the option corridor) within the option corridor classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation.*' The area of poor-quality land (peats and alluvial soils) is 39ha (16% of the option corridor). Approximately 15% of the Purple East Design Fenceline is classified as '*Lands principally occupied by agriculture, with significant areas of natural vegetation*' (which is lower than the option corridor) and 21% is poor-quality land (which is higher than the option corridor).

Comparison of Options East of Drumsna Junction (Node J)

Farm Size Criteria

All option corridors east of Node J will affect farms of a relatively small size (25ha as determined from CSO statistics) compared to the national average (32.7ha). Therefore, the PAG score for all options east of Node J is 2 or Moderately Negative on the basis that impacts will be proportionately higher on smaller farms.

Farm Type Criteria

Within the entire study area there is a low percentage of high-sensitive farming enterprises (e.g. dairy and equine). The PAG score for the farm type criteria is Not Significant or Neutral i.e. 4, 4, and 4 for the Yellow, Green and Purple East Options.

Landtake Criteria

The Purple East Option Corridor has the highest landtake. The Green Option Corridor has the lowest landtake. All options affect a similar number of farm yards. The area of poor-quality land within the Design Fencelines is highest in the Purple East. The PAG score for the Landtake Criterion is Minor or Slightly Negative i.e. 3, 3, and 3 for Yellow, Green and Purple East Options.

Severance (with mitigation) Criteria

The three option corridors are predominantly on-line and therefore the expected severance impacts are Not Significant or Neutral. The PAG score for the severance with mitigation criteria is 4, 4, and 4 for the Yellow, Green and Purple East Options.

Viability Criterion

Overall, the viability of agriculture along all three options is low-medium. The PAG score for the Viability Criterion is Not Significant or Neutral i.e. 4, 4, and 4 for the Yellow, Green and Purple East options.

Overall PAG score

Having examined the criteria farm size, farm type, landtake, severance with mitigation and viability for each of the three options east of Node J the overall PAG score is 3, or Minor or Slightly Negative for each option. The Purple East option is Least Preferred with the highest landtake, the Green option is Preferred with the lowest landtake and lowest severance impact and the Yellow option is Intermediate. The PAG scores are shown in Table 8.8.3.3.

Table 8.8.3.3 Assessment Matrix Material Assets- Agriculture Options East of Drumsna Junction / Node J

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Assessment Criterion 1 – Farm Size	25ha (based on CSO data for the study area). **PAG Score 2**	25ha (based on CSO data for the study area). **PAG Score 2**	25ha (based on CSO data for the study area). **PAG Score 2**
Assessment Criterion 2 – Farm type	Low – medium sensitivity – mainly beef / sheep farms (98% of total). **PAG Score 4**	Low – medium sensitivity – mainly beef / sheep farms (98% of total). **PAG Score 4**	Low – medium sensitivity – mainly beef / sheep farms (98% of total). **PAG Score 4**
Assessment Criterion 3 – Landtake	• Corridor **landtake** = 234ha of agri land adjusted to 132ha for on-line sections. Design **landtake** = 34ha • 6.9km (87% of entire length) on-line • 11 farm yards / facilities within corridor – 2 yards affected by design • 41ha of poor quality land (18%). 51ha of land with significant areas of natural vegetation (22%). 24% and 13% of design are poor quality land and areas with significant natural vegetation **PAG Score 3**	• Corridor **landtake** = 234ha of agri land adjusted to 117ha for on-line sections. Design **landtake** = 29ha • 7.9km (100% of entire length) on-line • 11 farm yards / facilities within corridor – 2 yards affected by design • 41ha of poor quality land (18%). 51ha of land with significant areas of natural vegetation (22%). 24% and 16% of design are poor quality land and areas with significant natural vegetation **PAG Score 3**	• Corridor landtake = 243ha of agri land adjusted to 148ha for on-line sections. Design **landtake** = 53ha • 6.2km (78% of entire length) on-line • farm yards / facilities within corridor – 3 yards affected by design • 39ha of poor quality land (16%). 52ha of land with significant areas of natural vegetation (21%). 21% and 15% of design are poor quality land and areas with significant natural vegetation **PAG Score 3**
Assessment Criterion 4 – Severance (with mitigation)	1km off-line PAG Score 4	0km off-line PAG Score 4	1.75km off-line PAG Score 4

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criterion 5 – Viability	Baseline level is low-medium viability PAG Score 4	Baseline level is low-medium viability PAG Score 4	Baseline level is low-medium viability PAG Score 4
Scoring			
Qualitative Assessment	Mainly on-line and therefore impacts are low. Compared to other options it will have second highest predicted landtake and severance impact. **Minor** or **Slightly Negative**	On-line and therefore impacts are low. Compared to other options it will have lowest predicted landtake and lowest severance impact. **Minor** or **Slightly Negative**	Mainly on-line and therefore impacts are low. However compared to other options it will have highest predicted landtake and severance impact. **Minor** or **Slightly Negative**
Overall PAG Score / Impact Level for the Option	**3**	**3**	**3**
Preference	**Intermediate**	**Preferred**	**Least Preferred**

8.8.3.5 Summary

In summary, the effects of the alternatives on agriculture will be neutral overall due to the limited potential for landtake of agricultural land at the location of the alternatives, which is mainly in urban centres and along existing road infrastructure.

The findings of the options assessment are summarised as follows:

West of Drumsna Junction (Node J) the impact of the Black Option is likely to be so low as to be Not Significant or Neutral.

West of Drumsna Junction (Node J) the Orange Option with a PAG score of 3 has a higher preference than the Cyan, Purple West and Dark Green options due to the shortest off-line length resulting in lowest landtake and severance impacts. This option will affect one dairy farm but effects on high-sensitive enterprises are low along all options.

With the highest corridor landtake and severance impact, the Dark Green Option Corridor is the Least Preferred.

For options East of Drumsna Junction (Node J) there is little to differentiate the predicted significance levels, which are predicted to be Minor or Slightly Negative to Not Significant or Neutral, because the options are predominantly on-line. Based on the qualitative and quantitative assessments, the Green option will have the lowest impact and is Preferred because it is entirely on-line. The Purple East option is assigned the lowest preference because it has the longest length off-line.

8.8.4 Air Quality

8.8.4.1 Introduction

This section details the Stage 2 Assessment of Alternatives and Options described in Section 8.2 with respect to the Air Quality constraints identified in Section 4.7 of this report.

The physical constraints relating to Air Quality are identified among various other Environmental constraints. These are presented with the Stage 2 Options in the following figures:

- Sensitive Receptor Locations: Population Stage 2 Figures 8.8.1.1.0 to 8.8.1.1.5
- Designated Sites: Biodiversity Stage 2 Figures 8.8.9.1.0 to 8.8.9.1.5
- Integrated Pollution Control (IPC), Industrial Emissions (IE) or Waste Licences: Soils and Geology Stage 2 Figures 8.8.12.4.0 to 8.8.12.4.5

Section 8.8.4.2 outlines the methodology that was used to carry out the study. Section 8.8.4.3 details the Stage 2 Assessment of alternatives and Section 8.8.4.4 details the Stage 2 Assessment of the options. A summary is presented in Section 8.8.4.5.

8.8.4.2 Methodology

The methodology for the assessment of the Stage 2 Alternatives and Options is unchanged from that described for the Stage 1 Air Quality Assessment of the alternatives, Section 6.5.4.2, and assessment of the options described in Section 7.5.4.2 of this report.

Assessment Criteria

The Stage 2 Air Quality Assessments of both alternatives and options are based on the expected change in traffic volumes (where available) and the associated variation in air quality.

The air quality alternatives and options assessments are based on the number of sensitive receptors in proximity to each alternative or option and the projected traffic volumes accessing the corridors during the operational phase. The construction phase is assessed through the consideration of the number of sensitive properties located in proximity to the likely construction works where dust impacts may be experienced.

Section 2.3, Route Selection Process Stage 1 Preliminary Options Assessment, of the NRA, 2011 Guidelines[11] includes the initial steps to assess air quality within a study area as follows:

[11] National Roads Authority NRA, 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

"The specific objectives of the air quality input to the Stage 1 Preliminary Options Assessment of the Route Selection Process are to characterise the existing and ambient air quality in the study area and to initially identify all sensitive receptor locations within the study area likely to be impacted by the proposed scheme before feasible route options are identified. Once feasible route options are identified and in order to undertake the preliminary options assessment, the total number of sensitive receptors (e.g. residential properties) within 50m of the carriageway of each feasible route option should be recorded with a view to eliminating those routes with the greater number of sensitive receptors likely to be impacted by the proposed scheme."

The existing and ambient air quality and the initial identification of sensitive receptor locations within the study area are included in the Air Quality Constraints Section 4.7. The air quality conditions for this assessment are in line with the baseline conditions set out in Section 4.7.

The scope of the air quality assessment is described in Section 2.3 of the NRA, 2011 Guidelines[11] as follows:

"Identify and record all sensitive receptor locations within the study area and all sensitive receptors within 50 m of the carriageway of each feasible route option that are, or have the potential to be significantly affected by a proposed scheme"

In line with the NRA 2011 Guidelines[11], a quantitative assessment of potential air quality impacts on existing and potential sensitive receptors was undertaken.

Sensitive receptor locations are defined in the NRA, 2011 Guidelines[11] as residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. In addition, planning applications[12] give an indication of the potential number of future sensitive receptors adjacent to alternatives and options.

Traffic data is provided for the year 2030 for each option. This data is considered in the assessment of Alternative B and the options.

8.8.4.3 Stage 2 Air Quality Alternatives Assessment

The alternatives assessment comprises three alternatives:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

Alternative A: Active Travel

From an air quality perspective, Alternative A is likely to result in a positive impact at sensitive properties[12] along the existing N4 and through Carrick-on-Shannon. The potential reduction in traffic volumes will depend on the modal shift towards active travel and any potential reduction in private vehicles along the road networks.

[12] Department of House, Planning and Local Government, 2021. National Planning Applications. Available at: https://data.gov.ie/dataset/national-planning-applications

There is potential for a Minor or Slightly Positive impact to air quality from this alternative (PAG score 5).

Alternative B: Public Transport Improvements

From an air quality perspective, Alternative B is likely to result in a positive impact at sensitive properties along the existing N4 and through Carrick-on-Shannon. The potential reduction in traffic volumes will depend on the modal shift towards public transport and any potential reduction in private vehicles along the road networks.

Table 8.8.4.1 shows the predicted change in traffic volumes when introducing bus service enhancements (sum of total traffic volumes across network).

Table 8.8.4.1 Changes in Traffic Volumes with Bus Service Enhancement

Traffic	Do-Minimum	Do-Minimum + Bus Service Enhancements
AADTs (2030)	364,007	362,409

Table 8.8.4.1 shows a 0.44% reduction in traffic volumes with the introduction of bus service enhancement measures, which is an imperceptible difference from an air quality perspective.

It should be noted that the change recorded in Table 8.8.4.1 includes bus service enhancement only.

There is potential for a Minor or Slightly Positive impact to air quality from the cumulative public transport proposals (PAG score 5).

Alternative C: Demand Management

From an air quality perspective, Alternative C is likely to result in a positive impact for existing sensitive properties along the existing N4 and through Carrick-on-Shannon. The potential reduction in traffic volumes will depend on the reduced demand and any resulting potential significant reduction in private vehicles along the road networks. There is potential for a Minor or Slightly Positive impact to air quality from this alternative (PAG score 5).

Table 8.8.4.2 Stage 2 Air Quality Assessment Matrix of Alternatives

Assessment Criteria	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Traffic Volumes	Modal shift resulting in a reduction in private vehicles usage	Modal shift resulting in a reduction in private vehicles usage	Reduced demand resulting in reduction in private vehicles usage
Scoring			
Qualitative assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**
Score / Impact level	**5**	**5**	**5**

8.8.4.4 Stage 2 Air Quality Options Assessment

The number of existing and potential sensitive receptors in proximity to each option corridor determines air quality impacts. The zone of interest for the assessment is 0-50m from each indicative design fenceline within each option corridor. This is an offset from the edge of the indicative design fenceline within each option corridor and assumes that properties within the indicative design fenceline would be acquired and would therefore not be counted as receptors. The sensitive receptors are considered with respect to the traffic volumes on the road network.

Stage 2 Air Quality Assessment – West of Drumsna Junction (Node J)

The numbers of sensitive receptors in proximity to each option corridor, the traffic volumes and the air quality assessment determinations are outlined in Table 8.8.4.3 for the options west of Drumsna Junction (Node J).

The number of sensitive receptors is relatively similar among all options with the Cyan Option Corridor and the Orange Option Corridor having marginally higher numbers of receptors than the other options.

Cyan Option Corridor

The Cyan Option Corridor is an off-line proposal, south of the existing N4 which deviates from the existing N4 at Cloongownagh at Node A. This corridor passes through two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 0-50m distance. In addition, a tie back to the R368 (Elphin Road) south of the railway bridge and a new roundabout junction provided connecting the N4 and the R368 is proposed. This bypass option is increasing traffic volumes in proximity to new sensitive receptors, thus potentially decreasing air quality. As such, an impact level of Minor or Slightly Negative was assigned (PAG Score 3).

Orange Option Corridor

The Orange Option Corridor commences at Node B where it deviates from the existing N4 at Meera. This Option Corridor also passes through two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 0-50m distance. As outlined in Table 8.8.4.3, Orange Option Corridor has a slightly higher number of both existing and potential receptors in proximity relative to the other corridors. This bypass option is increasing traffic volumes in proximity to new sensitive receptors, thus potentially decreasing air quality in these locations. As such, an impact level of Minor or Slightly Negative was assigned (PAG Score 3).

Purple West Option Corridor

The Purple West Option Corridor is located north of the existing N4 and deviates from the N4 at Tumna at Node B. As outlined in Table 8.8.4.3, the Purple West Option Corridor has a slightly lower number of both existing and potential receptors in proximity relative to the Cyan and Orange Option Corridors. This bypass option is increasing traffic volumes in proximity to new sensitive receptors, thus

potentially decreasing air quality. As such, an impact level of Minor or Slightly Negative was assigned (PAG Score 3).

Dark Green Option Corridor

The Dark Green Option Corridor deviates from the existing N4 at Tumna at Node B. As detailed in Table 8.8.4.3, the Dark Green Option Corridor has the lowest number of both existing and potential receptors in proximity. This by-pass option is increasing traffic volumes in proximity to new sensitive receptors, thus potentially decreasing air quality. As such, an impact level of Minor or Slightly Negative was assigned (PAG Score 3).

Black Option Corridor

The Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon. The link road crosses agricultural land and in proximity to residential dwellings either side of the carriageway. Using the same methodologies discussed above, the Black Option Corridor was assessed but not compared to the other options as it was subject to a stand-alone assessment. The results are summarised in Table 8.8.4.3.

The Black Option Corridor is predicted to introduce road traffic at properties located in proximity to its alignment. In comparison to the do-minimum situation Black Option Corridor shows a slight increase in average traffic volumes on the existing N4. Therefore, the Black Option Corridor is increasing traffic volumes in proximity to new and existing sensitive receptors, thus potentially decreasing air quality. The impact is rated as Moderately Negative (PAG Score 2).

Comparative Assessment of Options West of Drumsna Junction (Node J)

All four option corridors in the comparative assessment attract relatively low traffic volumes which are unlikely to generate a significant air quality impact. In comparison to the Do-Minimum situation all four options show a slight decrease in average traffic volumes on the existing N4 (similar between options); however, this is not expected to be a significant change for the existing receptors from an air quality perspective. Nonetheless, the bypass options are increasing traffic volumes in proximity to new sensitive receptors, thus potentially decreasing air quality. As such, an impact level of Minor or Slightly Negative was assigned to all options.

The Dark Green Option Corridor has been rated as Preferred as it has the lowest number of sensitive receptors and lowest traffic volumes on both the option corridor and the existing N4. The Cyan, Orange and Purple West Option Corridors have only marginally higher receptors. The Cyan and Orange Option Corridors have been rated as the Least Preferred with the highest number of sensitive receptors in proximity and highest traffic volumes on both the option corridors and the existing N4.

Table 8.8.4.3 Stage 2 Air Quality Assessment Matrix of Options- West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**	**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option	Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway	Urban Street
Assessment Criteria					
Distance from footprint					
Property counts – existing receptors					
0 – 50m	67	68	60	54	10
Property counts - granted planning applications for sensitive receptor developments					
0 – 50m	5	5	3	3	13
Total sensitive receptors					
Total No. of Receptors within 0 – 50m	72	73	63	57	13
AADTs – average across road network					
AADTs (2030) – on proposed option corridor	8,004	6,739	6,177	6,150	5,419
AADTs (2030) – on existing N4 Carrick-on-Shannon Bridge when option is constructed (Do-Minimum AADT is 17,383 for all)	10,046	10,528	10,821	10,863	17,398

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Scoring						
Qualitative Assessment	**Minor** or **Slightly Negative** due to the traffic volumes in proximity to sensitive receptors	**Minor** or **Slightly Negative** due to the traffic volumes in proximity to sensitive receptors	**Minor** or **Slightly Negative** due to the traffic volumes in proximity to sensitive receptors	**Minor** or **Slightly Negative** due to the traffic volumes in proximity to sensitive receptors		**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors
Score / Impact Level	**3**	**3**	**3**	**3**		**2**
Preference	**Least Preferred**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

Stage 2 Air Quality Assessment – East of Drumsna Junction (Node J)

The numbers of sensitive receptors in proximity to each Option Corridor, the traffic volumes and the air quality assessment determinations are outlined in Table 8.8.4.4 for the Options East of Drumsna Junction (Node J).

Green Option Corridor

The Green Option Corridor comprises an on-line upgrade of the existing single carriageway between Lissenghan at Node J and Faulties at Node H. As detailed in Table 8.8.4.4 the Green Option Corridor has a marginally higher number of sensitive receptors in proximity than the Yellow Option Corridor. The Green Option Corridor results in an increase in traffic volumes (see Table 8.8.4.4) in proximity to new sensitive receptors, thus potentially decreasing air quality. As such, an impact level of Moderately Negative is assigned (PAG Score 2).

Yellow Option Corridor

The Yellow Option Corridor comprises an on-line upgrade of the existing single carriageway between the Drumsna Junction at Node J and Fernaught at Node G, with a short off-line section proposed between Node G at Fernaught and Node H at Faulties. The Yellow Option Corridor has marginally lower traffic volumes and lower number of sensitive receptors in proximity than the Green Option Corridor. The Yellow Option Corridor results in an increase in traffic volumes (see Table 8.8.4.4) in proximity to new sensitive receptors, thus potentially decreasing air quality. As such, an impact level of Moderately Negative is assigned (PAG Score 2).

Purple East Option Corridor

The Purple East Option Corridor comprises an on-line upgrade of the existing N4 between Drumsna Junction at Node J and Drumgildra at Node F. A short off-line deviation to the east of Aghamore is proposed between Nodes F and G with the remaining N4 upgraded between Aghamore at Node G and Faulties at Node H. The Purple Option Corridor has the lowest number of sensitive receptors within the 0-50m distance compared to the other options in the eastern section. This is due to the lower property counts in the off-line section of this corridor. The Purple East Option Corridor also has the highest traffic volumes on both the on-line and off-line sections. Accordingly, an impact level of Moderately Negative is assigned (PAG Score 2).

Comparative Assessment of Options East of Drumsna Junction (Node J)

All three options attract relatively low traffic volumes which are unlikely to generate a significant air quality impact. In comparison to the Do-Minimum situation all three options show a slight increase in average traffic volumes on the existing N4, however, this is not expected to result in a significant change in air quality for the existing receptors. In addition, all the option corridors are predicted to increase traffic volumes in proximity to new sensitive receptors, thus potentially decreasing air quality. As such, an impact level of Moderately Negative was assigned to all options.

The Purple East Option Corridor is rated as the Preferred Option, although it is predicted to generate the highest average traffic volumes on both the off-line section and the existing N4. In addition, it has a lower number of sensitive receptors in proximity relative to the other two options and is thus introducing potential impacts to the lowest number of new receptors. It should be noted there is very little difference in projected traffic volumes on the off-line and on-line sections among all three options.

The Green Option Corridor has the highest number of sensitive receptors. The Yellow Option Corridor has slightly lower sensitive receptors in proximity than the Green Option, however the difference is marginal and the traffic is equal.

Table 8.8.4.4 Stage 2 Air Quality Assessment Matrix of Options - East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Distance from footprint			
Property counts - existing sensitive receptors			
0 – 50m	116	108	60
Property counts - granted planning applications for sensitive receptor developments			
0 – 50m	3	5	3
Total sensitive receptors			
Total No. of Receptors within 0-50m	119	113	63
AADTs – average across road network			
AADTs (2030) – new option corridor	9,064	9,067	8,980
AADTs (2030)- Do-Minimum on Existing N4 at Aghamore	6,387	6,387	6,387
Scoring			
Qualitative Assessment	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors	**Moderately Negative** due to the traffic volumes in proximity to sensitive receptors
Score / Impact Level	**2**	**2**	**2**
Preference	**Least Preferred**	**Intermediate**	**Preferred**

8.8.4.5 Summary

The results from the Stage 2 Air Quality Alternatives Assessment concludes that all three alternatives would result in a potential Minor or Slightly Positive impact to air quality dependent on the reduction in private vehicles on the road network.

The results from the Stage 2 Air Quality Assessment of the Option Corridors conclude that the Dark Green Option Corridor is the Preferred option west of Node Drumsna Junction (Node J), and the Purple East Option Corridor is the Preferred option east of Node J at Drumsna Junction. This determination is based on the consideration of the numbers of sensitive receptors and traffic volumes associated with each option. The impact of the Black Option Corridor was found to be minor or slightly negative.

8.8.5 Climate

8.8.5.1 Introduction

This section details the Stage 2 Assessment of the alternatives and options described in Section 8.2 with respect to the Climate constraints identified in Section 4.8 Climate of this report.

Section 8.8.5.2 outlines the methodology that was used to carry out the study. Section 8.8.5.3 details the Stage 2 Assessment of alternatives and Section 8.8.5.4 details the Stage 2 Assessment of the options. A summary is presented in Section 8.8.5.5.

8.8.5.2 Methodology

The methodology for the assessment of the embodied carbon emissions for the Stage 2 Alternatives and Options is unchanged from that described for the Stage 1 Climate Assessment of the alternatives described in Section 6.5.5.2 and assessment of the options described in Section 7.5.5.2 of this report. The assessment of the operational carbon emissions for the Stage 2 Climate Assessment is more advanced than the Stage 1 assessment as it takes account of the outputs from the traffic modelling coupled with the outputs of the software used to calculate the cost benefits as carbon emissions are considered a cost to the project.

Assessment Criteria

The Climate Assessment evaluates potential carbon emissions from road traffic during the construction phase of each alternative and option. The TII Carbon tool is customised for road projects in Ireland and uses emission factors for a wide range of activities and materials to predict the total carbon generated by a project. The most recent version of the TII Carbon Tool (at the time of this assessment), version 2.1 of February 2021, was used to assess carbon emissions during the construction stage for the Stage 2 Assessment. The tool was also used to calculate the embodied carbon for the concrete, steel, pavement and earthworks volumes based on the indicative designs for the option corridors.

The TII Carbon Tool was also used to estimate carbon emissions from the operational phases for each option. The output of the traffic modelling of the various alternatives and options was input to the cost benefit analysis software known as TUBA, which computes total carbon emissions based on the total kilometres travelled on the road network. A quantum of emissions was also calculated for the operational use of the road which includes maintenance such as the replacement of road surface. Therefore, TUBA calculates the total emissions due to the volume of traffic accessing the route option which is then added to the emissions associated with regular maintenance of the road estimated by the TII Carbon Tool to give a total value for the operational emissions.

An assessment of carbon for the decommissioning phase has not been carried out at this early stage. This is on the basis that it is not considered to be a determining comparative factor among the options due to the similar length and infrastructural requirements.

The unit used to quantify greenhouse gases which would be emitted from the development is carbon dioxide equivalent ($CO_{2\text{-}e}$). A carbon dioxide equivalent is a term used for quantifying different greenhouse gases by using a common unit.

8.8.5.3 Stage 2 Climate Alternatives Assessment

The alternatives assessment comprises three alternatives:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

Alternative A: Active Travel

This option is likely to result in a positive impact to climate, however, the potential change in traffic volumes will depend on the modal shift towards active travel. Any reduction in private vehicles along the road network has the potential to reduce operational carbon emissions. Embodied carbon is likely to be generated during the construction phase, however this is not expected to be significant, due to the likely extent of the works involved. There is potential for a Minor or Slightly Positive impact to climate from this alternative due to the potential for modal shift to more sustainable modes (PAG Score 5).

Alternative B: Public Transport Improvements

This option is likely to result in a positive impact to climate due to a modal shift towards public transport and away from private car usage. Any reduction in private vehicles along the road network has the potential to reduce operational carbon emissions.

Table 8.8.5.1 shows the change in vehicle kilometres travelled when introducing bus service enhancements (sum of total vehicle kilometres travelled across the road network for the year 2030) and the resultant operational carbon emissions.

Table 8.8.5.1 Predicted Changes in Traffic Volumes and Associated Carbon Emissions with Bus Service Enhancement

Traffic within the study area	Do-Minimum	Do-Minimum + Bus Service Enhancements	Difference	% Change
Vehicle kilometres travelled (km) (2030)	248,894,815	247,928,834	-965,981	-0.4
Operational carbon (tonnes CO_2e per year) (2030)	70,212	69,989	-223	-0.3

Table 8.8.5.1 shows a 0.3% reduction in operational carbon emissions per year with the introduction of bus service enhancement measures, which results in a Minor or Slightly Positive impact from a climate perspective.

It should be noted that the change recorded in Table 8.8.5. only includes bus service enhancement.

It is expected that embodied carbon would be generated during the construction phase, however this is not expected to be significant, dependent on the works involved.

There is potential for a Minor or Slightly Positive impact to climate from this alternative (PAG Score 5).

Alternative C: Demand Management

This option is likely to result in a positive impact to climate due to a reduction in car trips. Any potential reduction in private vehicles along the road network has the potential to reduce operational carbon emissions. It is expected embodied carbon would be generated during the construction phase; however, this is not expected to be significant, dependent on the works involved. There is potential for a Minor or Slightly Positive impact to climate from this alternative (PAG Score 5).

Table 8.8.5.2 Stage 2 Climate Assessment Matrix of Alternatives

Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Operational Carbon (vehicle kilometres)	Modal shift resulting in a reduction in traffic volumes and vehicle kilometres travelled, thus reducing operational carbon emissions	Modal shift resulting in a reduction in traffic volumes and vehicle kilometres travelled, thus reducing operational carbon emissions	Reduced demand resulting in a reduction in traffic volumes and vehicle kilometres travelled, thus reducing operational carbon emissions
Embodied Carbon (construction materials)	Low embodied carbon, dependent on works	Low embodied carbon, dependent on works	Low embodied carbon, dependent on works
Scoring			
Qualitative assessment	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**	**Minor** or **Slightly Positive**
Score / Impact level	**5**	**5**	**5**

8.8.5.4 Stage 2 Climate Options Assessment

From a climate perspective, greater corridor lengths have the potential to increase carbon emissions from road traffic during the operational phase due to an increase in vehicle kilometres travelled. In addition, the more materials required to construct an Option Corridor, the greater the embodied carbon generated for the construction phase. Thus, the vehicle kilometres travelled, and the associated carbon emissions were considered across the road network rather than only on the bypass corridor, in order to assess the full impact of the project on operational carbon emissions in the region.

Assessment of Options West of Drumsna Junction (Node J)

The corridor lengths and climate assessment determinations are outlined in Table 8.8.5.3 for the options west of Drumsna Junction (Node J). For the construction or embodied carbon this is assessed based on the construction length of the options to the west of Drumsna. For the operational emissions, the traffic modelling is undertaken on the entire network, therefore all the options to the west of Drumsna are modelled with the same option to the east of Drumsna so that the difference in operational emissions is attributed to what is happening in terms of traffic generating emissions to the west of Drumsna.

Cyan Option Corridor

The Cyan Option Corridor is an off-line proposal, south of the existing N4 which deviates from the existing N4 at Cloongownagh at Node A. As outlined in Table 8.8.5.3 the Cyan Option Corridor generates an intermediate value of the operational carbon relative to the other options, and an intermediate value of embodied carbon.

Orange Option Corridor

The Orange Option Corridor commences at Node B where it deviates from the existing N4 at Meera. As outlined in Table 8.8.5.3, the Orange Option Corridor has the highest operational carbon of all the options. The Orange Option Corridor also has significant infrastructural requirements but due to its shorter length it has the lowest embodied carbon of the options.

Purple West Option Corridor

The Purple West Option Corridor is located north of the existing N4 and deviates from the N4 at Tumna at Node B. As outlined in Table 8.8.5.3, the Purple West option has slightly lower operational carbon than the Orange Option Corridor but higher than the other two options. The Purple West Option Corridor also has significant infrastructural requirements resulting in high embodied carbon.

Dark Green Option Corridor

The Dark Green Option Corridor deviates from the existing N4 at Tumna at Node B. As outlined in Table 8.8.5.3, the Dark Green Option Corridor has the lowest operational carbon relative to the other options. The Dark Green Option Corridor also has new road infrastructure requirements and is the longest length of new construction resulting in the highest embodied carbon.

Black Option Corridor

The Black Option Corridor comprises an urban street improvement within Carrick-on-Shannon. Using the same methodologies discussed above, the Black Option Corridor was assessed but not compared to the other options as it was subject to a stand-alone assessment. The results are summarised in Table 8.8.5.3.

The embodied carbon in the materials required to construct the new road infrastructure have the potential to result in a negative impact on climate due to the use of materials which generate carbon, for example concrete, bitumen and aggregates, which have been taken into consideration when assigning the impact rating.

It is worthy to note, although a comparative assessment is not being conducted on the Black Option Corridor, the corridor length is significantly shorter than the option corridors both west and east of Node J which would generate the least carbon emissions at the construction phase relative to the other options.

The option will result in a slight overall increase in operational carbon emissions across the road network in comparison to the Do-Minimum situation, however, the increase is not considered significant from a climate perspective. This has been taken into consideration when assigning the impact rating.

As such, the impact is rated as Moderately Negative (PAG Score 2).

Comparative Assessment of Options West of Drumsna Junction (Node J)

The embodied carbon in the materials required to construct new road infrastructure and on-line upgrades have the potential to result in a negative impact on carbon emissions and subsequently climate. The works will require the use of materials which generate carbon, for example concrete, bitumen and aggregates. All options require significant new infrastructure resulting in a high embodied carbon associated with them, which has been taken into consideration when assigning the impact rating.

All four options in the comparative assessment west of Drumsna Junction (Node J) result in an increase in operational carbon emissions on the road network in comparison to the Do-Minimum situation, which has been taken into consideration when assigning the impact rating.

As such, all options are rated as Major or Highly Negative (PAG Score 1).

All options are predicted to generate significant embodied carbon. As operational emissions are ongoing over the lifetime of the option therefore, the preferences have been given a higher weighting compared to embodied carbon emissions.

The Cyan and Dark Green Option Corridor are rated as Preferred as they are predicted to generate the lowest operational carbon emissions. The Purple West Option Corridor is predicted to generate the second lowest operational carbon and is rated as Intermediate. The Orange Option Corridor has been rated as the Least Preferred with the highest predicted operational carbon emissions.

Table 8.8.5.3 Climate Assessment Matrix of Options – West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Operational & Vehicle Use Carbon - difference between Do-Min and Do-Something[13] (per year) tonnes CO2eq	1,815	1,963	1,882	1,814		32
Estimated embodied carbon tonnes CO2eq	20,030	16,840	21,055	23,360		2,073
Scoring						
Qualitative Assessment	**Major** or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.	**Major** or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.	**Major** or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.	**Major**\ or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.		**Moderately Negative** as the embodied carbon in the materials required to construct the new road infrastructure have the potential to result in a negative impact on climate and the operational carbon is showing a slight increase from the Do-Minimum situation
Score / Impact Level	**1**	**1**	**1**	**1**		**2**
Preference	**Preferred**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

[13] The carbon factors used for the calculation of operational carbon were 0.1197375kg/kg (for LGVs) and 0.994945kg/kg (for HGVs) as per the TII Carbon Tool

East of Drumsna Junction (Node J)

The climate assessment determination is outlined in Table 8.8.5.4 for the Options East of Drumsna Junction (Node J). The construction phase determination is assessed based on embodied carbon. For the operational phase emissions, all options are modelled to include a southern bypass option to the west of Drumsna to allow the consideration of emissions associated with traffic to the east of Drumsna. It is also noted that there is very little difference in the predicted traffic on the various options to the east of Drumsna as there are no alternative roads available over this length.

Green Option Corridor

The Green Option Corridor comprises an on-line upgrade of the existing single carriageway between Lissenghan at Node J and Faulties at Node H. As outlined in Table 8.8.5.4, the Green Option Corridor has the lowest operational carbon relative to the other two options. The Green Option Corridor also has infrastructural requirements which results in embodied carbon however, the off-line infrastructural requirements are limited.

Yellow Option Corridor

The Yellow Option Corridor comprises an on-line upgrade of the existing single carriageway between the Drumsna Junction at Node J and Fernaught at Node G, with a short off-line section proposed between Node G at Fernaught and Node H at Faulties. As outlined in Table 8.8.5.4, the Yellow Option Corridor has slightly higher operational carbon relative to the Green Option Corridor. The Yellow Option Corridor also has infrastructural requirements which results in embodied carbon; however, the off-line infrastructural requirements are limited.

Purple East Option Corridor

The Purple East Option Corridor comprises an on-line upgrade of the existing N4 between Drumsna Junction at Node J and Drumgildra at Node F. A short off-line deviation to the east of Aghamore is proposed between Nodes F and G with the remaining N4 upgraded between Aghamore at Node G and Faulties at Node H. As outlined in Table 8.8.5.4, the Purple East Option Corridor has the highest operational carbon relative to the other two options. The Purple East Option Corridor also has infrastructural requirements which results in significantly higher embodied carbon.

Comparative Assessment of Options East of Drumsna Junction (Node J)

The embodied carbon in the materials required to construct new road infrastructure and on-line upgrades have the potential to result in a negative impact on carbon emissions and thereby climate. The works will require the use of materials which generate carbon, for example concrete, bitumen and aggregates. All options require new infrastructure thus have embodied carbon associated with them, which has been taken into consideration when assigning the impact rating. The Purple East Option Corridor has significantly higher embodied carbon due to the more significant construction involved.

All three options are predicted to result in an increase in operational carbon emissions on the road network in comparison to the Do-Minimum situation, which has been taken into consideration when assigning the impact rating. There is little difference in operational carbon among the three options, which aligns with the fact that there is little variation in traffic volumes to the east of Drumsna, but the Purple East is marginally higher due to the slightly higher traffic volumes associated with the dual carriageway.

As such, all options were rated as Major or Highly Negative (PAG Score 1).

The Green Option Corridor is rated as Preferred as it is predicted to generate the lowest operational carbon emissions. The Yellow Option Corridor is predicted to generate only slightly more operational carbon and is rated as Intermediate. The Purple East Option Corridor has been rated as the Least Preferred with the highest operational carbon emissions and embodied carbon predicted to be generated.

Table 8.8.5.4 Stage 2 Climate Assessment Matrix of Options - East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Operational carbon & Operational Use – difference between Do-Minimum and Do-Something[14] (per year) tonnes CO2eq	1,136	1,051	1,816
Embodied carbon tonnesCO2eq	4,892	4,134	12,285
Scoring			
Qualitative Assessment	**Major** or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.	**Major** or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.	**Major** or **Highly Negative** due to the predicted increase in operational carbon and the embodied carbon generated.
Score / Impact Level	**1**	**1**	**1**
Preference	**Intermediate**	**Preferred**	**Least Preferred**

[14] The carbon factors used for the calculation of operational carbon were 0.1197375kg/kg (for LGVs) and 0.994945kg/kg (for HGVs) as per the TII Carbon Tool

8.8.5.5 Summary

The Stage 2 Climate Assessment concludes that all three alternatives are predicted to result in a potential Minor or Slightly Positive impact on climate due to the reduction in vehicle kilometres travelled on the existing road network and the embodied carbon associated with the works.

West of Drumsna Junction (Node J), the Cyan and Dark Green Option Corridors and east of Drumsna Junction (Node J) the Green Option Corridor is rated as the Preferred option from a climate perspective. These preferences are based on an assessment of vehicle kilometres travelled across the road network and the scale of construction works generating embodied carbon. The preference is marginal over the other options.

The Black Option Corridor is predicted to have a Moderately Negative impact on climate due the embodied carbon associated with the new road infrastructure.

8.8.6 Noise and Vibration

8.8.6.1 Introduction

This section details the Stage 2 Assessment of the alternatives and options described in Section 8.2 with respect to the Noise and vibration constraints identified in Section 4.9 Noise and Vibration of this report.

The Stage 2 alternatives are presented in Figures 8.7.1.0. 8.7.2.0 and 8.7.3.0. The alternatives are referenced as Alternative A: Active Travel, Alternative B: Public Transportation Improvements and Alternative C: Demand Management. The Stage 2 Options in conjunction with the Noise and Vibration constraints are presented in Figures 8.8.6.1.0 to 8.8.6.2.5.

Section 8.8.6.2 outlines the methodology that was used to carry out the study, Section 8.8.6.3 details the Stage 2 Assessment of alternatives and Section 8.8.6.4. A summary is presented in Section 8.8.6.5.

8.8.6.2 Methodology

The noise impact assessment has been conducted in accordance with the relevant guidance provided in Section 5.0 of the National Roads Authority (NRA) 2004 Guidelines for the Treatment of Noise and Vibration in National Road Schemes[15], Section 2 of the 2014 Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes[16] and in accordance with the requirements of the TII Project Management Guidelines 2020[17], the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031, October 2016[2] and Design Manual for Roads and Bridges (DMRB) (UKHA, 2020)[18].

In terms of operational noise, the NRA 2004 Noise and Vibration Guidelines[15] and the TII Noise Guidelines 2014[16] consider it appropriate to set the design goal for road traffic noise for new national roads in Ireland as follows:

- Day-evening-night 60 dB L_{den} (free field)

Both the NRA 2004[15] and TII 2014[16] noise documents referred to above acknowledge that it may not always be sustainable to achieve this design goal. In such circumstances, nevertheless, a structured approach should be taken in order to

[15]National Roads Authority (NRA), 2004. Guidelines for the Treatment of Noise and Vibration in National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Treatment_of_Noise_and_Vibration_in_National_Road_Schemes.pdf

[16] Transport Infrastructure Ireland (TII), 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Good_Practice_Guidance_for_the_Treatment_of_Noise_during_the_Planning_of_National_Road_Schemes.pdf

[17] Transport Infrastructure Ireland (TII), 2020. Project Management Guidelines PE-PMG-02041. Available at: https://www.tiipublications.ie/library/PE-PMG-02041-03.pdf

[18] Highways England, 2021. LA114 Climate, Design Manual for Roads and Bridges (DMRB) Available at: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0

ameliorate as far as practicable road traffic noise through the consideration of measures such as alignment changes, barrier type (e.g., earth mounds) or low noise road surfaces.

Assessment Criteria for Alternatives

The assessment of potential noise impacts and ranking is generally based primarily upon property counts and a review of the likely requirement for mitigation measures is based on the indicative noise footprint for each alternative and changes in traffic flows. As there are no corridors associated with the alternatives, it is not possible to do a property count and so the assessment of alternatives is entirely qualitative.

Assessment Criteria for Options

The option corridors are described in Section 8.2. In summary, a total of eight option corridors have been taken forward to the Project Appraisal of Project Options (Stage 2). Five of the option corridors are to the west of Node J at Drumsna Junction (Cyan, Orange, Purple West, Dark Green and Black) and three option corridors are to the east of Node J (Purple East, Green and Yellow).

This assessment has ranked the corridors in order of preference, except for the Black Option Corridor west of Node J which is given a stand-alone assessment. The assessment considers the potential impacts of each option corridor with respect to noise and vibration on the surrounding environment through which they pass. An indicative dual carriageway design (worst case scenario) was used to conduct the assessment.

The assessment of potential noise impacts and ranking of option corridors is based primarily upon property counts, a review of the likely requirement for mitigation measures based on the indicative noise footprint for each option and changes in traffic flows. The following has been conducted to assess the impact rating of each of the option corridors under consideration:

- Property counts have been conducted within four bands from the centreline of each option corridor, i.e., 0 to 50m, 50 to 100m, 100 to 200m and 200 to 300m, in accordance with Section 5.2 of the NRA 2004[15] document. Using this information, the Potential Impact Rating (PIR) for each option corridor was established
- The potential noise footprint of the indicative carriageway design for each option was then established taking into account the vertical alignments for varying sections of each option, projected future traffic flows and traffic speed
- An assessment of the potential number of properties likely to be exposed to traffic noise levels at or above 60 dB $L_{den,}$[16] and consequently require noise mitigation was determined using a noise 'footprint' assessment
- A high-level review of changes in traffic noise levels on the existing road network was undertaken based on a comparison between Do Minimum traffic data and the Do Something traffic data for the year 2045, for each route option

In terms of vibration, road traffic along normal well-maintained surfaces, in line with this proposed development, generates very low levels that are normally not perceptible to building occupants. For the purposes of this assessment, therefore, it

is assumed that all routes will have a comparable low vibration impact during their operational phase and vibration is not assessed further.

The potential noise and vibration impacts associated with the construction phase of each route will be of an impermanent duration (i.e. less than 7 years). Whilst there will be varying impacts associated with each, the construction phase will be undertaken using standard road construction techniques and will be controlled by the implementation of construction noise and vibration limits. For the purposes of ranking options, this assessment has focused on longer terms operational impacts only.

The ranking of option corridors during their operational phase is focused on the potential operational phase noise impacts which will vary among option corridors.

Stage 2 Assessment Methodology for the Assessment of Potential Impact Rating (PIR)

An assessment of Potential Impact Rating (PIR) based upon the number of noise sensitive receptors (NSRs) within specified distance bands from each of the option corridors is set out in the following section.

The number of properties potentially sensitive to noise and/or vibration within 300m of each of the proposed option corridors has been identified.

Property counts have been undertaken for four bands from the centreline of each option corridor, i.e., 0 to 50m, 50 to 100m, 100 to 200m and 200 to 300m. A weighting value for each distance band has been applied with a weighting factor of 4 for the closest distance band (0 to 50m) down to 1 for the furthest distance band (200 to 300m). For the PIR assessment, the calculated weighted value for each distance band is summed to obtain a total PIR value. The option corridor with the lowest PIR has the lowest potential impact for this assessment criterion.

Stage 2 Assessment Methodology for the Assessment of Noise Footprint and Potential Requirement for Noise Mitigation

The procedure used for Stage 2 of the options assessment is to provide an objective methodology for ranking the potential noise impacts associated with each option on a comparative basis.

To assess the indicative noise impacts associated with each option corridor, a review of the indicative carriageway design within each corridor has been undertaken. The preliminary indicative dual carriageway design provided for each option was used to determine the likely noise 'footprint' of each and the likely number of NSRs likely to require noise mitigation. The noise 'footprint' of each carriageway design was determined using the following methodology.

- Each dual carriageway design was overlaid on OS and aerial mapping. The proposed vertical alignment of each dual carriageway design option was then reviewed to determine areas of grade, cuttings and embankments
- Using guidance from the TII Noise Guidelines 2014[2], the approximate distance to a 60 dB L_{den} contour was established using the noise footprint graphs set out in Chapter 5 of the Guidance document

- The noise footprint was determined for individual sections of each dual carriageway design option, taking account of the vertical alignment, the Annual Average Daily Traffic flows (AADT), traffic speed, and the road surface
- An operational speed of 100km/hr and a standard hot rolled asphalt road surface were assumed along all dual carriageway design options and assuming the traffic flows based on the 2045 traffic model outputs listed in Table 8.8.6.1. The road link with largest traffic flows (rounded to nearest 100) are presented

Table 8.8.6.1 Traffic Flows Based on the 2045 Traffic Model Outputs

Option Corridor	Section Between Nodes	Traffic Flow (2045 AADT)
West of Drumsna Junction (Node J)		
Black	R280 to Summerhilll Road	5,600
	Summerhill Road to Castlecara Road	4,000
Orange	Node B – Node D	7,000
	Node D – Node J	9,800
Cyan	Node A – Node D	8,200
	Node D – Node J	9,500
Purple West	Node B – R280 Road	6,400
	R280 Road – Node J	4,800
Dark Green	Node B – R280 Road	6,400
	R280 Road – Node J	4,800
Do Minimum	N4 – West of R368	8,800
	N4 – R368 to Castlecarra Road	18,300
	N4 – Castlecarra Road to Node J	12,000
East of Drumsna Junction (Node J)		
Purple East	Node J – R201	9,700
	R201 – West Aghamore	9,200
	East Aghamore – Node H	6,400
Green	Node J – R201	9,300
	R201 – Node H	6,500
Yellow	Node J – R201	9,300
	R201 – Node H	6,500
Do Minimum	Node J – R201	9,000
	R201 – Node H	6,400

- The number of noise sensitive properties likely to exceed 60 dB L_{den} within each section of carriageway was counted and a total number between each section was established

- With respect to NSRs along either off-line or on-line option corridors, the following three conditions must be satisfied under the NRA 2004[15] and TII 2014[16] noise guidelines for noise mitigation to be provided:
    - The combined expected maximum traffic noise level, i.e., the relevant noise level, from the proposed road development together with other traffic in the vicinity is greater than the design goal of 60 dB L_{den}
    - The relevant noise level is at least 1 dB more than the expected traffic noise level without the proposed road development in place
    - The contribution to the increase in the relevant noise level from the proposed road development is at least 1 dB

Option corridors with the highest number of NSRs likely to require noise mitigation based on the conditions noted above are ranked least favourably as part of this element of the analysis.

Stage 2 Assessment Methodology Change in Traffic Noise Level

For off-line option corridors, an element of traffic will be diverted off the existing N4 onto the new proposed alignments. The level of traffic reduction along the existing N4 varies between option corridors as does the associated magnitude of noise change. Traffic flow data for the year 2045 has been reviewed to provide an analysis on the expected change in noise level along the existing N4 with the implementation of the various proposed options.

In the absence of any Irish guidelines or standards relating to the assessment of the effects associated with changes in road traffic noise levels, reference is made to the UK's DMRB[18]. This document provides suggested magnitude rating tables relating to changes in noise levels associated with road traffic noise.

The calculated road traffic noise levels used in this study relate to the design year of 2045, hence in line with the DMRB guidance[18], the following magnitude of change is applied for the long-term period (design year) as reproduced in Table 8.8.6.2.

Table 8.8.6.2 Classification of Magnitude of Traffic Noise Impacts in Long-Term (DMRB 2020)

Long-term Magnitude	Long-term noise change, dB
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3 to 4.9
Negligible	Less than 3.0

8.8.6.3 Noise and Vibration Stage 2 Alternatives Assessment

Alternative A: Active Travel

From a noise point of view this alternative is likely to result in a neutral to potentially positive impact for existing noise sensitive properties along the existing N4 and through Cortober and Carrick-on-Shannon. The potential change in traffic

noise levels will depend on the modal shift towards active travel and any potential significant reduction in private vehicles along the road networks.

Alternative B: Public Transport Improvements

From a noise point of view this option is likely to result in a neutral to potentially positive impact for existing noise sensitive properties along the existing N4 and along through Carrick-on-Shannon. The potential change in traffic noise levels will depend on the modal shift towards public transport and any potential significant reduction in private vehicles along the road networks.

Alternative C: Demand Management

From a noise point of view this option is likely to result in a neutral to potentially positive impact for existing noise sensitive properties along the existing N4 and along through Carrick-on-Shannon. The potential change in traffic noise levels will depend on the success of demand reduction on the use of private vehicles along the road networks.

8.8.6.4 Noise and Vibration Stage 2 Options Assessment

Table 8.8.6.3 summarises the PIR values calculated for the option corridors west of Node J at Drumsna Junction using the weighting values for each distance band discussed above and taking account of existing properties within the 300m band.

Table 8.8.6.3 PIR Assessment Table for Option Corridors West of Drumsna Junction (Node J)

Option Corridor	PIR 0-50m Band	PIR 50-100m Band	PIR 100-200m Band	PIR 200-300m Band	Total PIR
Cyan Option Corridor	72	204	340	256	872
Orange Option Corridor	68	138	300	203	709
Purple West Option Corridor	60	42	70	47	219
Dark Green Option Corridor	64	30	68	51	213
Black Option Corridor	40	54	308	136	538

The highest PIR value is associated with the Cyan Option Corridor (872) which follows an off-line corridor south of Carrick-on-Shannon between Nodes A and D and joins the existing N4 at Lissenghan (Node D) to follow an on-line corridor to Node J. This option corridor passes in proximity to two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 50 to 300m distant bands.

The Orange Option (709) has a marginally lower PIR value compared to the Cyan Option Corridor but has a higher PIR value compared to the Purple, Dark Green

and Black Option Corridors. The Orange Option Corridor follows an off-line route south of Carrick-on-Shannon, but commences at Node B, north of the Cyan Option Corridor, as far as Node C. The Orange Option Corridor follows a similar corridor to the Cyan Option Corridor between Nodes C and D with a deviation north of the Cyan Option Corridor west of the River Shannon. Both option corridors follow the same on-line corridor between Nodes D and J. This option corridor also passes in proximity to two residential estates located within 50m of the corridor centreline between Nodes C and D which make up a large majority of the properties counted within the 50 to 300m distant bands.

In addition to the noise sensitive buildings along each corridor, both the Cyan and Orange Option Corridors cross the River Shannon south of Carrick-on-Shannon along a section of the river that has a high amenity value used for a mixture of outdoor amenities and boat mooring areas. The noise environment would be increased in the vicinity of a new bridge crossing and the surrounding amenity area for both these options.

The Purple West Option Corridor yields the second lowest overall PIR (219) in the western comparative assessment. This option follows an off-line corridor north of Carrick-on-Shannon between Nodes B and J. The option corridor passes through more rural areas compared to the southern option corridors with an associated lower density of noise sensitive buildings. This option corridor crosses the River Shannon north of Carrick-on-Shannon which will also increase the ambient noise environment at any amenity areas along the river crossing. The presence of specific amenity areas are, however, less frequent in this section of the River Shannon compared to those south of Carrick-on-Shannon. However, there is a Blueway under consideration for this area.

The Dark Green Option Corridor has the lowest overall PIR (213) in the western comparative assessment. This option also follows an off-line corridor through rural areas, following the Purple West Option Corridor but continues further east at Castlecarra Road before re-joining the existing N4 at Node J. This option corridor also crosses the River Shannon north of Carrick-on-Shannon which, as noted above, will also increase the ambient noise environment at any amenity areas along the river crossing. Again, there is a Blueway under consideration for this area.

The Black Option Corridor has an overall PIR of 538. This is a relatively high score for a short option corridor and is driven by the proximity to the Oaklands residential housing estate to the south. The majority of NSRs that make up the total PIR are located in the outer distance bands of 100 – 200m and 200 – 300m. The number of NSRs in the 0 – 50m and 50 – 100m bands, i.e. the receptors most exposed to traffic noise, are relatively low by comparison to the outer distance bands.

On the basis of the PIR analysis in isolation, in terms of the comparative assessment, the Cyan Option Corridor has the highest potential noise impact due to the number and distribution of noise sensitive properties in proximity to its corridor and the Dark Green Option Corridor would result in the lowest potential noise impacts.

Stage 2 PIR Assessment of Option Corridors East of Node J at Drumsna Junction

Table 8.8.6.4 summarises the PIR values calculated for the option corridors east of Node J at Drumsna Junction using the weighting values for each distance band and taking account of existing properties within the 300m band.

Table 8.8.6.4 PIR Assessment Table for Option Corridors East of Drumsna Junction (Node J)

Option Corridor	PIR 0-50m Band	PIR 50-100m Band	PIR 100-200m Band	PIR 200-300m Band	Total PIR
Purple East Option Corridor	60	81	130	29	300
Green Option Corridor	116	81	100	18	315
Yellow Option Corridor	108	81	100	18	307

The resultant PIR values are all broadly similar for the option corridors east of Node J, with the Green Option Corridor having a marginally higher value (315) followed by the Yellow Option Corridor (307). These options follow the same on-line corridor with the exception of the section between Nodes G to H where the Yellow Option diverts off-line to the west of the existing N4.

The Purple East Option Corridor follows the same on-line corridor as the Green Option Corridor but deviates between Nodes F and G where it follows an off-line corridor to the east of Aghamore. The Purple East Option Corridor has the lowest PIR (300) compared to the other two options in the eastern section due to the lower property counts in the off-line section of this corridor. On this basis the Purple East Option would result in marginally lower potential noise impacts.

Whilst the PIR assessment provides information on the number of noise sensitive properties in the vicinity of each option corridor, the NRA 2004[1] and TII 2014[2] Noise Guidelines acknowledge that the PIR process only provides an initial high-level screening for option ranking.

In addition to property counts, other factors which also dictate the potential noise impact from an option corridor, relate to its vertical alignment (cuttings, embankments, at-grade, tunnels etc.), road traffic flows and potential for noise mitigation.

Stage 2 Assessment of Noise Footprint and Potential Requirement for Noise Mitigation - West of Node J at Drumsna Junction

In general, sections of road alignments in cut have the smallest noise footprint compared to those associated with high embankments or those at-grade.

Table 8.8.6.5 summaries the number of counted properties likely requiring noise mitigation based on the noise ‘footprint’ for the section west of Node J at Drumsna Junction for the five option corridors.

Table 8.8.6.5 Number of Properties Likely Requiring Noise Mitigation – West of Drumsna Junction (Node J)

Option Corridor	Design Description	Indicative No. of Properties Likely requiring noise mitigation
West of Node J		
Cyan Option Corridor	Pink Dual Carriageway Design	24
Orange Option Corridor	Orange Dual Carriageway Design	21
Purple West Option Corridor	Purple Dual Carriageway Design	3
Dark Green Option Corridor	Grey Dual Carriageway Design	1
Black Option Corridor	Black Single Carriageway Design	11

For west of Node J at Drumsna Junction, the highest number of properties likely to trigger the requirement for noise mitigation were counted along the Cyan and Orange Option Corridors. The majority of these properties are located between Node C and Node D, within two housing estates north of the option corridors and to the east of the River Shannon. Overall, a marginally higher number of properties were counted along the Cyan Option Corridor.

A low number of properties were determined to require noise mitigation along the Dark Green (1) and Purple West Options (3) due to the option corridors passing through rural areas with a low density of NSRs, making these favourable options.

With respect to the Black Option Corridor, noise mitigation would be required along the northern length of the alignment between Summerhill Road and Leitrim Road as a minimum.

The assessment has concluded therefore that the Cyan, Orange and Black Option Corridors are those likely to generate the greatest noise footprint and require the greatest extent of noise mitigation measures to reduce noise levels to within the TII traffic design goal of 60 dB L_{den}. On this basis, these option corridors are less preferred compared to the Purple West and Dark Green Option Corridors.

Based on the assessment of the likely requirement for noise mitigation, the Purple West and Dark Green options result in the lowest potential noise impacts.

Stage 2 Assessment of Noise Footprint and Potential Requirement for Noise Mitigation - East of Node J at Drumsna Junction

For the section east of Node J at Drumsna Junction, similar footprint distances were calculated to those discussed in the section west of Node J at Drumsna Junction, due to similar traffic flows, particularly between Nodes J and H.

For east of Node J at Drumsna Junction, given three of the option corridors in this section follow an on-line corridor over the majority of their alignments, the noise footprint will be similar to the existing N4. Review of the traffic model outputs confirm no significant change in traffic volumes between the Do-Minimum and Do-Something scenarios along the N4 that would trigger a notable increase in noise

levels. The only likely requirement for noise mitigation will therefore be associated with off-line sections, along widened sections of the on-line alignment and/or along parallel roads, new junctions and other ancillary works which have the potential to an increase traffic noise levels above 60 dB L_{den} or the prevailing traffic noise level.

Table 8.8.6.6 summarises the number of properties likely to trigger the requirement for noise mitigation based on their 'footprint' within the eastern section for the three carriageway design options.

Due to the fact that the options in this section follow the on-line corridor for the majority of their alignments with no notable difference in traffic noise levels between the Do-Something and Do-Minimum scenarios, the likely requirement for mitigation is driven by the proximity of NSRs to new parallel roads or junctions which have the potential to result in increased traffic noise levels above 60 dB L_{den}. The assessment is based on indicative layout plans.

Table 8.8.6.6 Number of Properties Likely Requiring Noise Mitigation – East of Drumsna Junction (Node J)

Option Corridor	Design Description	Indicative No. of Properties Likely requiring noise mitigation
East of Node J		
Purple East Option Corridor	Purple East Dual Carriageway Design	7
Green Option Corridor	Green Dual Carriageway Design	13
Yellow Option Corridor	Yellow Dual Carriageway Design	13

Within the section east of Node J, the highest number of properties likely to trigger the requirement for noise mitigation were counted along the Yellow and Green Option Corridors. These properties are located in proximity to new parallel roads and new junctions.

The Purple East Option Corridor results in a lower number of properties likely to require noise mitigation compared to the Yellow and Green Option Corridors. The identified properties are located in proximity to new parallel roads and new junctions.

On the basis of the above analysis, the Purple East Option Corridor results in the lowest potential noise impacts compared to the Yellow and Green Option Corridors.

Stage 2 Assessment of Change in Traffic Noise Level - West of Node J at Drumsna Junction

With reference to the Design Manual for Roads and Bridges (DMRB) the predicted change in noise level along the existing N4 during the operation of the various option corridors is summarised in Table 8.8.6.7.

Table 8.8.6.7 Estimated Change in Noise Level along Existing N4 (West)

Option Name & Colour	Road Section	Do-Minimum AADT (2045)	Do-Something AADT (2045)	Change in Noise Level (dB)	DMRB Impact categorisation
West of Drumsna / Node J					
Black	N4 Drumharlow	8,284	8,225	0.0	Neutral
	N4 Tumna	8,791	8,733	0.0	Neutral
	N4 Cloonman	8,791	8,733	0.0	Neutral
	N4 West of Station Road	13,200	13,149	0.0	Neutral
	N4 East of Station Road	17,088	17,084	0.0	Neutral
	N4 River Shannon Bridge	17,515	17,497	0.0	Neutral
	N4 Landmark	18,314	18,143	0.0	Neutral
	N4 West of Shannon Roundabout	17,924	17,846	0.0	Neutral
	N4 West of Attirory Roundabout	15,949	14,231	-0.5	Negligible Positive
	N4 East of Attirory Roundabout	15,021	14,015	-0.3	Negligible Positive
	N4 East of Castlecarra Road	11,999	12,377	+0.1	Negligible Negative
	N4 at Attirory	10,193	10,571	+0.2	Negligible Negative
	N4 at Lisseeghan	10,193	10,571	+0.2	Negligible Negative
	N4 at Corbally	9,491	9,869	+0.2	Negligible Negative
	N4 at Tully	8,144	8,465	+0.2	Negligible Negative
	N4 at Mountcampbell	8,144	8,465	+0.2	Negligible Negative
	N4 West of Drumsna Junction	8,144	8,465	+0.2	Negligible Negative
Cyan	N4 Drumharlow	8,284	8,815	+0.3	Negligible Negative
	N4 Tumna	8,791	4,174	-3.2	Minor Positive
	N4 Cloonman	8,791	4,174	-3.2	Minor Positive
	N4 West of Station Road	13,200	8,264	-2.0	Negligible Positive
	N4 East of Station Road	17,088	9,710	-2.5	Negligible Positive
	N4 River Shannon Bridge	17,515	10,125	-2.4	Negligible Positive

Option Name & Colour	Road Section	Do-Minimum AADT (2045)	Do-Something AADT (2045)	Change in Noise Level (dB)	DMRB Impact categorisation
West of Drumsna / Node J					
	N4 Landmark	18,314	9,766	-2.7	Negligible Positive
	N4 West of Shannon Roundabout	17,924	9,130	-2.9	Negligible Positive
	N4 West of Attirory Roundabout	15,949	10,117	-2.0	Negligible Positive
	N4 East of Attirory Roundabout	15,021	13,036	-0.6	Negligible Positive
	N4 East of Castlecarra Road	11,999	13,427	+0.5	Negligible Negative
	N4 at Attirory	10,193	12,571	+0.9	Negligible Negative
	N4 at Lisseeghan	10,193	9,098	-0.5	Negligible Positive
	N4 at Corbally	9,491	9,098	-0.2	Negligible Positive
	N4 at Tully	8,144	9,098	+0.5	Negligible Negative
	N4 at Mountcampbell	8,144	9,098	+0.5	Negligible Negative
	N4 West of Drumsna Junction	8,144	9,098	+0.5	Negligible Negative
Orange	N4 Drumharlow	8,284	8,776	+0.3	Negligible Negative
	N4 Tumna	8,791	10,539	+0.8	Negligible Negative
	N4 Cloonman	8,791	6,325	-1.4	Negligible Positive
	N4 West of Station Road	13,200	7,490	-2.5	Negligible Positive
	N4 East of Station Road	17,088	10,138	-2.3	Negligible Positive
	N4 River Shannon Bridge	17,515	10,582	-2.2	Negligible Positive
	N4 Landmark	18,314	10,183	-2.5	Negligible Positive
	N4 West of Shannon Roundabout	17,924	9,572	-2.7	Negligible Positive
	N4 West of Attirory Roundabout	15,949	9,916	-2.1	Negligible Positive
	N4 East of Attirory Roundabout	15,021	12,306	-0.9	Negligible Positive

Option Name & Colour	Road Section	Do-Minimum AADT (2045)	Do-Something AADT (2045)	Change in Noise Level (dB)	DMRB Impact categorisation
West of Drumsna / Node J					
	N4 East of Castlecarra Road	11,999	12,541	+0.2	Negligible Negative
	N4 at Attirory	10,193	11,616	+0.6	Negligible Negative
	N4 at Lisseeghan	10,193	9,836	-0.2	Negligible Positive
	N4 at Corbally	9,491	9,836	+0.2	Negligible Negative
	N4 at Tully	8,144	9,836	+0.8	Negligible Negative
	N4 at Mountcampbell	8,144	9,836	+0.8	Negligible Negative
	N4 West of Drumsna Junction	8,144	9,836	+0.8	Negligible Negative
Purple West	N4 Drumharlow	8,284	8,544	+0.1	Negligible Negative
	N4 Tumna	8,791	10,150	+0.6	Negligible Negative
	N4 Cloonman	8,791	7,852	-0.5	Negligible Positive
	N4 West of Station Road	13,200	8,668	-1.8	Negligible Positive
	N4 East of Station Road	17,088	10,443	-2.1	Negligible Positive
	N4 River Shannon Bridge	17,515	10,882	-2.1	Negligible Positive
	N4 Landmark	18,314	11,185	-2.1	Negligible Positive
	N4 West of Shannon Roundabout	17,924	10,605	-2.3	Negligible Positive
	N4 West of Attirory Roundabout	15,949	11,928	-1.3	Negligible Positive
	N4 East of Attirory Roundabout	15,021	12,088	-0.9	Negligible Positive
	N4 East of Castlecarra Road	11,999	8,806	-1.3	Negligible Positive
	N4 at Attirory	10,193	7,021	-1.6	Negligible Positive
	N4 at Lisseeghan	10,193	7,021	-1.6	Negligible Positive
	N4 at Corbally	9,491	6,873	-1.4	Negligible Positive

Option Name & Colour	Road Section	Do-Minimum AADT (2045)	Do-Something AADT (2045)	Change in Noise Level (dB)	DMRB Impact categorisation
West of Drumsna / Node J					
	N4 at Tully	8,144	5,516	-1.7	Negligible Positive
	N4 at Mountcampbell	8,144	8,471	+0.2	Negligible Negative
	N4 West of Drumsna Junction	8,144	8,471	+0.2	Negligible Negative
Dark Green	N4 Drumharlow	8,284	8,492	+0.1	Negligible Negative
	N4 Tumna	8,791	10,155	+0.6	Negligible Negative
	N4 Cloonman	8,791	8,355	-0.2	Negligible Positive
	N4 West of Station Road	13,200	9,090	-1.6	Negligible Positive
	N4 East of Station Road	17,088	10,778	-2.0	Negligible Positive
	N4 River Shannon Bridge	17,515	11,208	-1.9	Negligible Positive
	N4 Landmark	18,314	11,489	-2.0	Negligible Positive
	N4 West of Shannon Roundabout	17,924	10,920	-2.2	Negligible Positive
	N4 West of Attirory Roundabout	15,949	11,918	-1.3	Negligible Positive
	N4 East of Attirory Roundabout	15,021	12,474	-0.8	Negligible Positive
	N4 East of Castlecarra Road	11,999	9,164	-1.2	Negligible Positive
	N4 at Attirory	10,193	7,379	-1.4	Negligible Positive
	N4 at Lisseeghan	10,193	7,379	-1.4	Negligible Positive
	N4 at Corbally	9,491	6,682	-1.5	Negligible Positive
	N4 at Tully	8,144	5,152	-2.0	Negligible Positive
	N4 at Mountcampbell	8,144	5,152	-2.0	Negligible Positive
	N4 West of Drumsna Junction	8,144	9,826	+0.8	Negligible Negative

During the operational phase of the Purple West Option, traffic noise levels along the majority of existing N4 road links are reduced in the range of -0.5 to -2 dB. For some of the road sections an increase of less than 1dB is calculated. With reference to the DMRB[18] the predicted change in noise level along the existing N4 is categorised as negligible positive to negligible negative.

During the operational phase of the Dark Green Option, traffic noise levels along the majority of existing N4 road links are reduced in the range of -0.2 to -2 dB. For some of the road sections an increase of less than 1 dB is calculated. With reference to the DMRB the predicted change in noise level along the existing N4 is categorised as negligible positive to negligible negative.

During the operational phase of the Orange Option, traffic noise levels along the majority of existing N4 road links are reduced in the range of -0.2 to ~3 dB. For some of the road sections an increase of less than 1 dB is calculated. With reference to the DMRB[18], the predicted change in noise level along the existing N4 is categorised as negligible positive to negligible negative.

During the operational phase of the Cyan Option, traffic noise levels along the majority of existing N4 road links are reduced in the range of -0.2 to ~3 dB. For some of the road links an increase of less than 1 dB is calculated. With reference to the DMRB[18], the predicted change in noise level along the existing N4 is categorised as minor positive to negligible negative.

For the Black Option, traffic noise levels along the existing N4 are predicted to be unchanged between N4 Drumharlow and the Shannon Roundabout. East of this point, small changes in traffic numbers result in changes in noise level that are categorised as negligible positive to negligible negative.

In summary, traffic flow data indicates that whilst all options remove an element of traffic out of Carrick-on-Shannon, there is not expected to be a significant reduction in noise levels associated with the residual traffic passing through the town. The highest reductions are achieved with the off-line Cyan Option Corridors to the south. The next highest reductions, some 0.5 dB less than the Cyan, are seen on the Orange Option Corridor. The highest reductions associated with the Purple West and Dark Green Option Corridors are of the order of 2 dB.

Stage 2 Assessment of Change in Traffic Noise Level - East of Node J at Drumsna Junction

East of Node J, due to the on-line alignments of the three option corridors, traffic noise levels will remain similar to those in the Do-Minimum scenario, depending on the final alignment design. For the Green and Yellow Options Corridors, a neutral change in traffic noise levels is expected for the majority of NSRs along the N4 between Nodes J to H. The Purple East Option will result in a reduction in traffic volumes and associated reduction in traffic noise levels along the N4 through Aghamore.

8.8.6.5 Summary

Impact Rating Score

Based on the qualitative analysis undertaken for each of the alternatives discussed in Section 8.8.6.3, all alternatives have the potential to generate a neutral noise impact given the negligible change in traffic noise levels associated with either option.

Table 8.8.6.8 Summary Noise and Vibration Stage 2 Assessment Table

Assessment Criterion	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Potential change in traffic noise levels	Neutral to Not Significant (Positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.	Neutral to Not Significant (Positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.	Neutral to Not Significant (Positive) dependent on modal shift towards active travel and resultant reduction in private vehicles.
Scoring			
Qualitative assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact level	**4**	**4**	**4**

All option corridors have the potential to generate a negative noise impact at noise sensitive properties impacted by the new and existing alignments.

Summary Assessment of Option Corridors West of Node J at Drumsna Junction

Taking account of the assessments set out above including the PIR, the likelihood of required mitigation and associated qualitative assessment for each option corridor within the western section of the study area are summarised in Table 8.8.6.9. With reference to Table 8.8.6.9 the predicted change in noise level associated with each option corridor has been categorised. For example, a minor change in noise level is defined as being a 3 – 4.9 dB change. The change is denoted as positive where a reduction in noise level is predicted and negative in the case that there is a predicted increase in noise level.

Taking account of the assessment criteria, the Cyan and Orange Option Corridors are determined to have a Moderately Negative impact. This is due to the number of properties likely requiring noise mitigation and the PIR values being notably higher compared to the Purple West and Dark Green Option Corridors. Both the Cyan and Orange Option Corridors are also more likely to impact highly sensitive amenity areas along the River Shannon at the river crossing compared to the Purple West Option Corridor. It is noted both the Cyan and Orange Option Corridors provide a marginally greater benefit in terms of traffic noise reduction to noise sensitive properties along the existing N4 through Carrick-on-Shannon compared to the

Purple West and Dark Green Option Corridors, however the variation between the Option Corridors is largely imperceptible.

The Purple West Option Corridor has been determined to have a Minor or Slightly Negative impact due to its low PIR and low number of properties likely to require noise mitigation compared to the Cyan and Orange Option Corridors. Whilst this option will affect a small number of properties along its alignment, it results in a negligible change in noise levels to noise sensitive properties along the existing N4 through Carrick-on-Shannon. This option is Preferred alongside the Dark Green Option Corridor.

The Dark Green Option Corridor has also been determined to have a Minor or Slightly Negative impact due to its low PIR and low number of properties likely to require noise mitigation compared to the Cyan and Orange Option Corridors. Whilst this option will affect a small number of properties along its alignment, it results in a negligible change in noise levels to noise sensitive properties along the existing N4 through Carrick-on-Shannon. This option is preferred alongside the Purple West Option Corridor.

On the basis of the above, the Dark Green and Purple West Option Corridors are Preferred over the Cyan and Orange Option Corridors. Both the Cyan and Orange Option Corridors are ranked as Intermediate on the basis that whilst they have higher potential noise impacts, the impacts could be controlled through further detailed design and noise mitigation at focused locations along the carriageways.

The Black Option Corridor has been determined to have a Moderately Negative impact. While traffic flow numbers are relatively low, the connector road introduces traffic closer to noise sensitive locations than the existing condition. Once operational, small amounts of traffic will make use of this option resulting in no change and a negligible increase in traffic noise levels on the existing N4 alignment.

Table 8.8.6.9 Summary Noise and Vibration Assessment Table – Option Corridors West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR		BLACK OPTION CORRIDOR
	Pink Design Option Dual Carriageway	Orange Design Option Dual Carriageway	Purple West Design Option Dual Carriageway	Grey Design Option Dual Carriageway		Black Design Single Carriageway Urban Street
Potential Impact Rating (PIR)	872	709	219	213		538
No. of properties likely to require noise mitigation	24	21	3	1		11
Predicted Change in Noise Level (dB) along existing N4 (DMRB Long-term rating)	Minor Positive to Negligible Negative	Negligible Positive to Negligible Negative	Negligible Positive to Negligible Negative	Negligible Positive to Negligible Negative		N/A
Scoring						
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**		**Moderately Negative**
Score / Impact Level	**2**	**2**	**3**	**3**		**2**
Preference	**Intermediate**	**Intermediate**	**Preferred**	**Preferred**		**N/A**

Summary Assessment of Option Corridors East of Node J at Drumsna Junction

Taking account of the assessments set out above, the PIR, likelihood of required mitigation and associated qualitative assessment for each option corridor within the eastern section of the study area are summarised in Table 8.8.6.10.

With reference to Table 8.8.6.10 the predicted change in noise level associated with each option corridor has been categorised. Taking account of the assessment criteria, the Purple East, Green and Yellow Option Corridors are determined to result in changes in noise levels that are negligible. The changes range from negligible increases to negligible decreases in noise level.

The Green and Yellow Option Corridors score similarly in terms of PIR and number of properties likely requiring noise mitigation and are ranked Intermediate. This relates to the potential for new impacts at properties adjacent to new junctions or parallel roads. Given the early stage of this assessment, however, these impacts may be further reduced at more detail assessment stages.

The Purple East Option Corridor has the lowest PIR and second lowest number of properties likely requiring noise mitigation. The marginally lower number of affected properties associated with new junction or parallel road layouts coupled with the likely reduction in traffic noise levels along the N4 through Aghamore ranks this route Preferred over the Green and Yellow Option Corridors.

Table 8.8.6.10 Summary Noise and Vibration Assessment Table – Option Corridors East of Drumsna Junction (Node J)

Assessment Criteria	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**
	Yellow Design Option Single Carriageway	Green Design Option Single Carriageway	Purple Design Option Dual Carriageway
Potential Impact Rating (PIR)	307	315	300
No. of properties likely to require noise mitigation	13	13	7
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**	**Minor** or **Slightly Negative**
Score / Impact Level	**3**	**3**	**3**
Preference	**Intermediate**	**Intermediate**	**Preferred**

8.8.7 Archaeology, Architectural and Cultural Heritage

8.8.7.1 Introduction

This section details the Archaeological, Architectural and Cultural Heritage assessment of the Stage 2 alternatives and options with respect to the Archaeology, Architectural and Cultural Heritage constraints identified in Section 4.10 Archaeology, Architectural and Cultural Heritage of this report.

The Archaeological, Architectural and Cultural Heritage constraints are presented with the Stage 2 Option Corridors in Figures 8.8.7.1.0 to 8.8.7.1.5. The sites are referenced as per the Leitrim County Development Plan 2015-2021, noting that the Draft Leitrim County Development Plan 2023-2029 will come into effect on 21 March 2023. The proposed additions and deletions to the protected structures listed in the new Plan have been reviewed and this assessment of the Stage 2 Option Corridors remains unchanged.

Section 8.8.7.2 details the methodology and assessment criteria that was used to carry out the study. The Stage 2 Assessments of alternatives and options are presented in Sections 8.8.7.3 and 8.8.7.4 and a summary is provided in Section 8.8.7.5.

8.8.7.2 Methodology

The Stage 2 Assessment of the alternatives and options has been carried out with reference to the TII Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes[19] and Assessment of Architectural Heritage Impacts of National Road Schemes[20], although it should be noted that the guidelines themselves predate the establishment of a preliminary options assessment process.

Potential positive and negative direct and indirect impacts arising from both the alternatives and the options corridors upon the archaeological, architectural and cultural heritage resource are assessed. A positive impact is possible if it results in a change that improves or enhances the setting of an archaeological/architectural monument/structure with the scale varying from imperceptible positive if the impact is capable of measurement but is without noticeable consequences to minor positive to moderately positive depending on the degree to which it enhances the integrity or sensitivities of the site. Equally a negative impact is also possible with a similar sliding scale to define the level of negative impact.

The following desktop resources were assessed as part of the route alternatives and options assessment:

[19] Transport Infrastructure Ireland, 2005. Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Assessment-of-Archaeological-Heritage-Impact-of-National-Road-Schemes.pdf

[20] Transport Infrastructure Ireland, 2005. Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Assessment_of_Architectural_Heritage_Impact_of_National_Road_Schemes.pdf

- Record of Monuments and Places (RMP) for County Leitrim and County Roscommon
- Sites and Monuments Record (SMR) for County Leitrim and County Roscommon
- Monuments in State Care Database County Leitrim and County Roscommon
- Preservation Orders County Leitrim and County Roscommon
- Register of Historic Monuments County Leitrim and County Roscommon
- Topographical Files of the National Museum of County Leitrim and County Roscommon
- Cartographic and written sources relating to the scheme study area
- National Inventory of Architectural Heritage County Leitrim and County Roscommon (Architectural & Garden Survey)
- Excavations Bulletin (1970-2021)
- Leitrim County Development Plan, 2015–2021
- Roscommon County Development Plan, 2014–2020
- Aerial photographic coverage

Record of Monuments and Places (RMP) Section 12 (1) of the National Monuments Act (1994 amendment) provides that the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for Housing, Local Government and Heritage) shall establish and maintain a record of monuments and places (RMP) where it is known that such monuments exist. The record comprises of a list of monuments and relevant places and mapping showing each monument and relevant place in respect of each county in the State. Sites recorded on the Record of Monuments and Places all receive statutory protection under the National Monuments Act. All recorded monuments are referred to as Archaeological Heritage (AH sites) within this assessment.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Service as ‘un-located sites’ and cannot be afforded legal protection. As a result, these are omitted from the Record of Monuments and Places. SMR sites are also listed on a website maintained by the Department of Housing, Local Government and Heritage (DoHLGH) – www.archaeology.ie. All SMR sites are referred to as Archaeological Heritage (AH sites) within this assessment.

National Monuments in the State Care Database is a list of all the National Monuments in the State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

A National Monument receives statutory protection and is described as ‘a monument or the remains of a monument the preservation of which is a matter of

national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (National Monuments Act, 1930, Section 2).

The Minister for the Department of Housing, Local Government and Heritage may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any National Monument (other than dwellings). The owners of National Monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

No National Monuments have been identified within the overall Constraints Area of the proposed project.

Preservation Orders List and/or Temporary Preservation Orders can be assigned to a site or sites that are deemed to be in danger of injury or destruction. These are included under the 1930 Act

Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be issued under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister (DoHLGH).

No sites with Preservation Orders have been identified within the overall Constraints Area of the proposed project.

Register of Historic Monuments was established under Section 5 of the 1987 National Monuments Act, which requires the Minister to establish and maintain such a record. Historic monuments and archaeological areas present on the Register are afforded statutory protection under the 1987 Act. The Register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are also included in the Record of Monuments and Places.

Topographical files of the National Museum of Ireland are the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources that may relate to known, suspected or as-yet unidentified sites of archaeological significance.

Cartographic sources are important in tracing land use development within the development area, as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies, structures and demesne landscapes that may longer remain within the landscape. All sites of potential archaeological or architectural heritage merit identified during the map analysis are listed as Cultural Heritage (CH) sites within this assessment.

Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape containing the proposed Option Corridors/alternatives.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeological discovery. Ordnance Survey aerial photographs (1995-2013), Google Earth coverage (2020) and Bing Maps were examined for this assessment. Any sites identified during cartographic or aerial photographic assessment as identified as Cultural Heritage (CH) sites within this assessment.

Development Plans contain a catalogue of all the Protected Structures, archaeological sites and Architectural Conservation Areas within every county.

The development plans for Counties Leitrim and Roscommon were examined as part of this assessment, along with relevant local or town plans. All protected structures are referred to as Built Heritage sites (BH) as part of this assessment. There are no Architectural Conservation Areas located within any of the Option Corridors under assessment.

The National Inventory of Architectural Heritage is a government-based initiative tasked with making a nationwide record of significant local, regional, national and international structures, which in turn provides County Councils with a guide as to what structures to list within the Record of Protected Structures. The NIAH also comprises a nationwide desk-based survey of historic gardens, including demesnes that surround large houses. All structures contained within The NIAH are referred to as Built Heritage sites (BH) as part of this assessment.

The NIAH Garden Survey was utilised as part of this assessment in conjunction with detailed analysis of the historic Ordnance Survey maps in order to identify all designed landscapes (DL) within the Option Corridor corridors/alternatives.

Excavations Bulletin is a summary publication that has been produced every year since 1970. The Bulletin—produced in hard copy between 1970 and 2010—summarises every archaeological excavation that takes place in Ireland during each year; since 1987 it has been edited by Isabel Bennett. Information for the period 1970-2021 is available digitally (www.excavations.ie). This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. It should be noted that in some instances there can be a delay to the lodgement of summaries and, as such, the record should not be considered comprehensive.

Stage 2 Methodology for the Assessment of Alternatives

For the assessment of the alternatives, the methodology addressed a study area comprising 250m either side of where interventions may be required as part of the alternatives. This enables the assessment of potential direct and indirect impacts upon the archaeological, architectural and cultural heritage resource.

A direct impact occurs where an asset is within the potential footprint of interventions required as part of the alternatives. An indirect impact may occur where the asset is within 250m of the proposed intervention. For the purposes of

this assessment, the establishment of cycle ways and traffic management measures within the existing road network are not considered to represent interventions that may negatively affect the archaeological, architectural or cultural heritage resource. This is due to the fact that such measures represent a re-use of the existing road network that is neutral when applied to potential impacts on the resource under assessments.

Measurements are taken from the edge of the proposed interventions to the upstanding remains of a site or structure, or to the edges of features/monuments visible on aerial photography. Where no upstanding remains are visible, the measurement is taken from the edge of the potential interventions to the centre of the site. These measurements are noted as "Distance from Alternative" in the assessment tables herein.

Stage 2 Methodology for the Assessment of Option Corridors

For the Stage 2 option corridor assessment, the overall project has been split into two sections, i.e. West of Drumsna Junction (Node J) and East of Drumsna Junction (Node J) and the option corridors assessed are those described in Section 8.2.

For the assessment of the options, the methodology addressed a 250m study area either side of the potential road footprint. This enables a meaningful assessment of potential positive and negative direct and indirect impacts upon the archaeological, architectural and cultural heritage resource.

A direct impact occurs where an asset is within the potential road footprint (within an option corridor). An indirect impact may occur where the asset is within the 250m wide study area of the potential road footprint. A neutral impact occurs where proposals will not change the feature or setting, for example where the site sits within the existing carriageway, or where a site has previously been fully excavated and preserved by record. This is distinct from an indirect impact where works will potentially have a visual impact on a site/structure in terms of setting.

The severity of an indirect impact is dependent on the distance from the potential road footprint and the presence (or lack) of upstanding remains. The severity of a direct impact is dependent on the extent to which the potential road footprint encroaches on the site, e.g. a site that is merely touching the potential road footprint would be moderately impacted, whereas a site/structure which lies 100% within the potential road footprint would be subject to a very significant or profound negative impact.

Measurements are taken from the edge of the potential road footprint to the upstanding remains of a site or structure, or to the edges of features/monuments where they are visible on aerial photography. Where there are no upstanding remains, or where upstanding remains are not visible on aerial photography, the measurement is taken from the edge of the potential road footprint to the approximate centre of the site as recorded on the RMP, NIAH etc. These measurements are noted as "Distance from Potential Road Footprint" in the assessment tables herein.

The area of greenfield land within each potential road footprint and corridor has been calculated to assist in the assessment of the likelihood of impacts to previously unrecorded archaeological remains.

Assessment Criteria

The quality and type of an impact can vary to include the following (as per NRA's Guidelines for the Assessment of Archaeological/Architectural Heritage Impacts of National Road Schemes[19,20]):

- **Negative Impact:** A change that will detract from or permanently remove an archaeological/architectural monument/structure from the landscape.
- **Neutral Impact:** A change that does not affect the archaeological/architectural heritage.
- **Positive Impact:** A change that improves or enhances the setting of an archaeological/architectural monument/structure.
- **Direct Impact:** Where an archaeological/architectural feature or site is physically located within the footprint of a potential route and entails the removal of part, or all of the monument or feature.
- **Indirect Impact:** Where a feature or site of archaeological/architectural heritage merit or its setting is located in close proximity to the footprint of a potential route alignment.
- **No Predicted Impact:** Where the potential route does not adversely or positively affect an archaeological/architectural heritage site.

Impact Definitions (as outlined in the Guidelines for the Assessment of Archaeological/Architectural Heritage Impacts of National Road Schemes (NRA, 2005a/2005b, p. 54/33), are included in Table 8.8.7.1 and

Table 8.8.7.2 below. These have been supplemented with the additional impact definitions as per the most recent EPA guidelines (2017).

Table 8.8.7.1 Significance of Effect definitions: Archaeology

Significance of Effect	Definition relating to sites of an archaeological nature
Profound	Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise when an archaeological site is completely and irreversibly destroyed by a proposed development.
Very Significant	Effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Significant	An impact which, by its magnitude, duration or intensity, alters an important aspect of the environment. An impact like this would be where part of a site would be permanently impacted upon, leading to a loss of character, integrity and data about the archaeological feature / site.
Moderate	A moderate impact arises where a change to the site is proposed, which although noticeable, is not such that the archaeological integrity of the site is compromised, and which is reversible. This

Significance of Effect	Definition relating to sites of an archaeological nature
	arises where an archaeological feature can be incorporated into a modern-day development without damage and that all procedures used to facilitate this are reversible.
Slight	An impact which causes changes to the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument.
Not Significant	Impacts which cause noticeable changes in the character of the environment but without significant consequences
Imperceptible	An impact capable of measurement but without noticeable consequences.

Table 8.8.7.2 Significance of Effect definitions: Architecture

Significance of Effect	Definition relating to sites of an architectural nature
Profound	An impact that obliterates the architectural heritage of a structure or feature of national or international importance. These effects arise where an architectural structure or feature is completely and irreversibly destroyed by the proposed development. Mitigation is unlikely to remove adverse effects.
Very Significant	An impact which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Significant	An impact which, by its magnitude, duration or intensity alters the character and / or setting of the architectural heritage. These effects arise where an aspect or aspects of the architectural heritage is / are permanently impacted upon leading to a loss of character and integrity in the architectural structure or feature. Appropriate mitigation is likely to reduce the impact.
Moderate	An impact that results in a change to the architectural heritage which, although noticeable, is not such that alters the integrity of the heritage. The change is likely to be consistent with existing and emerging trends. Impacts are probably reversible and may be of relatively short duration. Appropriate mitigation is very likely to reduce the impact.
Slight	An impact that causes some minor change in the character of architectural heritage of local or regional importance without affecting its integrity or sensitivities. Although noticeable, the effects do not directly impact on the architectural structure or feature. Impacts are reversible and of relatively short duration. Appropriate mitigation will reduce the impact.
Not Significant	An impact which causes noticeable changes in the character of the environment but without noticeable consequences
Imperceptible	An impact on architectural heritage of local importance that is capable of measurement but without noticeable consequences.

The TII Project Appraisal Guidelines for National Roads (PAG) Unit 7.0 - Multi Criteria Analysis[2] (hereafter referred to as the TII PAG) was used as a basis for the assessment of potential impacts on the archaeological, architectural and cultural

heritage resource. Impacts were assigned assessment scores based on the PAG Unit 7.0[2] seven point scale shown in Table 8.1.1.

The assessment was informed by the Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Specifically, the significance of effects, as detailed in Table 3.3 of that document, have been aligned with those impacts described above as shown in Table 8.8.7.3 below.

Table 8.8.7.3 Alignment of TII and EPA Impact Guidelines

TII Guidelines	EPA Guidelines
Majorly Positive 7	Profound Positive
	Very Significant Positive
Moderately Positive 6	Significant Positive
	Moderate Positive
Minor or Slightly Positive 5	Slight Positive
	Not Significant Positive
Not Significant or Neutral 4	Imperceptible
	Not Significant
Minor or Slightly Negative 3	Slight
Moderately Negative 2	Moderate
	Significant
Major or Highly Negative 1	Very Significant
	Profound

Due to the more condensed nature of the TII scale of impacts in comparison with that provided by the EPA, the impact assessment remains high level at this stage.

8.8.7.3 Archaeological, Architectural and Cultural Heritage Stage 2 Alternatives Assessment

Alternative A: Active Travel

Alternative A comprises improvements to cycling and walking facilities and includes the elements as follows:

- Development of a comprehensive cycle network
- Improved facilities for cyclists (cycle parking, changing areas, e-bike charging, etc.)
- Improvements to pedestrian facilities (e.g. improved crossings and footpath provision)
- Improve permeability (non-motorised) within the town
- Potential pedestrianisation of key streets

Alternative A provides for an enhanced pedestrian/cycle-friendly environment within Carrick-on-Shannon and Cortober and along the full length of the N4 within the study area. The alternative proposed will not affect the archaeological, architectural or cultural heritage resource and as such the overall affect is Not Significant or Neutral.

Alternative B: Public Transport Improvements

Alternative B comprises improvements to public transport and includes the following measures:

- Development of an enhanced public transport network
- Increased frequency on the rail network
- Improved parking facilities at Carrick-on-Shannon railway station
- Linking of nearby urban settlements with Carrick-on-Shannon and key trip attractors in the town
- Increase in public transport services (i.e. up to every 20 minutes during peak periods)
- Development of a mobility hub in the town centre facilitating interchange with other modes
- Provision of demand responsive mini-bus services connecting isolated areas to Carrick-on-Shannon and Cortober

Alternative B will involve an improvement to and/or new bus services on the existing street network. This will involve additional signage and possible bus-stops but will not require land acquisition and significant construction.

Alternative B will also include improvements to the rail service which will be accomplished without new rail infrastructure construction. The addition of new facilities at the rail station could include line markings and signage to delineate parking for cyclists and/or vehicles.

This alternative will not negatively affect the archaeological, architectural and cultural heritage resource, as it represents changes to the existing travel network. As such the alternative is considered to be Not Significant or Neutral.

Alternative C: Demand Management

Alternative C involves Demand Management for car trips through Carrick-on-Shannon and includes the following measures:

- Rationalise parking along the existing N4 corridor
- Provision of Park & Stride sites on periphery of town
- Development of a car-free town centre
- Development of remote working hubs
- Delivery of centrally located mixed-use developments

Alternative C will involve measures to reduce the need to make the trip by car in the first instance. As such, it will be a reduction measure as opposed to a provision measure with a reassignment of on-street parking/existing traffic lanes to provide walking or cycling facilities in the urban realm, which will not require land acquisition and significant construction. The creation of Park and Stride sites will be located on existing brownfield sites or reassigned existing parking lots.

This alternative will not negatively affect the archaeological, architectural and cultural heritage resource. Proposals include for the reduction and removal of traffic within the town centre, which would overall have a moderate to significant positive impact on the built heritage environment, especially, the designated Architectural Conservation Area. As such, this alternative is considered to be Moderately Positive.

A summary of the Stage 2 Archaeological, Architectural and Cultural Heritage assessment of the alternatives is provided in Table 8.8.7.4.

Table 8.8.7.4 Stage 2 Archaeological, Architectural and Cultural Heritage Summary Assessment Matrix of Alternatives

Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Impacts to number of sites subject to statutory protection.	None predicted.	None predicted.	Potential positive impacts on the overall built heritage resource of the town of Carrick-on-Shannon, including protected structures and the ACA.
Impacts to number of sites not subject to statutory protection.	None predicted.	None predicted.	Potential positive impacts on the overall built heritage resource of the town of Carrick-on-Shannon, including structures of architectural merit that may not be subject to statutory protection.
Scoring			
Qualitative assessment	The alternative proposed will not affect the archaeological, architectural or cultural heritage resource and as such the overall affect is neutral. **Not Significant** or **Neutral**	The alternative proposed will not affect the archaeological, architectural or cultural heritage resource and as such the overall affect is neutral. **Not Significant** or **Neutral**	The alternative proposed has the potential to result in a moderately positive impact on the built heritage environment of Carrick-on-Shannon, due to the removal of traffic. **Moderately Positive**
Score / Impact level	**4**	**4**	**6**

8.8.7.4 Archaeological, Architectural and Cultural Heritage Stage 2 Option Corridor Assessment

Table 8.8.7.5 to Table 8.8.7.27 detail the potential impacts of each option corridor west of Drumsna Junction (Node J) on the known archaeological, architectural and cultural heritage resources. A summary of the impacts across each option corridor is then presented in Table 8.8.7.28 together with an average impact score and ranking of each option corridor from Preferred to Intermediate to Least Preferred.

Cyan Option Corridor (Pink Design Option)

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Cyan Option Corridor (Pink Design Option) travels are listed in Table 8.8.7.5 below.

Table 8.8.7.5 Cyan Option Corridor (Pink Design Option): NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Killukin	2010:79	Stone roof tile	Stone	UNKNOWN
	1986:67	Copper alloy blade fragment	Copper alloy	Ardakillen Lough, old shore
	1986:66	Openwork sub-triangular object resembling a dial component	Copper alloy object	Ardakillen Lough, old shore
	1986:65	Copper alloy rod	Copper alloy	Ardakillen Lough, old shore
Attirory	4990:W78	Copper Alloy Lade	Copper alloy	Found in 1847, in the bed of the River Shannon, Grose's Island
Jamestown	2000:166	Medieval pottery body sherd	Ceramic	Rear garden of the "Tee Pot"
	2000:165	Medieval pottery body sherd (possible)	Ceramic	Rear garden of the "Tee Pot"
	2000:164	Glazed red earthenware body sherd	Ceramic	Rear garden of the "Tee Pot"
	2000:163	Post-medieval pottery body sherd	Ceramic	Rear garden of the "Tee Pot"
	2000:162	Glazed red earthenware body sherd	Ceramic	Rear garden of the "Tee Pot"
	2000:161	Glazed red earthenware body sherd	Ceramic	Rear garden of the "Tee Pot"

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
	2000:160	Red earthenware rim sherd	Ceramic	Rear garden of the "Tee Pot"
	2000:159	Glazed red earthenware rim sherd	Ceramic	Rear garden of the "Tee Pot"
	1934:384	Decorated flat bronze Axehead	Bronze	River Shannon, Cornacarrow
	4402:W195	Bronze dirk	Bronze	Cornacarrow, near Jamestown
	4932:W20	Copper alloy basin	Copper alloy	Cornacarrow, near Jamestown
Tully	1974:25.2	Chert retouched flake	Chert	Shore of River Shannon
	1974:25.3	Chert retouched flake	Chert	Shore of River Shannon
	54:25.1	Chert side scraper	Chert	Shore of River Shannon
	1974:24	Chert blade	Chert	Unknown
	1974:23	Chert retouched flake	Chert	Unknown
	1974:22	Chert tertiary flake	Chert	Unknown
	1974:21	Chert retouched blade	Chert	Unknown
	1974:20	Chert retouched blade	Chert	Unknown
	1974:19	Polished stone axehead	Stone	Unknown
	2005C1:1281-1302	22 Siltstone flakes, blades and cores	Stone	Lough Allen
Drumsna	RIA1898:99	Flint flaked axehead	Flint	Drumsna

Table 8.8.7.6 Cyan Option Corridor (Pink Design Option) Assessment – Archaeological Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance From Potential Road Footprint:	Impact Type:	Potential Impact level:
AH1	Barrow - ring-barrow	Proposed RMP	249m WNW	Neutral	N/A
AH2	Fulacht fia	None (excavated)	c. 115m NW	Neutral	N/A
AH3	Burnt mound	None (excavated)	c. 31m SW	Neutral	N/A
AH4	Excavation-miscellaneous (poss corn-drying kiln)	Proposed RMP	c. 5m SW	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance From Potential Road Footprint:	Impact Type:	Potential Impact level:
AH5	Excavation-miscellaneous (Pit with charred material)	Proposed RMP	c. 17m NE	Neutral	N/A
AH5	Excavation-miscellaneous	None (excavated)	c. 23m SW	Neutral	N/A
AH6	Ringfort-rath	RMP	c. 9m SW	Indirect	Significant Negative
AH7	Excavation-miscellaneous	None (excavated)	c. 59m NE	Neutral	N/A
AH8	Excavation-miscellaneous	None (excavated)	c. 44m NE	Neutral	N/A
AH8	Burnt mound	None (excavated)	c. 47m NE	Neutral	N/A
AH9	Redundant record	None (excavated)	c. 133m NE	Neutral	N/A
AH10	House-prehistoric Hut site Ringfort-rath Enclosure Fulacht fia Burnt mound Burnt mound Burnt mound	Mixture of excavated sites and proposed RMPs	c. 62m-189m NE	Neutral	N/A
AH15	Burnt mounds	Proposed RMP	0m	Direct	Significant Negative
AH14	Ringfort-rath	RMP	c. 81m S	Indirect	Slight Negative
AH13	Ringfort-rath	RMP	c. 117m NE	Indirect	Imperceptible Negative
AH12	Redundant record	None (SMR)	c. 116m SW	Neutral	N/A
AH16	Redundant record	None (SMR)	c. 146m SW	Neutral	N/A
AH17	Redundant record	None (SMR)	c. 166m NE	Neutral	N/A
AH33	Ringfort-rath	RMP	c. 175m SSW	Indirect	Imperceptible Negative
AH36	Ringfort-rath	RMP	0m	Direct	Very significant Negative

Site Ref.	Name	Statutory Protection	Distance From Potential Road Footprint:	Impact Type:	Potential Impact level:
AH43	Ringfort - rath	Proposed RMP	c. 212m NW	Neutral	N/A
AH49	Ecclesiastical enclosure	Proposed RMP	0m	Direct	Moderately Negative
AH49	Church & Graveyard	RMP	c. 52m south	Indirect	Slight Negative
AH50	Inscribed stone	Proposed RMP	c. 112m E	Neutral	N/A
AH66	Ringfort-rath	Proposed RMP	c.63m NE	Indirect	Slight Negative
AH67	Ringfort-rath	Proposed RMP	c.142m N	Indirect	Slight Negative
AH68	Ringfort-rath	Proposed RMP	c. 141m N	Indirect	Slight Negative
AH65	Ringfort-rath	RMP	c. 230m N	Neutral	N/A
AH142	Bullaun stone, Burial Ground, Ecclesiastical enclosure, Church	One SMR, one RMP And two Proposed RMPs	c. 62m-131 NW	Indirect	Slight Negative
AH143	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH144	Ringfort-rath	RMP	c. 221m SW	Indirect	Imperceptible Negative
AH123	Ringfort-rath	RMP	c. 157m NE	Indirect	Imperceptible Negative
AH124	Ringfort-rath	RMP	c. 247m NE	Neutral	N/A
AH151	Fulacht fia	None (SMR)	0m	Neutral	N/A
AH129	Ringfort-rath	RMP	c. 225m N	Neutral	N/A
AH132	Enclosure	RMP	c. 136m NNW	Indirect	Slight Negative
AH150	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH139	Redundant record	None (SMR)	c. 231m N	Neutral	N/A
AH152	Mound	Proposed RMP	0m	Direct	Profound Negative
AH 133 / 155	Crannog	RMP	c. 127m SSE	Indirect	Slight Negative
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance From Potential Road Footprint:	Impact Type:	Potential Impact level:
AH154	Hut site & Fulacht fia	None (excavated)	0m	Neutral	N/A
AH266	Ringfort-rath	Proposed RMP	c.189m N	Neutral	N/A
AH267	Ringfort-rath	Proposed RMP	c. 43m ENE	Indirect	Slight Negative
AH270	Ringfort-rath	RMP	c. 10m SW	Indirect	Significant Negative
AH269	Ringfort-rath	RMP	c. 79m WSW	Indirect	Slight Negative
AH271	Ringfort-rath	RMP	c. 164m NE	Neutral	N/A

Table 8.8.7.7 Cyan Option Corridor (Pink Design Option) Assessment – Architectural Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance From Potential Road Footprint:	Impact Type	Potential Impact level
BH2	Railway Storehouse / warehouse	RPS	c. 15m SW	Indirect	Significant Negative
BH2	Railway Goods shed	RPS	c. 11m SW	Indirect	Significant Negative
BH2	Water tower	None	c. 13m SW	Indirect	Significant Negative
BH2	Signal box	RPS	To immediate SW	Indirect	Significant Negative
BH2	Waiting Room	RPS	To immediate SW	Indirect	Significant Negative
BH2	Carrick-on-Shannon Railway station	RPS	c. 14m SW	Indirect	Significant Negative
BH2	Footbridge	RPS	To immediate SW	Indirect	Significant Negative
BH8	Drumsna National School	None	c. 46m NE	Indirect	Slight Negative

Table 8.8.7.8 Cyan Option Corridor (Pink Design Option) Assessment – Demesne Landscapes – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
DL5	Charlestown House demesne	None	c. 110m S	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Slight Negative
DL7	Belmont	None	0m	Direct	Slight Negative

Table 8.8.7.9 Cyan Option Corridor (Pink Design Option) Assessment – Cultural Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH1	House and outbuilding visible on 6-inch OS map	None	c. 155m SW	Indirect	Slight Negative
CH2	House, marked 'Springfield House' on 25-inch map, earlier buildings shown on site on 6-inch map	None	c. 39m NE	Indirect	Moderately Negative
CH3	House, marked 'Cuiltyconnen House' on 25-inch OS map	None	c. 170m SE	Neutral	N/A
CH4	Sites of 2 vernacular structures	None	To immediate east	Neutral	N/A
CH9	Vernacular structure, first visible on 6-inch OS map	None	c. 48m S	Indirect	Imperceptible Negative
CH10	Vernacular structure visible on 6-inch OS map	None	c. 128m S	Neutral	N/A
CH12	Vernacular structure visible on 6-inch OS map	None	c. 62m W	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH13	School house visible on 6-inch OS map	None	c. 215m NE	Neutral	N/A
CH115	Semi-detached brick cottages adjacent to railway	None	0m	Direct	Significant Negative
CH116	Railway bridge & abutments	None	To the immediate SW	Indirect	Moderately Negative
CH14	Cluster of vernacular structures first visible on 6-inch OS map, extended on 25-inch	None	c. 151m-225m NE	Indirect	Imperceptible Negative
CH17	Vernacular structure visible on 6-inch OS map	None	c. 71m N	Indirect	Slight Negative
CH16	Vernacular structure visible on 6-inch OS map, extended on 25-inch map	None	c. 90m N	Indirect	Slight Negative
CH19	House visible on 25-inch OS map, possibly replacing earlier structure on 6-inch map	None	c. 135m N	Indirect	Slight Negative
CH20	Vernacular structure visible on 25-inch OS map	None	c. 185m NW	Indirect	Slight Negative
CH21	House visible on 25-inch OS map	None	c. 59m NW	Indirect	Imperceptible Negative
CH25	Vernacular structure visible on 6-inch OS map	None	c. 172m NE	Indirect	Imperceptible Negative
CH26	3 vernacular structures visible on 25-inch OS map	None	c. 171m N	Indirect	Imperceptible Negative
CH27	Site of vernacular	None	0m	Direct	Significant Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	structure visible on 6-inch OS map				
CH28	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH29	Modified Vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH30	Sites of 3 vernacular structures visible on 6-inch OS map and one on 25inch OS map	None	0m	Direct	Significant Negative
CH31	Site of 2 vernacular structures visible on 6-inch OS map and one further visible on 25-inch map	None	0m	Direct	Significant Negative
CH32	'Spa Well' marked on 6-inch OS map and 'Spa Well (Sulphur)' on 25-inch map	None	0m	Direct	Significant Negative
CH33	Vernacular structure visible on 6-inch OS map	None	c. 12m SW	Indirect	Moderately Negative
CH34	2 structures, house first visible on 6-inch OS map and outbuilding to west on 25-inch OS	None	c. 37m NNE	Indirect	Moderately Negative
CH35	Sites of 3 vernacular structure visible on 6-inch OS map, one	None	0m	Direct	Significant Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	(northernmost) still visible on 25-inch map				
CH36	2 vernacular structures visible on 6-inch OS map and 25-inch map, unclear if remains extant	None	0m	Direct	Significant Negative
CH40	House visible on 25-inch OS map	None	c. 224m SSW	Neutral	N/A
CH37	Vernacular structure visible on 6-inch OS map	None	c. 20m N	Indirect	Slight Negative
CH38	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH39	Site of 2 vernacular structures visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH41	House visible on 25-inch OS map	None	c. 10m E	Indirect	Moderately Negative
CH43	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH42	2 vernacular structures visible on 25-inch OS map, third (northernmost) visible on earlier 6-inch	None	c. 77m NW	Indirect	Slight Negative
CH75	Site of Mountcampbell House	None	c. 25m N	Neutral	N/A
CH 117	House	None	c. 80m NE	Indirect	Imperceptible negative

Orange Option Corridor

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Orange Option Corridor travels are listed in Table 8.8.7.10 below.

Table 8.8.7.10 Orange Option Corridor: NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Attirory	4990:W78	Copper Alloy Ladle	Copper alloy	Found in 1847, in the bed of the River Shannon, Grose's Island
Jamestown	2000:166	Medieval pottery body sherd	Ceramic	Rear garden of the "Tee Pot"
	2000:165	Medieval pottery bodt sherd (possible)	Ceramic	Read garden of the "Tee Pot"
	2000:164	Glazed red earthenware body sherd	Ceramic	Read garden of the "Tee Pot"
	2000:163	Post-medieval pottery body sherd	Ceramic	Read garden of the "Tee Pot"
	2000:162	Glazed red earthenware body sherd	Ceramic	Read garden of the "Tee Pot"
	2000:161	Glazed red earthenware body sherd	Ceramic	Read garden of the "Tee Pot"
	2000:160	Red earthenware rim sherd	Ceramic	Read garden of the "Tee Pot"
	2000:159	Glazed red earthenware rim sherd	Ceramic	Read garden of the "Tee Pot"
	1934:384	Decorated flat bronze Axehead	Bronze	River Shannon, Cornacarrow
	4402:W195	Bronze dirk	Bronze	Cornacarrow, near Jamestown
	4932:W20	Copper alloy basin	Copper alloy	Cornacarrow, near Jamestown
Tully	1974:25.2	Chert retouched flake	Chert	Shore of River Shannon
	1974:25.3	Chert retouched flake	Chert	Shore of River Shannon
	54:25.1	Chert side scraper	Chert	Unknown
	1974:24	Chert blade	Chert	Unknown
	1974:23	Chert retouched flake	Chert	Unknown
	1974:22	Chert tertiary flake	Chert	Unknown

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
	1974:21	Chert retouched blade	Chert	Unknown
	1974:20	Chert retouched blade	Chert	Unknown
	1974:19	Polished stone axehead	Stone	Unknown
	2005C1:1281-1302	22 Siltstone flakes, blades and cores	Stone	Lough Allen
Drumsna	RIA1898:99	Flint flaked axehead	Flint	Drumsna

Table 8.8.7.11 Orange Option Corridor Assessment – Archaeological Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH20	Ringfort-rath	Proposed RMP	c. 58m W	Indirect	Imperceptible Negative
AH18	Ringfort-rath	Proposed RMP	c. 238m SW	Indirect	Imperceptible Negative
AH19	Ringfort-rath	RMP	c. 31m SW	Indirect	Slight Negative
AH21	Ringfort-rath	RMP	c. 194m NNE	Neutral	N/A
AH22	Ringfort-rath	RMP	c. 125m NE	Neutral	N/A
AH23	Ringfort-rath and hut site	Proposed RMP	C .225m NE	Neutral	N/A
AH36	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH66	Ringfort-rath	Proposed RMP	c. 61m NE	Indirect	Slight Negative
AH67	Ringfort-rath	Proposed RMP	c. 130m N	Indirect	Slight Negative
AH68	Ringfort-rath	Proposed RMP	c. 121m NNW	Indirect	Slight Negative
AH65	Ringfort-rath	RMP	c. 135m N	Indirect	Imperceptible Negative
AH142	Bullaun stone, Burial Ground, Ecclesiastical enclosure, Church	One SMR, one RMP and two Proposed RMPs	c. 62m-131 NW	Indirect	Slight Negative
AH143	Ringfort-rath	RMP	0m	Direct	Very Significant Negative
AH144	Ringfort-rath	RMP	c. 221m SW	Indirect	Imperceptible Negative
AH123	Ringfort-rath	RMP	c. 157m NE	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH124	Ringfort-rath	RMP	c. 247m NE	Neutral	N/A
AH151	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH129	Ringfort-rath	RMP	c. 225m N	Neutral	N/A
AH132	Enclosure	RMP	c. 136m NNW	Indirect	Slight Negative
AH150	Fulacht fia	None (excavated)	0m	Neutral	N/A
AH139	Redundant record	None (SMR)	c. 231m N	Neutral	N/A
AH152	Mound	Proposed RMP	0m	Direct	Profound Negative
AH133	Crannog	RMP	c. 127m SSE	Indirect	Slight Negative
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A
AH154	Hut site & Fulacht fia	None (excavated)	0m	Neutral	N/A
AH266	Ringfort-rath	Proposed RMP	c. 189m N	Neutral	N/A
AH267	Ringfort-rath	Proposed RMP	c. 43m ENE	Indirect	Slight Negative
AH270	Ringfort-rath	RMP	c. 10m SW	Indirect	Significant Negative
AH269	Ringfort-rath	RMP	c. 79m WSW	Indirect	Slight Negative
AH271	Ringfort-rath	RMP	c. 164m NE	Neutral	N/A

Table 8.8.7.12 Orange Option Corridor Assessment – Architectural Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
BH2	Railway Storehouse / warehouse	RPS	c. 15m SW	Indirect	Significant Negative
BH2	Railway Goods shed	RPS	c. 11m SW	Indirect	Significant Negative
BH2	Water tower	None	c. 13m SW	Indirect	Significant Negative
BH2	Signal box	RPS	To immediate SW	Indirect	Significant Negative
BH2	Waiting Room	RPS	To immediate SW	Indirect	Significant Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
BH2	Carrick-on-Shannon Railway station	RPS	c. 14m SW	Indirect	Significant Negative
BH2	Footbridge	RPS	To immediate SW	Indirect	Significant Negative
BH8	Drumsna National School	None	c. 46m NE	Indirect	Slight Negative

Table 8.8.7.13 Orange Option Corridor Assessment – Demesne Landscapes – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
DL5	Charlestown House demesne	None	c. 110m S	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Slight Negative
DL7	Belmont	None	0m	Direct	Slight Negative

Table 8.8.7.14 Orange Option Corridor Assessment – Cultural Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH48	Vernacular structure visible on 6-inch OS map	None	c. 162m N	Neutral	N/A
CH5	2 vernacular structures, originally visible on 6-inch OS map, extended on 25-inch map	None	c. 46m W	Indirect	Slight Negative
CH6	Site of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH7	Site of vernacular	None	c. 5m E	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	structure visible on 6-inch OS map				
CH8	Vernacular structure first visible on 6-inch OS map	None	c. 21m ENE	Indirect	Slight Negative
CH13	School house visible on 6-inch OS map	None	c. 215m NE	Neutral	N/A
CH115	Semi-detached brick cottages adjacent to railway	None	0m	Direct	Significant Negative
CH116	Railway bridge & abutments	None	To the immediate SW	Indirect	Moderately Negative
CH14	Cluster of vernacular structures first visible on 6-inch OS map, extended on 25-inch	None	c. 151m-225m NE	Indirect	Imperceptible Negative
CH17	Vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH16	Vernacular structure visible on 6-inch OS map, extended on 25-inch map	None	c. 32m N	Indirect	Moderately Negative
CH19	House visible on 25-inch OS map, possibly replacing earlier structure on 6-inch map	None	c. 115m N	Indirect	Slight Negative
CH20	Vernacular structure visible on 25-inch OS map	None	c. 185m NW	Indirect	Slight Negative
CH21	House visible on 25-inch OS map	None	c. 59m NW	Indirect	Imperceptible Negative
CH25	Vernacular structure	None	c. 172m NE	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	visible on 6-inch OS map				
CH26	3 vernacular structures visible on 25-inch OS map	None	c. 171m N	Indirect	Imperceptible Negative
CH27	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH28	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH29	Modified Vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH30	Sites of 3 vernacular structures visible on 6-inch OS map and one on 25inch OS map	None	0m	Direct	Significant Negative
CH31	Site of 2 vernacular structures visible on 6-inch OS map and one further visible on 25-inch map	None	0m	Direct	Significant Negative
CH32	'Spa Well' marked on 6-inch OS map and 'Spa Well (Sulphur)' on 25-inch map	None	0m	Direct	Significant Negative
CH33	Vernacular structure visible on 6-inch OS map	None	c. 12m SW	Indirect	Moderately Negative
CH34	2 structures, house first visible on 6-inch OS map and outbuilding	None	c. 37m NNE	Indirect	Moderately Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	to west on 25-inch OS				
CH35	Sites of 3 vernacular structure visible on 6-inch OS map, one (northernmost) still visible on 25-inch map	None	0m	Direct	Significant Negative
CH36	2 vernacular structures visible on 6-inch OS map and 25-inch map, unclear if remains extant	None	0m	Direct	Significant Negative
CH40	House visible on 25-inch OS map	None	c. 224m SSW	Neutral	N/A
CH37	Vernacular structure visible on 6-inch OS map	None	c. 20m N	Indirect	Slight Negative
CH38	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH39	Site of 2 vernacular structures visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH41	House visible on 25-inch OS map	None	c. 10m E	Indirect	Moderately Negative
CH43	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH42	2 vernacular structures visible on 25-inch OS map, third (northernmost)	None	c. 77m NW	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	visible on earlier 6-inch				
CH75	Site of Mountcampbell House	None	c. 25m N	Neutral	N/A
CH117	House	None	c. 80m NE	Indirect	Imperceptible Negative

Purple West Option Corridor

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Purple West Option Corridor travels are listed in Table 8.8.7.15 below.

Table 8.8.7.15 Purple West Option Corridor (Pink Design Option): NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Tumna	W28-31, 31a, 32, 33, 1975:231, 1990:80, R580	Hoard of ten hollow gold beads	Gold	Found in a potato field in 1834
	4246:W39	Bronze sword	Bronze	Tumna, Boyle Water
Corryolus	4585:W77	Lead-shaped bronze spearhead	Bronze	Unknown
Dromore	P1955:20	Animal bones & teeth	Animal remains	Quarry
	2004C1:1014	Copper Alloy Coin	Copper Alloy	Lough Dromore
Tully	1974:25.2	Chert retouched flake	Chert	Shore of River Shannon
	1974:25.3	Chert retouched flake	Chert	Shore of River Shannon
	54:25.1	Chert side scraper	Chert	Shore of River Shannon
	1974:24	Chert blade	Chert	Unknown
	1974:23	Chert retouched flake	Chert	Unknown
	1974:22	Chert tertiary flake	Chert	Unknown
	1974:21	Chert retouched blade	Chert	Unknown
	1974:20	Chert retouched blade	Chert	Unknown
	1974:19	Polished stone axehead	Stone	Unknown

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
	2005C1:1281-1302	22 Siltstone flakes, blades and cores	Stone	Lough Allen
Drumsna	RIA1898:99	Flint flaked axehead	Flint	Drumsna

Table 8.8.7.16 Purple West Option Corridor Assessment – Archaeological Heritage

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH18	Ringfort-rath	Proposed RMP	c. 230m SW	Indirect	Imperceptible Negative
AH20	Ringfort-rath	Proposed RMP	c. 30m S	Indirect	Imperceptible Negative
AH19	Ringfort-rath	RMP	c. 15m W	Indirect	Significant Negative
AH22	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH21	Ringfort-rath	RMP	c. 114m NW	Indirect	Slight Negative
AH23	Ringfort-rath and hut site	Proposed RMP	c. 124m SE	Indirect	Slight Negative
AH308	Ringfort-rath	RMP	c. 83m NW	Indirect	Slight Negative
AH73	Ringfort-rath	RMP	c. 195m SE	Indirect	Imperceptible Negative
AH74	Ringfort-rath	RMP	c. 247m SE	Neutral	N/A
AH82	Ringfort - rath	RMP	c. 248m SE	Neutral	N/A
AH84	Ringfort - rath	Proposed RMP	c. 245m SE	Neutral	N/A
AH85	Ringfort-rath	Proposed RMP	c. 144m SE	Indirect	Slight Negative
AH75	Ringfort-rath	RMP	c. 167m NNW	Indirect	Imperceptible Negative
AH83	Megalithic structure	RMP	c. 98m WSW	Indirect	Slight Negative
AH80	Ringfort-rath	RMP	c. 83m S	Indirect	Slight Negative
AH81	Ringfort-rath	RMP	c. 111m S	Indirect	Slight Negative
AH86	Ringfort-rath	RMP	c. 250m E	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH96	Ringfort-rath & enclosure	RMP	c. 109m NE	Indirect	Slight Negative
AH99	Ringfort-rath	Proposed RMP	c. 11m NE	Indirect	Significant Negative
AH98	Castle - unclassified	Proposed RMP	c. 196m SW	Indirect	Imperceptible Negative
AH101	Ringfort-rath	Proposed RMP	c. 113m NE	Indirect	Slight Negative
AH110	Ringfort-rath	RMP	c. 12m NE	Indirect	Significant Negative
AH111	Ringfort-rath	RMP	c. 15m NE	Indirect	Significant Negative
AH112	Ringfort-rath	RMP	c. 30m SW	Indirect	Significant Negative
AH116	Ringfort-rath	RMP	c. 76m N	Indirect	Slight Negative
AH115	Ringfort-rath	Proposed RMP	0m	Direct	Significant Negative
AH115	Church	Proposed RMP	c. 12m W	Indirect	Significant Negative
AH119	Enclosure	Proposed RMP	c. 70m SW	Indirect	Slight Negative
AH118	Ringfort-rath	RMP	c. 208m NE	Neutral	N/A
AH127	Ringfort-rath	RMP	c. 86m NE	Indirect	Slight Negative
AH125	Ringfort-rath	RMP	c. 222m SW	Neutral	N/A
AH126	Ringfort-rath	RMP	c. 141m SW	Indirect	Slight Negative
AH135	Ringfort-rath	RMP	c. 222m NE	Neutral	N/A
AH134	Ringfort-rath	RMP	c. 111m NE	Neutral	N/A
AH131	Ringfort-rath	RMP	c. 122m SW	Indirect	Slight Negative
AH139	Redundant record	None (SMR)	c. 172m W	Neutral	N/A
AH153	Burnt mound	None (excavated)	0m	Neutral	N/A
AH154	Hut site & Fulacht fia	None (excavated)	0m	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH266	Ringfort-rath	Proposed RMP	c. 151m N	Neutral	N/A
AH267	Ringfort-rath	Proposed RMP	c. 30m ENE	Indirect	Moderately Negative
AH270	Ringfort-rath	RMP	c. 10m SW	Indirect	Significant Negative
AH269	Ringfort-rath	RMP	c. 79m WSW	Indirect	Slight Negative
AH271	Ringfort-rath	RMP	c. 126m NE	Neutral	N/A

Table 8.8.7.17 Purple West Option Corridor Assessment – Architectural Heritage

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
BH5	House	None	c. 17m W	Indirect	Moderately Negative
BH8	Drumsna National School	None	c. 10m NE	Indirect	Significant Negative

Table 8.8.7.18 Purple West Option Corridor Assessment – Demesne Landscapes

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
DL14	Hartley House demesne	None	0m	Direct	Slight Negative
DL15	Drumlumman (demesne)	None	c. 35m NE	Indirect	Slight Negative
DL3	Castlecarra	None	To immediate W	Indirect	Slight Negative
DL5	Charlestown House demesne	None	c. 110m S	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Moderately Negative
DL7	Belmont (demesne)	None	0m	Direct	Slight Negative

Table 8.8.7.19 Purple West Option Corridor Assessment – Cultural Heritage

Site Ref.	Name	Statutory Protection	Dist. From Potential Road Footprint	Impact Type	Potential Impact level
CH48	Vernacular structure visible on 6-inch OS map	None	c. 178m NW	Indirect	Imperceptible Negative
CH46	Vernacular structure visible on 25-inch OS map	None	c. 30m SE	Indirect	Moderately Negative
CH47	Vernacular structure visible on 6-inch OS map	None	c. 185m SE	Indirect	Imperceptible Negative
CH49	Vernacular structure visible on 25-inch OS map	None	c. 53m NW	Indirect	Moderately Negative
CH50	Vernacular structure visible on 25-inch OS map	None	c. 31m NW	Indirect	Moderately Negative
CH51	Vernacular structure visible on 25-inch OS map, plus possible second	None	c. 16m E	Indirect	Moderately Negative
CH52	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH53	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH54	Vernacular structure visible on 25-inch OS map	None	To immediate NE	Indirect	Moderately Negative
CH55	Drumlumman – country house	None	c. 156m NE	Indirect	Imperceptible Negative
CH56	Vernacular structure visible on 25-inch OS map	None	c. 58m NNE	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection	Dist. From Potential Road Footprint	Impact Type	Potential Impact level
CH59	Site of vernacular structure visible on 6-inch OS map.	None	0m	Direct	Significant Negative
CH60	Farm building complex first visible on 6-inch OS map, extended on 25-inch map	None	c. 115m SW	Indirect	Slight Negative
CH61	Complex of structures marked 'Castlecarra'. Associated with demesne DL3. Visible in historic maps	None	c. 155m WSW	Indirect	Slight Negative
CH62	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH63	2 vernacular structures visible on 25-inch OS map	None	c. 59m NE	Indirect	Slight Negative
CH67	Vernacular structure visible on 25-inch OS map	None	c. 33m NE	Indirect	Moderately Negative
CH64	Vernacular structure visible on 25-inch OS map (in ruins)	None	c. 112m SW	Indirect	Imperceptible Negative
CH65	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH66	Site of vernacular structure and outbuilding visible on 6-inch OS map	None	0m	Direct	Significant Negative

Site Ref.	Name	Statutory Protection	Dist. From Potential Road Footprint	Impact Type	Potential Impact level
CH67	Ruins of vernacular structure marked on the 25-inch OS map	None	c. 85m NE	Indirect	Imperceptible Negative
CH69	'Spa Well' marked on 6-inch OS map	None	c. 166m SW	Indirect	Imperceptible Negative
CH70	Vernacular structure visible on 6-inch OS map	None	c. 89m SW	Indirect	Slight Negative
CH72	One vernacular out building marked on 25-inch map	None	0m	Direct	Significant Negative
CH74	2 vernacular structures visible on 25-inch OS map	None	c. 236m ENE	Indirect	Slight Negative
CH44	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH45	Sites of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH42	2 vernacular structures visible on 25-inch OS map, third (northernmost) visible on earlier 6-inch	None	c. 67m NW	Indirect	Moderately Negative
CH75	Site of Mountcampbell House	None	0m	Direct	Significant Negative
CH117	House	None	c. 37m ENE	Indirect	Slight Negative

Dark Green Option Corridor (Grey Design Option)

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Dark Green Option Corridor (Grey Design Option) travels are listed in Table 8.8.7.20 below.

Table 8.8.7.20 Dark Green Option Corridor (Grey Design Option): NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Tumna	W28-31, 31a, 32, 33, 1975:231, 1990:80, R580	Hoard of ten hollow gold beads	Gold	Found in a potato field in 1834
	4246:W39	Bronze sword	Bronze	Tumna, Boyle Water
Corryolus	4585:W77	Leaf-shaped bronze spearhead	Bronze	Unknown
Dromore	P1955:20	Animal bones & teeth	Animal remains	Quarry
	2004C1;1014	Copper Alloy Coin	Copper Alloy	Lough Dromore
Drumsna	RIA1898:99	Flint flaked axehead	Flint	Drumsna

Table 8.8.7.21 Dark Green Option Corridor (Grey Design Option) Assessment – Archaeological Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH18	Ringfort-rath	Proposed RMP	c. 230m SW	Indirect	Imperceptible Negative
AH20	Ringfort-rath	Proposed RMP	c. 30m S	Indirect	Imperceptible Negative
AH19	Ringfort-rath	RMP	c. 15m W	Indirect	Significant Negative
AH22	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH21	Ringfort-rath	RMP	c. 114m NW	Indirect	Slight Negative
AH23	Ringfort-rath and hut site	Proposed RMP	c. 124m SE	Indirect	Slight Negative
AH308	Ringfort-rath	RMP	c. 83m NW	Indirect	Slight Negative
AH73	Ringfort-rath	RMP	c. 195m SE	Indirect	Imperceptible Negative
AH74	Ringfort-rath	RMP	c. 247m SE	Neutral	N/A
AH82	Ringfort - rath	RMP	c. 248m SE	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH84	Ringfort - rath	Proposed RMP	c. 245m SE	Neutral	N/A
AH85	Ringfort-rath	Proposed RMP	c. 144m SE	Indirect	Slight Negative
AH75	Ringfort-rath	RMP	c. 167m NNW	Indirect	Imperceptible Negative
AH83	Megalithic structure	RMP	c. 90m WSW	Indirect	Slight Negative
AH80	Ringfort-rath	RMP	c. 92m S	Indirect	Slight Negative
AH81	Ringfort-rath	RMP	c. 92m WSW	Indirect	Slight Negative
AH96	Ringfort-rath & enclosure	RMP	c. 109m NE	Indirect	Slight Negative
AH99	Ringfort-rath	Proposed RMP	c. 11m NE	Indirect	Significant Negative
AH98	Castle - unclassified	Proposed RMP	c. 196m SW	Indirect	Imperceptible Negative
AH101	Ringfort-rath	Proposed RMP	c. 93m NE	Indirect	Slight Negative
AH110	Ringfort-rath	RMP	0m	Direct	Significant Negative
AH111	Ringfort-rath	RMP	c. 108m SSW	Indirect	Slight Negative
AH116	Ringfort-rath	RMP	c. 72m SW	Indirect	Slight Negative
AH118	Ringfort-rath	RMP	c. 209m SSW	Neutral	N/A
AH117	Ringfort-rath	RMP	c. 79m NNE	Indirect	Imperceptible Negative
AH261	Ringfort-rath	RMP	c. 148m ENE	Indirect	Slight Negative
AH266	Ringfort-rath	RMP	c. 80m SW	Indirect	Imperceptible Negative
AH154	Hut site and fulacht fia	None (SMR)	c.213m W	Neutral	N/A
AH267	Ringfort-rath	Proposed RMP	c. 43m ENE	Indirect	Moderately Negative
AH270	Ringfort-rath	RMP	c. 10m SW	Indirect	Significant Negative
AH269	Ringfort-rath	RMP	c. 79m WSW	Indirect	Slight Negative
AH271	Ringfort-rath	RMP	c. 164m NE	Neutral	N/A

Table 8.8.7.22 Dark Green Option Corridor (Grey Design Option) Assessment – Architectural Heritage – West of Drumsna

Site Ref.	Name:	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
BH5	House	None	c. 17m W	Indirect	Moderately Negative
BH8	Drumsna National School	None	c. 46m NE	Indirect	Slight Negative

Table 8.8.7.23 Dark Green Option Corridor (Grey Design Option) Assessment – Demesne Landscapes – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
DL14	Hartley House demesne	None	0m	Direct	Slight Negative
DL15	Drumlumman (demesne)	None	c. 212m NE	Neutral	N/A
DL3	Castlecarra	None	To immediate W	Indirect	Slight Negative
DL5	Charlestown House demesne	None	c. 110m S	Neutral	N/A
DL6	Mountcampbell House demesne	None	0m	Direct	Significant Negative
DL7	Belmont (demesne)	None	0m	Direct	Slight Negative

Table 8.8.7.24 Dark Green Option Corridor (Grey Design Option) Assessment – Cultural Heritage – West of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH48	Vernacular structure visible on 6-inch OS map	None	c. 178m NW	Indirect	Imperceptible Negative
CH46	Vernacular structure visible on 25-inch OS map	None	c. 30m SE	Indirect	Moderately Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH47	Vernacular structure visible on 6-inch OS map	None	c. 185m SE	Indirect	Imperceptible Negative
CH49	Vernacular structure visible on 25-inch OS map	None	c. 53m NW	Indirect	Moderately Negative
CH50	Vernacular structure visible on 25-inch OS map	None	c. 31m NW	Indirect	Moderately Negative
CH51	Vernacular structure visible on 25-inch OS map, plus possible second	None	c. 16m E	Indirect	Moderately Negative
CH52	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH53	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH54	Vernacular structure visible on 25-inch OS map	None	c. 182m NE	Neutral	N/A
CH56	Vernacular structure visible on 25-inch OS map	None	c. 58m NNE	Indirect	Slight Negative
CH59	Site of vernacular structure visible on 6-inch OS map.	None	0m	Direct	Significant Negative
CH60	Farm building complex first visible on 6-inch OS map, extended on 25-inch map	None	c. 115m SW	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH61	Complex of structures marked 'Castlecarra'. Associated with demesne DL3. Visible in historic maps	None	c. 155m WSW	Indirect	Slight Negative
CH62	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH63	2 vernacular structures visible on 25-inch OS map	None	c. 81m NE	Indirect	Slight Negative
CH67	Vernacular structure visible on 25-inch OS map	None	c. 61m SSW	Indirect	Slight Negative
CH68	'Spa Well (Chalybeate)' marked on 25-inch OS map	None	c. 28m N	Indirect	Moderately Negative
CH71	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH73	Site of vernacular structure visible on 6-inch OS map	None	c. 12m SW	Indirect	Moderately Negative
CH75	Site of Mountcampbell House	None	c. 25m N	Neutral	N/A
CH117	House	None	c. 80m NE	Indirect	Imperceptible Negative

Black Option Corridor

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Black Option Corridor travels are listed in Table 8.8.7.25 below.

Table 8.8.7.25 Black Option Corridor: NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Kilboderry	Unpublished, 1947	Bronze leaf-shaped side-looped spearhead	Bronze	Bog

Table 8.8.7.26 Black Option Corridor assessment – Archaeological Heritage

Site Ref.	Name	Statutory Protection	Dist. from Potential Road Footprint	Impact Type	Potential Impact level
AH82	Ringfort	RMP	143m NNW	Neutral	N/A

Table 8.8.7.27 Black Option Corridor Assessment – Cultural Heritage

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint:	Impact Type	Potential Impact level
CH57	House marked 'Summer Hill' on 6-inch and 25-inch OS maps, second building to NE shown on 25-inch map only	None	c. 5m E	Indirect	Significant Negative
CH58	House visible on 25-inch OS map	None	c. 171m SSW	Indirect	Imperceptible Negative

Table 8.8.7.28 Stage 2 Archaeological, Architectural and Cultural Heritage Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Profound Negative (Direct)	AH152 Mound	AH152 Mound	-	-		-
Very Significant Negative (Direct)	AH36 Ringfort, AH143 Ringfort,	AH143 Ringfort	-	-		-
Significant Negative (Direct)	AH15 Burnt mound, CH115 Brick Cottages, CH27 Site of V. building, CH28 Site of V. building, CH29 Modified V. building, CH30 Site of V. buildings, CH31 Site of V. buildings, CH32 Spa Well, CH35 Site of V. buildings, CH36 Site of V. buildings, CH38 Site of V. buildings, CH39 Site of V. buildings, CH43 Site of V. building	AH26 Ringfort, CH6 Site of V. buildings, CH115 Brick cottages, CH17 V. building, CH27 Site of V. building, CH28 Site of V. building, CH29 Modified V. building, CH30 Site of V. buildings, CH31 Site of V. buildings, CH32 Spa Well, CH35 Site of V. buildings, CH36 Site of V. buildings, CH38 Site of V. buildings, CH39 Site of V. buildings, CH43 Site of V. building	AH22 Ringfort, AH115 Ringfort, CH52 Site of V. building, CH53 Site of V. building, CH59 Site of V. building, CH62 Site of V. building, CH65 Site of V. building, CH66 Site of V. building, CH72 V. outbuilding, CH44 Site of V. building, CH45 Site of V. buildings, CH75 Site of Mt. Campbell Ho. -	AH22 Ringfort, AH110 Ringfort, AH270 Ringfort, DL6 M'Campbell, CH52 Site of V. building, CH53 Site of V. building, CH59 Site of V. building, CH62 Site of V. building, CH71 Site of V. building,		-

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Moderate Negative (Direct)	AH49 Ecclesiastical Enclosure	-	DL6 Mountcampbell	-		-
Slight Negative (Direct)	DL6, 7	-	DL14	-		-
Very Significant Negative (Indirect)	-	-	-	-		-
Significant Negative (Indirect)	AH6 Ringfort, AH270 Ringfort, BH2 Railway storehouse, BH2 railway goods shed, BH2 water tower, BH2 railway station, BH2 footbridge, BH2 Signal box, BH2 Waiting room	AH270 Ringfort, BH2 Railway storehouse, BH2 railway goods shed, BH2 water tower, BH2 railway station, BH2 footbridge. BH2 Signal box, BH2 Waiting room	AH19 Ringfort, AH99 Ringfort, AH110 Ringfort, AH111 Ringfort, AH112 Ringfort, AH115 Church, AH270 Ringfort, BH5 Drumsna Sch.	AH19 Ringfort, AH99 Ringfort,		CH57 House
Moderate Negative (Indirect)	CH2, 116, 33, 34, 41	CH116, 16, 33, 34, 41	AH267, CH46, 49, 50, 51, 54, 67, 42	AH267, BH5, CH46, 49, 50, 51, 68, 73		-
Slight Negative (Indirect)	AH14, 49, 66, 67, 68, 142, 132, 133, 267, 269, BH8, CH1, 17, 16, 19, 20, 37, 42	AH19, 66, 67, 68, 42, 132, 133, 267, 269, BH8, DL6, 7, CH5, 7, 8, 19, 20, 37, 42	AH21, 23, 308, 85, 83, 80. 82, 96, 101, 116, 119, 127, 126, 131, 269, BH8, DL15, 3, 7, CH56, 60, 61, 63, 70, 74, 117	AH21, 23, 308, 85, 83, 80, 81, 96, 111, 116, 261, 269, BH8, DL14, 3, 7, CH56, 60, 61, 63, 67		-
Imperceptible Negative (Indirect)	AH13, 33, 144, 123, CH9, 14, 21, 25, 26, 117	AH20, 18, 144, 123, 14, 21, 25, 26, 117	AH18, 20, 73, 75, 98, CH48, 47, 55, 64, 67, 69	AH18, 20, 73, 75, 98, 117, 266, CH48, 47, 117		CH58

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Neutral	AH 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 16, 17, 43, 50, 65, 124, 151, 129, 150, 139, 153, 154, 266, 271, DL5, CH3, 4, 10, 12, 13, 40, 75	AH21, 22, 23, 124, 151, 129, 150, 139, 153, 154, 266, 271, DL5, CH48, 13, 40, 75	AH74, 82, 84, 86, 118, 125, 135, 134, 139, 153, 154, 266, 271, DL5	AH74, AH82, 84, 118, 154, 271, DL15, 5, CH54, 75		AH82
Scoring						
Qualitative Assessment	Major impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas. **Major** or **Highly Negative**	Major impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas. **Major** or **Highly Negative**	Moderate impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas. **Moderately Negative**	Moderate impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas . **Moderately Negative**		No major impacts to any statutorily protected heritage assets or to those not subject to protection at this time. Potential impact to previously unrecorded archaeological remains within greenfield areas. **Not Significant** or **Neutral**
Overall Score / Impact Level	1	1	2	2		4
Preference	**Least preferred**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

Table 8.8.7.29 to Table 8.8.7.43 detail the potential impacts of each option corridor east of Drumsna Junction (Node J) on the known archaeological, architectural and cultural heritage resource. A summary of the impacts across each corridor is then presented in Table 8.8.7.44, together with an average impact score and ranking of each option from Preferred to Intermediate to Least Preferred.

Yellow Option Corridor

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Yellow Option Corridor travels are listed in Table 8.8.7.29 below.

Table 8.8.7.29 Yellow Option Corridor: NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Drumsa	RIA1898:99	Flint flaked axehead	Flint	Drumsna
Carrick	1985:46 and 47	2 polished stone axeheads	Stone	River Shannon at Carrick
	4654:W146	Socketed bronze spearhead	Bronze	River Shannon
Aghamore	1939:147	Flat bronze axehead	Bronze	Unknown

Table 8.8.7.30 Yellow Option Corridor Assessment – Archaeological Heritage – East of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 233m ENE	Neutral	N/A
AH276	Ringfort-rath	RMP	c. 245m WSW	Neutral	N/A
AH277	Ringfort-rath	RMP	c. 129m SW	Indirect	Slight Negative
AH290	Fulacht fia (excavated)	Proposed RMP	0m	Neutral	N/A
AH289	Mound	RMP	c. 83m SW	Indirect	Slight Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c.52m SW	Indirect	Imperceptible Negative
AH293	Redundant record	None (SMR)	c. 23m SW	Neutral	N/A
AH294	Crannog	RMP	c. 85m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 248m W	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH300	Ringfort-rath	Proposed RMP	0m	Direct	Significant Negative
AH297	Ringfort-rath	RMP	c. 5m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 144m NE	Indirect	Slight Negative
AH306	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
AH305	Enclosure	RMP	c. 197m NE	Indirect	Imperceptible Negative
AH45	Standing stone	RMP	0m	Direct	Very Significant Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 104m SW	Indirect	Slight Negative

Table 8.8.7.31 Yellow Option Corridor Assessment – Architectural Heritage – East of Drumsna

Site Ref.	Name	Statutory Protection	Dist. From Potential Road Footprint	Impact Type:	Potential Impact level
BH9	Nesbitt Mausoleum & St Anne's Church	RPS	c. 30m SW	Indirect	Slight Negative
BH15	St. Mary's RC Church	RPS	c. 30m ESE	Indirect	Moderately Negative
BH16	House (in ruins)	RPS	0m	Direct	Significant Negative

Table 8.8.7.32 Yellow Option Corridor Assessment – Demesne Landscapes – East of Drumsna

Site Ref.	Name	Statutory Protection	Dist. From Potential Road Footprint	Impact Type	Potential Impact level
DL9	Cloonteem Cottage	None	c. 200m SW	Neutral	N/A

Table 8.8.33 Yellow Option Corridor Assessment – Cultural Heritage – East of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH77	Site of 'School Ho.' visible on 6-inch OS map, marked 'Drumsna School (No. 2)' on 25-inch OS map	None	0m	Direct	Significant Negative
CH78	Pound visible on 6-inch OS map, possible extant remains	None	c. 19m SSE	Indirect	Moderately Negative
CH79	Vernacular structure visible on 25-inch OS map	None	c. 109m SW	Indirect	Imperceptible Negative
CH80	2 vernacular structures visible on 25-inch OS map	None	c. 64m SW	Indirect	Imperceptible Negative
CH81	House visible on 25-inch OS map, possibly incorporated into modern structure	None	To immediate N	Indirect	Moderately Negative
CH83	House and outbuildings visible on 25-inch OS map	None	c. 35m NNW	Indirect	Slight Negative
CH82	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH84	Complex of vernacular structures visible on 6-inch OS map, marked 'Gortinty House' on 25-inch map	None	To immediate NE	Indirect	Moderately Negative
CH85	House and outbuildings visible on 25-inch OS map, replacing earlier structures shown on 6-inch map	None	0m	Direct	Significant Negative
CH86	Bridge visible on 6-inch OS map	None	c. 10m N	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH87	Sites of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH88	Vernacular structure visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH89	House and outbuilding visible on 25-inch OS map, house also visible on 6-inch map	None	c. 155m ENE	Indirect	Imperceptible Negative
CH90	Site of 2 small vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH91	Sites of 3 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH92	Complex of large buildings marked 'P.O.' (Post Office) on 25-inch OS map, some visible on earlier 6-inch map	None	0m	Direct	Significant Negative
CH93	Complex of large buildings visible in current layout on 25-inch OS map, original layout on 6-inch map	None	0m	Direct	Significant Negative
CH97	Site of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH98	2 vernacular structures, one visible on 6-inch OS map and one on 25-inch (southern)	None	0m	Direct	Significant Negative
CH99	Sites of 3 small vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH100	Vernacular structure visible on 25-inch OS map	None	To immediate W	Indirect	Moderately Negative
CH101	2 vernacular structure visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH102	Vernacular structure visible on 25-inch OS map, marked 'Smithy'	None	0m	Direct	Significant Negative
CH104	Possible vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH103	House visible on 25-inch OS map	None	c. 199m ENE	Indirect	Imperceptible Negative
CH105	Vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH106	2 vernacular structures visible on 25-inch OS map, western also visible on 6-inch map	None	To immediate E	Indirect	Slight Negative
CH107	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH108	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH109	Vernacular structure visible on 6-inch OS map	None	c. 169m SW	Indirect	Slight Negative
CH110	Vernacular structure visible on 25-inch OS map	None	c. 5m NE	Indirect	Slight Negative
CH112	Site of 4 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH114	Complex of vernacular structures marked	None	c. 154m N3	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	within the 25-inch map				
CH113	Vernacular structure visible on 6-inch OS map	None	c. 128m NE	Indirect	Imperceptible Negative

Green Option Corridor

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Green Option Corridor travels are listed in Table 8.8.7.34 below.

Table 8.8.7.34 Green Option Corridor: NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Drumsna	RIA1898:99	Flint flaked axehead	Flint	Drumsna
Carrick	1985:46 and 47	2 polished stone axeheads	Stone	River Shannon at Carrick
	4654:W146	Socketed bronze spearhead	Bronze	River Shannon
Aghamore	1939:147	Flat bronze axehead	Bronze	Unknown

Table 8.8.7.35 Green Option Corridor Assessment – Archaeological Heritage – East of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 233m ENE	Neutral	N/A
AH276	Ringfort-rath	RMP	c. 245m WSW	Neutral	N/A
AH277	Ringfort-rath	RMP	c. 129m SW	Indirect	Slight Negative
AH290	Fulacht fia	Proposed RMP	0m	Neutral	N/A
AH289	Mound	RMP	c. 83m SW	Indirect	Slight Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c.52m SW	Indirect	Imperceptible Negative
AH293	Redundant record	None (SMR)	c. 23m SW	Neutral	N/A

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH294	Crannog	RMP	c. 85m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 248m W	Neutral	N/A
AH300	Ringfort-rath	Proposed RMP	0m	Direct	Significant Negative
AH297	Ringfort-rath	RMP	c. 5m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 144m NE	Indirect	Slight Negative
AH306	Ringfort-rath	Proposed RMP	0m	Direct	Very Significant Negative
AH305	Enclosure	RMP	c. 197m NE	Indirect	Imperceptible Negative
AH45	Standing stone	RMP	c. 57m SW	Indirect	Slight Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 201m SW	Indirect	Imperceptible Negative

Table 8.8.7.36 Green Option Corridor Assessment – Architectural Heritage – East of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
BH9	Nesbitt Mausoleum & St. Anne's Church	RPS	c.30m SW	Indirect	Slight Negative
BH15	St. Mary's RC Church	RPS	c. 30m ESE	Indirect	Moderately Negative
BH16	House (in ruins)	RPS	c. 47m W	Indirect	Slight Negative

Table 8.8.7.37 Green Option Corridor Assessment – Demesne Landscapes – East of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
DL9	Cloonteem Cottage	None	c. 200m SW	Neutral	N/A

Table 8.8.7.38 Green Option Corridor Assessment – Cultural Heritage – East of Drumsna

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH77	Site of 'School Ho.' visible on 6-inch OS map, marked 'Drumsna School (No. 2)' on 25-inch OS map	None	0m	Direct	Significant Negative
CH78	Pound visible on 6-inch OS map, possible extant remains	None	c. 19m SSE	Indirect	Moderately Negative
CH79	Vernacular structure visible on 25-inch OS map	None	c. 109m SW	Indirect	Imperceptible Negative
CH80	2 vernacular structures visible on 25-inch OS map	None	c. 64m SW	Indirect	Imperceptible Negative
CH81	House visible on 25-inch OS map, possibly incorporated into modern structure	None	To immediate N	Indirect	Moderately Negative
CH83	House and outbuildings visible on 25-inch OS map	None	c. 35m NNW	Indirect	Slight Negative
CH82	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH84	Complex of vernacular structures visible on 6-inch OS map, marked 'Gortinty House' on 25-inch map	None	To immediate NE	Indirect	Moderately Negative
CH85	House and outbuildings visible on 25-inch OS map, replacing earlier structures shown on 6-inch map	None	0m	Direct	Significant Negative
CH86	Bridge visible on 6-inch OS map	None	c. 10m N	Indirect	Slight Negative
CH87	Sites of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH88	Vernacular structure visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH89	House and outbuilding visible on 25-inch OS map, house also visible on 6-inch map	None	c. 155m ENE	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH90	Site of 2 small vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH91	Sites of 3 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH92	Complex of large buildings marked 'P.O.' (Post Office) on 25-inch OS map, some visible on earlier 6-inch map	None	0m	Direct	Significant Negative
CH93	Complex of large buildings visible in current layout on 25-inch OS map, original layout on 6-inch map	None	0m	Direct	Significant Negative
CH97	Site of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH98	2 vernacular structures, one visible on 6-inch OS map and one on 25-inch (southern)	None	0m	Direct	Significant Negative
CH99	Sites of 3 small vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH100	Vernacular structure visible on 25-inch OS map	None	To immediate W	Indirect	Moderately Negative
CH101	2 vernacular structure visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH102	Vernacular structure visible on 25-inch OS map, marked 'Smithy'	None	0m	Direct	Significant Negative
CH104	Possible vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH103	House visible on 25-inch OS map	None	c. 199m ENE	Indirect	Imperceptible Negative
CH105	Vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH106	2 vernacular structures visible on 25-inch OS	None	c. 131m NE	Indirect	Imperceptible Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	map, western also visible on 6-inch map				
CH107	Site of vernacular structure visible on 6-inch OS map	None	To immediate E	Indirect	Slight Negative
CH108	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH109	Vernacular structure visible on 6-inch OS map	None	c. 169m SW	Indirect	Slight Negative
CH110	Vernacular structure visible on 25-inch OS map	None	c. 5m NE	Indirect	Slight Negative
CH112	Site of 4 vernacular structures visible on 6-inch OS map	None	c. 123m SW	Indirect	Imperceptible Negative
CH114	Complex of vernacular structures marked within the 25-inch map	None	c. 154m N3	Indirect	Imperceptible Negative
CH113	Vernacular structure visible on 6-inch OS map	None	c. 128m NE	Indirect	Imperceptible Negative

Purple East Option Corridor

National Museum of Ireland: Topographical Files

Topographical files held by the National Museum of Ireland (NMI) were consulted. Stray finds recorded within the townlands through which the Purple East Option Corridor travels are listed in Table 8.8.7.39 below.

Table 8.8.7.39 Purple East Option Corridor: NMI stray finds

Townland	NMI Reg No.	Description	Material	Find Place (if recorded)
Drumsna	RIA1898:99	Flint flaked axehead	Flint	Drumsna
Carrick	1985:46 and 47	2 polished stone axeheads	Stone	River Shannon at Carrick
	4654:W146	Socketed bronze spearhead	Bronze	River Shannon
Aghamore	1939:147	Flat bronze axehead	Bronze	Unknown

Table 8.8.7.40 Purple East Option Corridor Assessment – Archaeological Heritage

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
AH272	Ringfort-rath	RMP	c. 233m ENE	Neutral	N/A
AH276	Ringfort-rath	RMP	c. 188m W	Indirect	Slight Negative
AH277	Ringfort-rath	RMP	0m	Direct	Profound Negative
AH290	Fulacht fia	Proposed RMP	0m	Neutral	N/A
AH289	Mound	RMP	c. 65m SW	Indirect	Moderately Negative
AH288	Graveyard, church, ecclesiastical enclosure, architectural fragment	Proposed RMP	c. 52m SW	Indirect	Moderately Negative
AH293	Redundant record	None (SMR)	c. 23m SW	Neutral	N/A
AH294	Crannog	RMP	c. 85m SW	Indirect	Slight Negative
AH295	Redundant record	None (SMR)	c. 248m W	Neutral	N/A
AH300	Ringfort-rath	Proposed RMP	0m	Direct	Significant Negative
AH297	Ringfort-rath	RMP	c. 5m SW	Indirect	Significant Negative
AH298	Ringfort-rath	RMP	c. 144m NE	Indirect	Slight Negative
AH306	Ringfort-rath	Proposed RMP	To immediate NW	Indirect	Imperceptible Negative
AH299	Ringfort	RMP	c. 215m NE	Indirect	Imperceptible Negative
AH305	Enclosure	RMP	0m	Direct	Very Significant Negative
AH45	Standing stone	RMP	c. 53m SW	Indirect	Slight Negative
AH46	Bullaun stone and Ritual site - holy well	RMP	c. 198m SW	Indirect	Imperceptible Negative

Table 8.8.7.41 Purple East Option Corridor Assessment – Architectural Heritage

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
BH9	Nesbitt Mausoleum & St Anne's Church	RPS	c. 30m SW	Indirect	Slight Negative
BH15	St. Mary's RC Church	RPS	c. 30m ESE	Indirect	Moderately Negative
BH16	House (in Ruins)	RPS	c. 117m SSW	Indirect	Imperceptible Negative

Table 8.8.7.42 Purple East Option Corridor Assessment – Demesne Landscapes

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
DL9	Cloonteem Cottage	None	c. 200m SW	Neutral	N/A

Table 8.8.7.43 Purple East Option Corridor Assessment – Cultural Heritage

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH77	Site of 'School Ho.' visible on 6-inch OS map, marked 'Drumsna School (No. 2)' on 25-inch OS map	None	0m	Direct	Significant Negative
CH78	Pound visible on 6-inch OS map, possible extant remains	None	c. 39m WSW	Indirect	Slight Negative
CH79	Vernacular structure visible on 25-inch OS map	None	c. 10m W	Indirect	Moderately Negative
CH80	2 vernacular structures visible on 25-inch OS map	None	c. 10m N	Indirect	Moderately Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH81	House visible on 25-inch OS map, possibly incorporated into modern structure	None	0m	Direct	Significant Negative
CH83	House and outbuildings visible on 25-inch OS map	None	c. 40m N	Indirect	Slight Negative
CH82	Sites of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH84	Complex of vernacular structures visible on 6-inch OS map, marked 'Gortinty House' on 25-inch map	None	To immediate NE	Indirect	Moderately Negative
CH85	House and outbuildings visible on 25-inch OS map, replacing earlier structures shown on 6-inch map	None	0m	Direct	Significant Negative
CH86	Bridge visible on 6-inch OS map	None	c. 10m N	Indirect	Slight Negative
CH87	Sites of 2 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH88	Vernacular structure visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH89	House and outbuilding visible on 25-inch OS map, house also visible on 6-inch map	None	c. 136m NE	Indirect	Slight Negative
CH90	Site of 2 small vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
CH96	Sites of 3 vernacular structures visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH94	Site of Anaduff School, visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH95	2 buildings visible on 25-inch OS map, marked 'Antfield Cottage'	None	To immediate SE	Indirect	Moderately Negative
CH92	Complex of large buildings marked 'P.O.' (Post Office) on 25-inch OS map, some visible on earlier 6-inch map	None	To immediate W	Indirect	Moderately Negative
CH93	Complex of large buildings visible in current layout on 25-inch OS map, original layout on 6-inch map	None	0m	Direct	Significant Negative
CH98	2 vernacular structures, one visible on 6-inch OS map and one on 25-inch (southern)	None	c. 37m SSE	Indirect	Slight Negative
CH100	Vernacular structure visible on 25-inch OS map	None	c. 162m W	Neutral	N/A
CH101	2 vernacular structure visible on 25-inch OS map	None	c. 90m W	Indirect	Slight Negative
CH102	Vernacular structure visible on 25-inch OS map, marked 'Smithy'	None	c. 87m W	Indirect	Slight Negative
CH104	Possible vernacular	None	c. 53m W	Indirect	Slight Negative

Site Ref.	Name	Statutory Protection	Distance from Potential Road Footprint	Impact Type	Potential Impact level
	structure visible on 6-inch OS map				
CH103	House visible on 25-inch OS map	None	c. 93m E	Indirect	Slight Negative
CH105	Vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH106	2 vernacular structures visible on 25-inch OS map, western also visible on 6-inch map	None	c. 121m NE	Indirect	Slight Negative
CH107	Site of vernacular structure visible on 6-inch OS map	None	To immediate E	Indirect	Slight Negative
CH108	Site of vernacular structure visible on 6-inch OS map	None	0m	Direct	Significant Negative
CH109	Vernacular structure visible on 6-inch OS map	None	c. 200m SW	Indirect	Imperceptible Negative
CH110	Vernacular structure visible on 25-inch OS map	None	0m	Direct	Significant Negative
CH113	Vernacular structure visible on 6-inch OS map	None	c. 110m NE	Indirect	Slight Negative
CH112	Site of 4 vernacular structures visible on 6-inch OS map	None	c. 91m SW	Indirect	Imperceptible Negative
CH114	2 vernacular structures visible on 25-inch OS map	None	c. 134m NE	Indirect	Slight Negative

Table 8.8.7.44 Stage 2 Archaeological, Architectural and Cultural Heritage Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Profound Negative (Direct)	-	-	AH277 Ringfort
Very Significant Negative (Direct)	AH306 Ringfort, AH45 Standing Stone	AH306 Ringfort,	AH305 Enclosure
Significant Negative (Direct)	AH300 Ringfort, BH16 House (in ruins), CH77 Site of school house, CH82 Site of V. building, CH85 House & outbuildings, CH87 Site of V. buildings, CH88 Site of V. building, CH90 Site of V. buildings, CH91 Site of V. buildings, CH92 Complex of V. buildings, CH93 Complex of V. buildings, CH97 Site of V. buildings, CH98 V. buildings, CH99 Site of V. buildings, CH101 V. buildings, CH102 V. building, CH104 V. building, CH105 V. buildings, CH107 Site of V. building, CH108 Site of V. building,	AH300 Ringfort, CH77 Site of school house, CH82 Site of V. building, CH85 House & outbuildings, CH87 Site of V. buildings, CH88 Site of V. building, CH90 Site of V. buildings, CH91 Site of V. buildings, CH92 Complex of V. buildings, CH93 Complex of V. buildings, CH97 Site of V. buildings, CH98 V. buildings, CH99 Site of V. buildings, CH101 V. buildings, CH102 V. building, CH104 V. building, CH105 V. buildings, CH108 Site of V. building	AH300 Ringfort, CH77 Site of school house, CH81 V. Building, CH82 Site of V. building, CH85 House & outbuildings, CH87 Site of V. buildings, CH88 Site of V. building, CH90 Site of V. buildings, CH96 Site of V. buildings, CH94 Site of School, CH93 Complex of V. buildings, CH105 V. buildings, CH108 Site of V. building, CH110 V. building

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
	CH112 Site of V. buildings		
Moderate Negative (Direct)	-	-	-
Slight Negative (Direct)	-	-	-
Very Significant Negative (Indirect)	-	-	
Significant Negative (Indirect)	AH297 Ringfort	AH297 Ringfort	AH297 Ringfort
Moderate Negative (Indirect)	BH15, CH78, 81, 84, 100	BH15, CH78, 81, 84, 100	AH289, 288, BH15, CH79, 80, 84, 95, 92
Slight Negative (Indirect)	AH277, 289, 294, 298, 46, BH9, CH83, 86, 106, 109, 110	AH277, 289, 294, 298, 45, BH9, 16 83, 86, 107, 109	AH276, 294, 298, 45, BH9, CH78, 83, 86, 89, 98, 101, 102, 104, 103, 106, 107, 113, 114
Imperceptible Negative (Indirect)	AH288, 305, CH79, 80, 89, 103, 114 113	AH288, 305, 46, DL9, CH79, 80, 89, 103, 106, 112, 114, 113	AH306, 299, 46, BH16, CH109, 112
Neutral	AH272, 276, 290, 293, 295, DL9	AH272, 276, 290, 293, 295	AH272, 290, 293, 295, DL9, CH100
Scoring			
Qualitative Assessment	Major impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas **Major** or **Highly Negative**	Moderate impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas **Moderately Negative**	Major impacts to a range of heritage assets including archaeological and built heritage sites Potential impact to previously unrecorded archaeological remains within greenfield areas **Major** or **Highly Negative**
Overall Score / Impact Level	**1**	**2**	**1**
Preference	**Intermediate**	**Preferred**	**Least Preferred**

8.8.7.5 Summary

Summary Stage 2 Assessment of the Alternatives

Of the alternatives assessed, Alternative A and Alternative B would be Not Significant or Neutral in relation to the archaeological, architectural and cultural heritage resource. This is due to the reuse of the existing road network as part of the alternatives proposed. No interventions would be required as part of the proposal.

Alternative C would have an overall Moderately Positive impact on the historic built heritage environment of Carrick-on-Shannon, due to the removal of traffic from the town and the pedestrianisation of streets. This positive impact can be applied to structures that are subject to statutory protection and the overall ACA, along with the structures of built heritage merit within the town that are present.

Summary Stage 2 Assessment of the Option Corridors West of Drumnsa Junction (Node J)

The Dark Green Option Corridor (Grey Design Option) is the Preferred Option Corridor west of Drumsna Junction (Node J) due to having the least number of major impacts to statutorily protected heritage assets and sites that have been identified as being of archaeological or built heritage merit, which are not subject to statutory protection.

The Purple West Option is considered to be of Intermediate preference, as, whilst the route has a similar number of potential impacts on sites/structures that are subject to statutory protection, it will affect more sites and structures that have been identified during the course of this assessment that possess archaeological or architectural merit, but are not subject to statutory protection.

The Cyan Option and Orange Option Corridors are considered to represent the Least Preferred Option Corridors. This is due to the high amount of direct negative major impacts on archaeological and built heritage sites that are subject to statutory protection (including the indirect significant negative impacts on the railway station buildings at Carrick-on-Shannon), as well as a number of sites that are of archaeological and built heritage merit, which are not protected.

The Black Option Corridor is considered as a stand-alone option and is not comparable to the other option corridors. The option corridor will not result in any significant impacts on the recorded cultural heritage resource.

Summary Stage 2 Assessment of the Option Corridors East of Drumsna Junction (Node J)

The Green Option Corridor is the Preferred option for east of Drumsna Junction (Node J) as this option will directly affect the least number of sites that are subject to statutory protection. One major impact may occur in relation to an archaeological site that is proposed for inclusion in the next revision of the RMP. This option also represents a partial on-line upgrade and as such requires the least amount of previously undisturbed greenfield.

The Yellow Option Corridor is considered to be the Intermediate option as this option has two major impacts on recorded monuments as well as directly affecting a further ringfort site, a house that is listed as a protected structure and multiple sites of cultural heritage significance.

The Purple East Option Corridor is considered to be the Least Preferred option, as this option has two major impacts on recorded monuments, as well as directly affecting a further ringfort site and multiple sites of cultural heritage significance. This option will also require more greenfield areas and therefore has more potential to impact previously undiscovered archaeology.

8.8.8 Landscape and Visual

8.8.8.1 Introduction

This section describes the Stage 2 Assessment of the alternatives and options in the context of the Landscape and Visual constraints identified in Section 4.11 Landscape and Visual of this report. The Stage 2 alternatives and options are described in Section 8.2 Description of Stage 2 Alternatives and Options.

The Landscape and Visual constraints are presented with the Stage 2 Option Corridors in Figures 8.8.8.1.0 to 8.8.8.1.5.

Section 8.8.8.2 outlines the methodology utilised to carry out the Landscape and Visual assessment of the alternatives and options. The Landscape and Visual assessment of the alternatives is contained in Section 8.8.8.3 and the option corridors is provided in Section 8.8.8.4 with associated summary assessments and scorings presented in Section 8.8.8.5.

8.8.8.2 Methodology

The methodology utilised to carry out the Landscape and Visual assessment of alternatives is as set out for the Stage 1 Assessment (Sections 6.5.8.2 and 7.5.8.2) of this report.

In summary, the assessment is based on the comparative likelihood of significant/profound visual impact on properties; and the comparative likelihood of significant/profound impact on landscape designations (amenities, characteristics and views) and key landscape features.

The impact of each alternative on the landscape and visual receptors is assessed and is scored on a seven point scale in accordance with the Project Appraisal Guidelines (TII, 2016)[2]. The scale ranges from 7 to 1 as shown in Table 8.1.1.

8.8.8.3 Landscape and Visual Stage 2 Alternatives Assessment

Three alternatives are proposed:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

The description of the alternatives remains as presented in Section 6.5.8.3 Stage 1 assessment with the following principal change:

- The proposed pedestrian crossing bridge over the River Shannon has been removed from Alternative A
- The improvements to rail services element of Alternative B have been removed

The alternatives primarily relate to interventions, initiatives and works primarily on and within the existing street network, with some elements (e.g. mobility hub

(Alternative B); park and stride sites (Alternative C) provided on existing brownfield/parking areas. Therefore, the alternatives will have broadly similar landscape and visual impacts, which are not considered significant.

While the alternatives seek to either improve pedestrian/cycle movement (Alternative A), public transport (Alternative B), or to reduce traffic demand (Alternative C), they may not remove increasing vehicle pressure on the road network and therefore will not improve the adverse impact of traffic on the quality of the townscape and visual environment in Cortober/Carrick-on-Shannon.

The landscape and visual assessment of the alternatives is presented in Table 8.8.8.1.

Table 8.8.8.1 Stage 2 Landscape and Visual Assessment Matrix of Alternatives

Assessment Criteria	ALTERNATIVE A ACTIVE TRAVEL	ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS	ALTERNATIVE C DEMAND MANAGEMENT
Landscape	Positive streetscape interventions in Carrick-on-Shannon and Cortober and along existing road network. Alternative A will not result in a significant reduction in traffic congestion in Carrick-on-Shannon and Cortober, which will maintain existing adverse effects of traffic on the townscape character.	No significant landscape / townscape impacts expected.	No significant landscape / townscape impacts expected.
Visual	Positive streetscape interventions in Carrick-on-Shannon and Cortober and along existing road network. Alternative A will not result in a significant reduction in traffic through Carrick-on-Shannon and Cortober, which will maintain existing adverse effects of traffic on the townscape / visual character.	No significant visual impacts expected.	No significant visual impacts expected.
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

8.8.8.4 Landscape and Visual Stage 2 Option Corridors Assessment

Stage 2 Landscape and Visual Option Corridors Assessment

Four of the option corridors (Cyan, Orange, Purple West and Dark Green) included in the Stage 2 Landscape and Visual comparative assessment are located to the west of Node J at Drumsna Junction.

A fifth option (Black) is also located to the west of Node J comprises a short link to the north of Carrick-on-Shannon town centre. This is not comparatively assessed but rather assessed in isolation.

Three options are located to the east of Node J at Drumsna Junction (Yellow, Green and Purple East). The Purple East Option Corridor provides for a dual carriageway road, while Yellow and Green provide for a single carriageway road to the east of Node J.

Assessment of Option Corridor West of Drumsna Junction (Node J)

The four option corridors to the west of Drumsna which are comparatively assessed provide for a dual carriageway design of road to ensure that the worst-case scenario is assessed. Two options (Cyan and Orange) bypass Carrick-on-Shannon via a new bridge to the south (down river) of the town. The remaining two options (Purple West and Dark Green) bypass Carrick-on-Shannon via a new bridge to the north (up river) of the town.

The Black Option Corridor is a shorter single-carriageway, 'urban street' link located to the north of Carrick-on-Shannon town centre connecting the R280 at Ballynamony, to the Summerhill Road at Drummagh, and the Castlecara Road at Keenaghan.

The description of the option corridors are described in detail in Section 8.2 but remain as presented in Section 7.5.8.3 Stage 1 assessment with the following principal changes/details:

- The Cyan Option Corridor to the south of the town includes for a new c.800m link road to tie back crossing the railway and connecting to the existing R368 (Elphin Road) with a new roundabout junction on the R368. The route of this link road runs to the rear and east of residential properties at The Well which is a housing development located along the R368
- The Cyan, Orange, Purple West and Dark Green Option Corridors provide for dual carriageway road designs
- The Black Option Corridor provides for a single carriageway urban street link road

Otherwise, the description of the landscape and visual impact assessment for the option corridors remains as presented in the Stage 1 Assessment in Section 7.5.8.3 of this report and summarised in Table 8.8.8.2.

Option Corridors: East of Drumsna Junction (Node J)

The description of the option corridors are described in detail in Section 8.2 but remain as presented in Section 7.5.8.3 Stage 1 assessment with the following principal changes/details:

- The Yellow and Green Option Corridors provide for a single carriageway road design as presented in Figures 8.1.8.0. to 8.1.8.3 (Yellow) and Figures 8.1.7.0 to 8.1.7.3 (Green)
- The Purple East Option Corridor provides for a dual carriageway road design as presented in Figures 8.1.9.0 to 8.1.9.3

Otherwise, the description of the landscape and visual impact assessment for the option corridors remains as presented in the Stage 1 Assessment in Section 7.5.8.3 of this report and summarised in Table 8.8.8.3.

Table 8.8.8.2 Landscape and Visual Option Corridor Assessment – West of Drumsna (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR		BLACK OPTION CORRIDOR
	Pink Design Option Dual Carriageway	Orange Design Option Dual Carriageway	Purple Design Option Dual Carriageway	Grey Design Option Dual Carriageway		Black Design Single Carriageway Urban Street
Landscape Effects	Impact on local ridgelines (County Roscommon), mature trees, field boundaries, roadside plantings. Impact on sports grounds at Pairc an Gael. Impact on River Shannon Corridor / Floodplain LCA. Impact on Area of High Amenity along River Shannon (County Leitrim).	Impact on local ridgelines (County Roscommon), mature trees, field boundaries, roadside plantings. Impact on River Shannon Corridor / Floodplain LCA – with curving crossing. Impact on Area of High Amenity along River Shannon (County Leitrim).	Impact on local ridgelines (County Leitrim), mature trees, field boundaries, roadside plantings. Impact on River Shannon Corridor / Floodplain LCA. Impact on Area of High Amenity along River Shannon (County Leitrim).	Impact on local ridgelines (County Leitrim), mature trees, field boundaries. Impact on River Shannon Corridor / Floodplain LCA. Impact on Area of High Amenity along River Shannon (County Leitrim).		Impact on local ridgeline, mature field boundaries, stream corridor and associated semi-natural vegetation.

Assessment Criteria	CYAN OPTION CORRIDOR Pink Design Option Dual Carriageway	ORANGE OPTION CORRIDOR Orange Design Option Dual Carriageway	PURPLE WEST OPTION CORRIDOR Purple Design Option Dual Carriageway	DARK GREEN OPTION CORRIDOR Grey Design Option Dual Carriageway		BLACK OPTION CORRIDOR Black Design Single Carriageway Urban Street
Visual Effects	Impact on Protected Views V27 & V28 (Tully / Minkill). Impacton residential properties west of Cortober, at Station Road, east of Cortober (Carrick-on-Shannon), at The Well / R368, Glas na hAbhainn, Ard na Slí, Cnoc na Slí, and along existing N4.	Impact on Protected Views V27 & V28 (Tully / Minkill). Impact on residential properties at Station Road, east of Cortober (Carrick-on-Shannon), at The Well / R368, Glas na hAbhainn, Ard na Slí, Cnoc na Slí, and along existing N4.	Impact on Protected Views V8 (Hartley), V27 & V28 (Tully / Minkill). Impact from waterbody of Shannon (and future blueway along river). Impact on properties in Hartley, Cloonsheerrvagh, Cartown and Drumlumman, Cornamucklagh, Cloonmulligan, Dromore, Keenaghan, Cornaslieve, Garvlough, Aughriman South, Tully and Minkill.	Impact on Protected Views V8 (Hartley). Impact from waterbody of Shannon (and future blueway along river). Impact on properties in Hartley, Cloonsheerrvagh, Cartown and Drumlumman, Cornamucklagh, Cloonmulligan, Dromore, Garvlough and Aughriman South.		Impact on residential properties at R280, Ros Airgid, Oaklands and Summerhill Road, including Summer Hill (House).
Scoring						
Qualitative Assessment	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**		**Moderately Negative**
Score / Impact Level	**1**	**1**	**1**	**1**		**2**
Preference	**Intermediate**	**Least Preferred**	**Intermediate**	**Preferred**		**N/A**

Table 8.8.8.3 Stage 2 Landscape and Visual Option Corridor Assessment – East of Drumsna (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
	Yellow Design Option Single Carriageway	Green Design Option Single Carriageway	Purple Design Option Dual Carriageway
Landscape Effects	Impact on roadside trees, hedgerows and plantings. Impact on edge of Gortinty (Drumgilra) Lough. Impact on grounds of residential, sports (Annaduff GAA / Leitrim GAA Centre) and other properties.	Impact on roadside trees, hedgerows and plantings. Impact on edge of Gortinty (Drumgilra) Lough. Impact on grounds of residential, sports (Annaduff GAA / Leitrim GAA Centre) and other properties.	Impact on roadside trees, hedgerows and plantings and on sections of field boundaries. Impact on setting of section of River Shannon and Lough Annaduff. Impact on edge of Gortinty (Drumgilra) Lough. Deep cut through ridge at Aghamore. Impact on grounds of residential properties.
Visual Effects	Impact on residential property fronting existing N4 road corridor – including through Aghamore.	Impact on residential property fronting existing N4 road corridor – including through Aghamore.	Impact on residential property fronting existing N4 road corridor. Less impact on properties through Aghamore than other options.
Scoring			
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Major** or **Highly Negative**
Score / Impact Level	**2**	**2**	**1**
Preference	**Preferred**	**Preferred**	**Least Preferred**

***** *It is noted that this view and prospect is recommended for removal in the Leitrim Review of Views and Prospects carried out for and included in the Draft Leitrim County Development Plan 2023-2029 (January 2022).*

8.8.8.5 Summary

Summary of Alternatives

All the alternatives provide for an enhanced pedestrian/cycle friendly environment within Carrick-on-Shannon and Cortober. Alternative A also provides for an enhanced pedestrian/cycle network along the full length of the N4 within the study area, however it is unlikely to reduce current traffic levels, which is having an adverse effect on the townscape and visual character of the towns.

The other alternatives seek to either improve public transport (Alternative B), or to reduce traffic demand (Alternative C), and while either should reduce traffic on the existing N4 to some extent, again they may not remove increasing pressures on the network and the associated quality of the townscape and visual environment.

Summary of Options

In landscape and visual terms all options give rise to similar incidences and levels of significant landscape and visual impacts.

To the west of Drumsna Junction (Node J) the Dark Green Option Corridor is Preferred – being most remote from residential properties for much of its length. The Cyan and Purple West Option Corridors are considered as Intermediate preferences. The Orange Option Corridor is considered Least Preferred because of its slightly more northern bridging of the River Shannon and resulting impact on west bank of the river.

To the east of Drumsna Junction (Node J) the Yellow and Green Option Corridors follow the existing N4 and are marked as the Preferred options. The Purple East Option Corridor is marked as Least Preferred, diverting around the existing settlement along the N4 at Aghamore in deep cutting. All option corridors have impacts on properties located along the existing N4 – especially the Yellow and Green Option Corridors at Aghamore.

8.8.9 Biodiversity

8.8.9.1 Introduction

This section details the assessment of the Stage 2 alternatives and options with respect to the Biodiversity constraints identified in identified in Section 4.12 Biodiversity of Chapter 4 – Constraints Study.

The Biodiversity constraints are presented with the Stage 2 Option Corridors in Figures 8.8.9.1.0 to 8.8.9.2.5.

Section 8.8.9.2 outlines the methodology that was used to carry out the assessment. Section 8.8.9.3 and 8.8.9.4 details the assessment of the alternatives and options respectively and a summary is presented in section 8.8.9.5.

8.8.9.2 Methodology

The principal objectives of this assessment are to:

- Evaluate all alternatives and option corridors, based on ecological criteria, as per the National Road Authority (NRA) Guidelines for Assessment of Ecological Impacts of National Road Schemes (2009)[21] and Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (2018)[22]
- Assess the significance of the likely impacts on each of the biodiversity receptors potentially impacted by each of the alternatives and option corridors. As per the Transport Infrastructure Ireland (TII) guidance, this step discounted biodiversity receptors or ecological sites where the risk of significant impacts is unlikely considering where the application of standard mitigation and best practice during construction is unambiguous and success is highly likely
- To assess each alternative and option corridor in accordance with Transport Infrastructure Ireland's Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (TII, 2016)[2]

To fulfil these objectives, an assessment of the likely or potential impacts of each alternative and option corridor on key ecological receptors is carried out so that an informed assessment of the alternatives, and assessment and comparison of the option corridors, can be made with the knowledge of the potential ecological consequences.

[21] National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

[22] Chartered Institute for Ecology and Environmental Management (CIEEM), 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1.pdf

Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Alongside the term "biodiversity", the terms "ecology" and "ecological" are also used throughout this section of the report as a broader term to refer to the relationships of biodiversity receptors to one another and to their environment.

The alternatives have been categorised as follows:

- Alternative A: Active Travel
- Alternative B: Public Transport Improvements
- Alternative C: Demand Management

The potential footprint and construction works associated with the alternatives have been assessed in terms of potential biodiversity impacts.

There are eight option corridors, five of which are to the west of Node J at Drumsna Junction (Cyan, Orange, Purple West, Dark Green and Black) and three which are to the east of Node J (Yellow, Green and Purple East).

The Stage 2 Biodiversity Assessment is based on an indicative fenceline within a proposed corridor centred around a possible alignment centreline for a dual carriageway (with the exception of the Black, Yellow and Green which are single carriageway alignments). As noted previously the cross-section has yet to be determined, but for the purpose of this assessment a dual carriageway has been assumed where possible. The assessment is also mindful that the alignments could be realigned within their option corridors. Unlike the earlier Stage 1 Assessment, this Stage 2 Assessment is focused on the fence to fence boundary associated with each of the various option corridors that have been brought forward for further consideration.

Biodiversity Stage 2 Assessment Process

The process by which the identified alternatives and options were assessed was as follows:

- The key ecological receptors within the study area were identified based on a combination of desktop data, consultation (i.e. relevant bodies/organisations) and field surveys
- The key ecological receptors were assigned an ecological valuation based on a geographic frame of reference ranging from international to local importance
- The likely impacts of each of the alternatives and option corridors on the key ecological receptors were identified and assessed, indicating which, if any, of these are likely to be significant, and at what geographical level
- The impacts of each of the alternative and option corridors on the key ecological receptors were scored based, in accordance with the TII approach[2] on a seven-

point scale ranging from 'Major or Highly Negative' (1) to 'Major or Highly Positive' (7)[23]

- The overall cumulative impact of each alternative and option corridor across all the key ecological receptors affected was also scored on the same seven-point scale
- The scores attributed to each of the option corridors were assessed comparatively and assigned a preference ranking score. It should be noted that the alternatives were not given a preference ranking

Key Ecological Receptors

Key ecological receptors are those biodiversity receptors confirmed, or likely to occur, within the overall study area with an ecological value of local importance (higher value) or greater and, therefore, likely to affect the scoring and assessment of the alternatives and options corridors. These include:

- Designated sites for nature conservation (e.g. SACs, SPAs, NHAs, pNHAs and Nature Reserves)
- Sensitive habitats (e.g. non-designated areas of Annex I habitat[24], non-Annex I semi-natural woodland habitats and watercourses[25])
- Sensitive species (e.g. freshwater pearl mussel *Margaritifera margaritifera* and whooper swan *Cygnus cygnus*)
- Ecological sites (identified from a combination of desktop and field assessment)

The key ecological receptors were initially identified in the constraints study detailed in Section 4.12 - Biodiversity based on collation of available existing information, from the desk study and consultations with relevant bodies/organisations and focus on the known/potential ecological value for the habitats/species present. In the case of the ecological sites, the boundaries were initially defined based on interpretation of orthophotography and collation of available existing habitat information.

Walkover surveys of the study area were undertaken in August and September 2020, along with specialist habitat surveys of two locations within the River Shannon floodplain:

1. north-west of Carrick-on-Shannon in the townlands of Corryolus and Cloonman

[23] In respect of the Black Option and the Active Travel and Public Transport Alternatives, these are not comparatively compared, rather assessed as standalone assessments. However, they are similarly described in as far as is possible based on the detail provided of likely or potential impacts on key ecological receptors.

[24] The short-hand names of Annex I habitats are used in this assessment, as per NPWS, 2019. The Status of European Habitats and Species in Ireland. Volume 2: Habitat Assessments. Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol2_Habitats_Article17.pdf

[25] Watercourses are referred to as per: The Environmental Protection Agency (EPA), 2022. Online Map Viewer. Available at: https://gis.epa.ie/EPAMaps/]

2. in the townlands of Cortober, Cordrehid, Attirory, Rinnacurreen and Drumkeeran to the south of Carrick-on-Shannon

This was further supplemented by additional field surveys undertaken in February and September 2021. The aim of the field surveys was a ground truthing exercise to verify the orthophotography interpretation and selection of ecological sites, refine site boundaries, assess the ecological evaluation of each of the identified ecological sites and to capture additional ecological sites not identified during the desk study. Walkover surveys of ecological sites which were located in close proximity to, or overlapped with, one or more of the option corridors, were undertaken in February 2021 and September 2021.

In some cases, a small number of ecological sites were viewed from a distance, owing to limited access or winter river levels covering certain areas (EC29, EC30, EC31, EC32, EC52, EC77 and EC80). Furthermore, in a small number of situations ecological sites could not be viewed at a distance due to the local topography or limited access (EC02, EC03 and EC05). However, assumptions have been made on the value of those ecological sites based on local information gathered during previous constraints field surveys and desk study, as necessary.

Where possible, during the site walkover surveys, habitat types were classified using the Guide to Habitats in Ireland (Fossitt, 2000)[26] and the likelihood/potential for Annex I habitat types was confirmed where possible or inferred based on the professional judgement of the surveyor, with reference to the Interpretation manual of European Union Habitats EUR 28 (CEC, 2013)[27]. Where it was not possible to confirm the presence of Annex I habitats, a precautionary approach was adopted with regards to the identification of the potential presence of Annex I habitats within an ecological site.

It should be noted that for this stage of the option selection process, the assessment is based on the information currently available for the ecological sites.

Ecological Valuation

The key ecological receptors identified have been valued with regard to ecological valuation guidance set out in Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)21 and Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018)[22].

The following geographic frame of reference is used when valuing the key ecological receptors:

- International importance
- National importance

[26] Fossitt, J.A., 2000. A Guide to Habitats in Ireland. Heritage Council, Kilkenny. Available at: https://www.npws.ie/sites/default/files/publications/pdf/A%20Guide%20to%20Habitats%20in%20Ireland%20-%20Fossitt.pdf

[27] Commission of the European Communities (CEC), 2013. Interpretation manual of European Union Habitats EUR28. European Commission, DG Environment. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

- County importance
- Local importance (higher value)

All Annex I habitats that lie outside of European sites, are valued as being of at least national importance, given that these habitats are of high conservation concern. Priority Annex I habitat types that lie outside of European sites may be valued as being of international importance given that they are of the highest conservation concern at a European level (i.e. natural habitat types in danger of disappearance[28]).

For individual sites (e.g. designated sites, watercourses or ecological sites identified during the Constraints Study), the overall ecological valuation for each of the key ecological receptors was based upon the highest value receptor known to be present, or potentially present, within the site.

Assessment Criteria

The assessment of each alternative and option corridor included both a quantitative and qualitative assessment. Firstly, the impacts on each key ecological receptor are assessed.

Although a given alternative or option corridor may impact upon a particular key ecological receptor, the direct impact(s) on the site may not necessarily directly impact on the highest value receptor(s). This is accounted for in the assessment as much as possible, based on the level of ecological information available.

To assess the likely ecological impacts of each alternative or option corridor on individual key ecological receptors, the following criteria are applied, with the use of professional judgement as to the likelihood of significant effects occurring:

- Potential impacts on an ecological receptor of national/international importance were assessed as being Major or Highly Negative
- Potential impacts on an ecological receptor of county importance were assessed as being Moderately Negative
- Potential impacts on a receptor of local importance (higher value) were assessed as being Minor or Slightly Negative

To assess the likely cumulative overall ecological impacts for each alternative and option corridor, the following criteria were applied, in conjunction with the use of professional judgement as to the likelihood of significant effects occurring:

- Biodiversity impacts are Major or Highly Negative if:
    - the impact is directly on one or more designated sites valued as international or national importance (i.e. SAC, SPA, pNHA or NHA)

    or

    - the impacts associated with the construction works for the alternative or with constructing a road within the option corridor would likely result in an adverse effect on the integrity of the SAC/SPA/pNHA/NHA site (i.e. for

[28] From the definition of "*priority natural habitat types*" in Article 1(d) of the Habitats Directive. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

SAC/SPA this could equate to the loss of qualifying interest habitat or undermining the conservation objectives and for pNHA/NHA this could relate to the loss of features for which the site is designated)

- Biodiversity impacts are Moderately Negative if:
  - the impact is directly on one or more non-designated ecological sites valued as national or county importance, or numerous ecological sites valued as local high importance

  or

  - the impacts associated with the construction works for the alternative or with constructing a road within the option corridor would likely result in permanent/long-term effects on non-qualifying interest Annex I habitat or on a species population considered to be of national importance

  or

  - Impacts associated with the construction works for the alternative or with constructing a road within the option corridor would likely have permanent/long-term effects on a habitat(s) or on a species population considered to be of county/local (high) importance
- Biodiversity impacts are Minor or Slightly Negative if:
  - the impact is directly on a small number of ecological sites valued as local high importance

  or

  - the impacts associated with the construction works for the alternative or with constructing a road within the option corridor would likely have permanent/long-term effects on a habitat(s) or on a species population considered to be of local (high) importance

Considering these cumulative impacts on the key ecological receptors identified, each option corridor was scored, based on the seven-point scale below and an integer was assigned according to the impact significance:

Assessment Score	Description
7	Major or Highly Positive
6	Moderately Positive
5	Minor or Slightly Positive
4	Not Significant or Neutral
3	Minor or Slightly Negative
2	Moderately Negative
1	Major or Highly Negative

As the alternatives are each assessed individually and are not assessed against each other an assessment score is assigned but they are not assigned as Preferred, Intermediate or Least Preferred. Equally the alternatives are not compared against

the option corridors as these may be complementary to an option corridor and may form part of the overall transport solution.

As all option corridors are likely to have some level of a negative impact on biodiversity, neutral or positive impact scorings do not apply in this assessment, as in the absence of a detailed design and/or mitigation there is no understanding that any option requiring construction could be assessed as neutral or positive.

Each of the option corridors were also comparatively assessed in terms of the overall impact significance, in order to provide a preference ranking. The preference ranking was as follows:

- Preferred
- Intermediate
- Least Preferred

In accordance with the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)21, key ecological receptors within the study area were not assessed against the alternatives or option corridors where the risk of significant impacts is unlikely, considering where the delivery of standard mitigation and best practice during construction is unequivocal and success is highly likely. For example, with the application of standard pollution control measures during construction and an operational drainage and pollution control system designed to current standards, sensitive biodiversity receptors downstream of alternatives or option corridors are not likely to be affected. However, it should be noted that potential watercourse crossings were considered in this assessment, as it cannot be assumed that clear-span crossings will be possible at each crossing point. In addition, potential watercourse crossings will undoubtedly result in habitat loss, with regards riparian habitat, and other indirect impacts on the watercourse in question (e.g. disturbance to aquatic fauna).

8.8.9.3 Biodiversity Stage 2 Assessment of Alternatives

This section details the Stage 2 Assessment of alternatives. For the most extent all of the alternatives relate to interventions, initiatives and works primarily on and within the existing street network, with some elements provided on existing brownfield/parking areas and therefore, have broadly similar biodiversity impacts including minor landtake. A full description of each of the alternatives (e.g. active travel, public transport improvement and demand reduction) are described in Section 8.2.

With respect to biodiversity, there are no major impacts associated with any of the alternatives as none of these alternatives interact with any ecological sites or watercourses identified and there are no sites of international, national, county or local value impacted.

Table 8.8.9.1 Biodiversity Assessment Matrix of Stage 2 Alternatives

Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Significant impact on sites of International Importance (major or highly negative)	0	0	0
Significant impact on sites of National Importance (major or highly negative)	0	0	0
Significant impact on sites of County Importance (moderately negative)	0	0	0
Significant impact on sites of Local Importance (Higher Value) (minor or slightly negative)	0	0	0
Scoring			
Qualitative Assessment	Although the proposed alternative could result in minor landtake, no likely impacts of any ecological sites or watercourses are predicted **Not Significant** or **Neutral**	Although the proposed alternative could result in minor landtake, no likely impacts of any ecological sites or watercourses are predicted **Not Significant** or **Neutral**	Although the proposed alternative could result in minor landtake, no likely impacts of any ecological sites or watercourses are predicted **Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

8.8.9.4 Biodiversity Stage 2 Assessment of Options

This section details the biodiversity Stage 2 Assessment of the option corridors. Key ecological receptors which are located within, or partially within, an option corridor, and on which the option corridors were assessed, are presented in Table 8.8.9.2. It should be noted that the Stage 2 Assessment takes cognisance of the indicative fenceline associated with each option corridor and whilst an ecological site may have been impacted in the Stage 1 assessment which was based on the full corridor width it may not be impacted by the Stage 2 Assessment. Any impacts identified within this Stage 2 Assessment relate to the indicative fenceline associated with each option corridor.

Table 8.8.9.2 Key Ecological Receptors Located within, or Partially within, Option Corridor

Site Name	Description	Ecological Value
Lough Eidin pNHA [001643]	Designated site (pNHA). Lake, lakeshore habitat and extensive areas of seasonally flooded wet grassland (callows), with confirmed stand of Annex I 6410 *Molinia* meadows habitat adjacent to the River Shannon. Important wintering bird site supporting Greenland white-fronted geese.	National
EC12	Immature broadleaved / wet woodland (including some recently planted).	Local (high)
EC16	Broadleaved / wet woodland / scrub, marsh and wet grassland on bank of River Shannon. Areas of confirmed and potential *91E0 habitat.	International
EC27	Broadleaved / wet woodland and scrub.	Local (high)
EC28	Broadleaved / wet woodland and scrub.	Local (high)
EC30	Broadleaved / wet woodland / scrub in River Shannon floodplain. Hydrologically connected to the river. Potential for *91E0 habitat.	International
EC32	Broadleaved / wet woodland / scrub and wet grassland in River Shannon floodplain. Hydrologically connected to the river. Potential for *91E0 habitat.	International
EC47	Broadleaved / wet woodland and scrub.	Local (high)
EC49	Broadleaved woodland / wet woodland.	Local (high)
EC50	Marsh, wet grassland and scrub. Potential to develop into *91E0 habitat in the short to medium term. Contains an area of Annex I Transition mires habitat [7140].	National
EC51	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats. Confirmed *91E0 habitat present.	International
EC52	Broadleaved / wet woodland, scrub and wet grassland. Potential for peatland habitats. Confirmed and potential *91E0 habitat present.	International
EC62	Artificial lake with surrounding semi-natural grassland and scrub.	Local (high)
EC63	Broadleaved / wet woodland and wet grassland.	Local (high)
EC77	Broadleaved woodland, scrub, semi-natural grassland and wet grassland. Potential for peatland habitats including *91D0.	International

Site Name	Description	Ecological Value
EC78	Broadleaved / conifer woodland and wet grassland. Area of recently planted oak woodland bordering N4. Wet grassland with devil's bit scabious *Succisa pratensis* and potential for Annex II marsh fritillary *Euphydryas aurinia* butterfly.	Local (high)
EC87	Broadleaved woodland and mixed conifer / broadleaf woodland.	Local (high)
EC88	Broadleaved and conifer woodland along the River Shannon.	Local (high)
EC97	Lake Gortconnellan or Spa Lough and associated wet grassland and scrub.	County
EC99	Broadleaved / wet woodland, scrub and wet grassland on bank of River Shannon. Potential for *91E0 habitat.	International
EC105	Lake Drumgilra or Gortinty Lough and associated wetland, broadleaved / wet woodland and scrub habitats. Potential for *91E0. Confirmed Whooper swan location along eastern bank of lake.	International
EC112	Broadleaved / wet woodland, scrub and wet grassland.	Local (high)
Killukin stream	River known to support brown trout *Salmo trutta*.	County
River Shannon	Nationally important watercourse of a large scale which runs through numerous counties and intersects a number of upstream (e.g. Lough Arrow SAC [001673]) as well as downstream European sites, the nearest of which is Lough Forbes Complex SAC [001818]. A number of other European sites including the Lower River Shannon SAC [002165] are present in the downstream receiving environment and species for which this is designated are likely to be present throughout the Shannon watercourse.	National
Drumercool stream	Watercourse	Local (high)
Drumsna stream	Watercourse	Local (high)
Unnamed stream - border of Annaduff and Gortinty	Watercourse	Local (high)
Gortinty stream	Watercourse	Local (high)
Cornaslieve_26 stream	Watercourse	Local (high)
Lismoyle_26 stream	Watercourse	Local (high)
Kiltycarney stream	Watercourse	Local (high)

Site Name	Description	Ecological Value
Kildorragh_26 stream	Watercourse	Local (high)
Unnamed stream - Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon	Watercourse	Local (high)
Attifinlay stream	Watercourse	Local (high)
Kilmaddaroe stream	Watercourse	Local (high)
Woodbrook house stream	Watercourse	Local (high)
Knockadalteen_26 stream	Watercourse	Local (high)
Clooneigh_26 stream	Watercourse	Local (high)
Knockananima stream	Watercourse	Local (high)
Aghameeny stream	Watercourse	Local (high)
Killasanowl stream	Watercourse	Local (high)
Unnamed stream - from the Shannon at Annaghbeg to Drumlumman	Watercourse	Local (high)
Assumptions made for this assessment: Only direct impacts were considered. Indirect impacts, such as those resulting from air quality impacts / impacts to hydrogeology were not considered at this stage of the assessment.		

Ecological Receptors West of Drumsna Junction (Node J)

Table 8.8.9.3 below provides a summary of the number of ecological receptors impacted by each option corridor.

Table 8.8.9.3 No. of Biodiversity Impacts for each Options Corridors – West of Drumsna Junction (Node J)

Assessment Criteria	Cyan Option Corridor (Pink Design Option)	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor (Grey Design Option)		Black Option Corridor
Significant impact on sites of International Importance (Major or Highly Negative)	2	2	3	4		0
Significant impact on sites of National Importance (Major or Highly Negative)	2	2	2	2		0
Significant impact on sites of County Importance (Moderately Negative)	1	1	0	0		0
Significant impact on sites of Local Importance (Higher Value) (Minor or Slightly Negative)	15	12	16	12		1

West of Drumsna (Node J)

Cyan Option Corridor

The indicative fenceline associated with the Cyan Option Corridor avoids direct impacts on Lough Eidin pNHA, although the northern section of the option corridor indicative fenceline is located in close proximity (i.e. 16m) to the mapped boundary of the pNHA near Node B in Cuiltyconeen. This pNHA is ecologically important at a national level.

At the most westerly point, between nodes A and C the indicative fenceline intersects a single ecological site: namely EC12. EC12 is composed of immature broadleaf and wet woodland which provides amenity value for a commercial enterprise – "Carrick Quads" and is of local importance (higher value).

Further east, between nodes C and D the indicative fenceline associated with the Cyan Option Corridor interacts with a number of ecological sites including EC50, EC51 and EC52. EC50 is of National importance due to the presence of marsh, wet grassland, confirmed transitional mires and quaking bogs 7140 habitat and scrub which is considered to have the potential to develop into *91E0 habitat in the short to medium term. Sites EC51 and EC52 are both of international importance due to the confirmed presence of priority Annex I *91E0 habitat. The indicative fenceline clips the northern and western boundaries of EC50, EC51 and EC52 before reconverging with the existing N4 at node D. It is estimated that the indicative fenceline could result in the direct loss of c.0.5ha, c.0.4ha, and c.0.5ha of priority Annex I habitat loss for EC50, EC51 and EC52 respectively.

The penultimate section of this option corridor, between nodes D and E intersects three ecological sites including EC62, EC63 and EC78, alongside their roadside boundaries. All three of these ecological sites are of local importance (higher value). EC62 consists of an artificial lake with surrounding semi-natural grassland and scrub, while EC63 comprises a mixture of broadleaf/wet woodland and wet grassland fields. EC78 comprises a combination of broadleaved/conifer woodland and wet grassland, as well as an area of recently planted oak woodland bordering the N4. However, the only section of EC78 that is intersected by the indicative fenceline consists of immature mixed broadleaf woodland and scrub and a small section of the recently planted oak woodland along the northern edge of the existing N4.

The final section of the Cyan Option Corridor, between nodes E and J, crosses two ecological sites as it moves eastward along the existing N4: EC87 and EC88, both of which are valued as being of local importance (higher value). Both EC87 and EC88 consist of broadleaf/conifer woodlands along either side of the existing N4 road.

The indicative fenceline crosses a number of watercourses of local importance (higher value), including the Lismoyle_26 stream, the Woodbrook House stream, the Kilmaddaroe stream, the Clooneigh_26, the Knockananima stream, the Kiltycarney stream, the Kildorragh stream, the Drumercool stream, the Killasanowl stream, all of which are tributaries of the River Shannon. In addition to the above, this option corridor also crosses one watercourse: the Killukin stream between node C-D, ranked as being of county importance, as it is known to support populations

of brown trout *Salmo trutta*. The Cyan Option Corridor between nodes C and D also crosses one watercourse of national importance, the River Shannon. The River Shannon is a large watercourse which runs through numerous counties intersecting a number of European sites upstream and in the downstream receiving environment, including the Lower River Shannon SAC [002165]. Habitats and species for which this is designated are likely to be present throughout the River Shannon watercourse.

The Cyan Option Corridor is assessed as being Major or Highly Negative with a PAG Score of 1 and is ranked as Intermediate with respect to biodiversity. This is because the indicative fenceline would result in direct impacts on an ecological site of national importance, namely EC50 which supports a small area of Annex I 6410 *Molinia* meadow habitat. Lough Eidin pNHA is not intersected by the indicative fenceline, thus this option corridor was preferred over the Purple West and Dark Green Option Corridors and described within this section. The Cyan Option Corridor also intersects two sites of international importance, EC51 and EC52 as well as six ecological sites of local importance (higher value). It also crosses one watercourse of national importance: the River Shannon, as well as one watercourse of county importance, namely the Killukin Stream. A further nine watercourses of local importance (higher value) would be intersected by this option corridor.

Orange Option Corridor

The indicative fenceline associated with the Orange Option Corridor crosses two watercourses between nodes B and C; the Knockadalteen_26 Stream and the Knockananima Stream, both of which are local importance (higher value). The indicative fenceline also crosses one watercourse of county importance between node C and D; the Killukin Stream (which is known to support populations of brown trout *Salmo trutta)* and one watercourse of national importance between nodes C-D, the River Shannon. The River Shannon is a large watercourse which runs through numerous counties intersecting a number of European sites upstream and in the downstream receiving environment, including the Lower River Shannon SAC [002165]. Habitats and species for which this is designated are likely to be present throughout the River Shannon watercourse.

Additionally, the Lower River Shannon SAC [002165] is located in the downstream receiving environment and species for which this is designated are likely to be present throughout the River Shannon watercourse. Between nodes D and E the indicative fenceline crosses two watercourses (the Kilmaddaroe Stream and the Kiltycarney Stream), both of which are classified as being of local importance (higher value). The final section of the Orange Option Corridor, between nodes E and J crosses an additional three streams, all of which are valued as local importance (higher value); namely the Lismoyle Stream, the Killasanowl Stream and the Kildorragh Stream.

The indicative fenceline does not intersect with any ecological sites between nodes B and C. Further east, between nodes C and D it intersects a number of ecological sites EC50, EC51 & EC52. Site EC50 is of national importance due to the presence of marsh, wet grassland, confirmed presence of transitional mires and quaking bogs 7140 habitat and scrub which is considered to have the potential to develop into priority Annex I *91E0 habitat in the short to medium term. EC51 and EC52 are

both of international importance due to the confirmed presence of priority Annex I *91E0 habitat. The indicative fenceline clips the northern and western boundaries of EC50, EC51 and EC52 before converging with the existing N4 at node D. It is estimated that this option corridor could result in the direct loss of c. 0.3ha, c.0.4ha and c.0.5ha of habitat loss for EC50, EC51 and EC52 respectively.

The next section of this option corridor, between nodes D and E intersects three ecological sites along their roadside boundaries namely: EC62, EC63 and EC78. All three of these ecological sites are of local importance (higher value). EC62 consists of an artificial lake with surrounding semi-natural grassland and scrub, while EC63 comprises broadleaf/wet woodland and wet grassland fields. EC78 comprises a combination of broadleaved/conifer woodland and wet grassland as well as an area of recently planted oak woodland bordering the N4. However, the only section of this ecological site that is intersected by the indicative fenceline consists of immature mixed broadleaf woodland and scrub and a small section of recently planted oak woodland along the northern edge of the existing N4.

The final section of the Orange Option Corridor, between nodes E and J, partially intersects two additional ecological sites along their boundaries on the existing N4, namely: EC87 and EC88, both of which are valued as being of local importance (higher value) and consist of broadleaf/conifer woodlands.

From a biodiversity perspective, the Orange Option Corridor is assessed as being Major or Highly Negative with a PAG Score of 1 and is ranked as Preferred. It would not result in any impacts to Lough Eidin pNHA (national importance) by virtue of its routing. As with all other option corridors, however, it would result in impacts of potentially national significance to the River Shannon, as well as one ecological site of national importance EC50. This option corridor would result in direct impacts on two sites of international importance - EC51 and EC52. The indicative fenceline would also impact on five ecological sites (EC62, EC63, EC78, EC87 and EC88) which would only be significant at the local scale, as the habitats which would be lost there are of local importance (higher value). The Orange Option Corridor would also result in impacts to one watercourse of county importance (Killukin stream), as well as resulting in potential impacts on seven watercourses, significant at the local scale.

As well as avoiding any impacts on Lough Eidin pNHA, this option corridor intersected the lowest number of ecological sites overall resulting in a Preferred ranking.

Purple West Option Corridor

The indicative fenceline associated with the Purple West Option Corridor crosses a number of watercourses of local importance (higher value), including the Cornaslieve_26 Stream, the Kiltycarney Stream, an unnamed stream - Kilmaddoroe Lough to Bran Lough to Carrickevy Lough to the River Shannon, the Kilmaddaroe Stream, an unnamed stream - from the River Shannon at Annaghbeg to Drumlumman, the Lismoyle Stream, the Killasanowl Stream, the Kildorragh Stream and the Aghameeny Stream, all of which are tributaries of the River Shannon. In addition to the above, this option corridor also crosses the River Shannon, a watercourse of national importance, northeast of node B. The River Shannon is a large watercourse which runs through numerous counties intersecting

a number of European sites upstream and in the downstream receiving environment of the Purple West Option Corridor, including the Lower River Shannon SAC [002165]. Habitats and species for which this and other European sites are designated for are likely to be present throughout the River Shannon watercourse.

This option corridor would impact Lough Eidin pNHA, an ecologically important site at a national level. This pNHA site is composed of a mosaic of habitats including wet woodland, wet grassland, improved grassland, riparian woodland, marsh and raised bog. The indicative fenceline cuts through a significant proportion of the pNHA and it is estimated that it could result in *c.* 4.2ha of direct habitat loss, with the majority of this comprising wet grassland and marsh vegetation. Areas of riparian woodland (with priority Annex I *91E0 habitat) have been confirmed within and adjacent to the pNHA boundary, as has a stand of Annex I 6410 *Molinia* grassland habitat, which is within the indicative fenceline intersecting the pNHA.

Between node B and the River Shannon, on the western side of Carrick-on-Shannon the indicative fenceline bisects ecological site EC16. This ecological site is valued as international importance due to the confirmed presence of priority Annex I *91E0 habitat. This site, located along the banks of the River Shannon, comprises broadleaved/wet woodland, scrub, marsh and wet grassland. The indicative fenceline is estimated to result in the direct loss of c.1.5ha of EC16, c. 0.35ha of which corresponds to priority Annex I *91E0 habitat.

Extending north towards Hartley Court, the Purple West Option Corridor interacts with two ecological sites of local importance (higher value), namely EC27 and EC28, which consist mostly of broadleaf/wet woodland and scrub as well as two other ecological sites of international importance (EC30 and EC32). Both EC30 and EC32 comprise broadleaved/wet woodland and scrub mosaics within the River Shannon floodplain, with potential for priority Annex I *91E0 habitat. It is estimated that this option corridor would result in the direct loss of EC30 and EC32 (*c.* 0.2ha and 0.8ha respectively).

As this option corridor turns eastward towards node E it interacts with EC47 and EC49. Both EC47 and EC49 are valued as local importance (higher value) comprising broadleaf/wet woodland and scrub. The Purple West Option Corridor intersects a small section of EC47 and a small section of the northern edge of EC49 although it is predicted unlikely that any impacts on these ecological sites will occur as a result of this option corridor. North of node E the Purple West Option Corridor intersects a number of discrete parcels of EC78, which is valued as local importance (higher value). EC78 comprises four distinct areas and is characterised by a combination of broadleaved/conifer woodland and wet grassland, as well as an area of recently planted oak woodland bordering the N4. Sections of this ecological site that are intersected by the indicative fenceline consists of immature mixed broadleaf woodland and scrub, an area of mixed broadleaf/conifer woodland and a small section of the recently planted oak woodland along the northern edge of the existing N4.

The final section of the Purple West Option Corridor, between nodes E and J, crosses three additional ecological sites including and additional part of EC78 described above, EC87 and EC88, all of which are valued as being of local importance (higher value) and consist of broadleaf/conifer woodlands

The Purple West Option Corridor is assessed as being Major or Highly Negative with a PAG Score of 1 and is the second Least Preferred from a biodiversity point of view. This is due to the fact that it is estimated that it would result in significant impacts on Lough Eidin pNHA (*c.* 4.2ha of direct habitat loss), the greatest loss of habitat across all of the option corridors that intersect the pNHA, with the exception of the Dark Green Option Corridor. Although not statutorily proposed for designation, pNHA's are afforded strict protection under Planning objectives contained within the Leitrim County Development Plan. The Purple West Option Corridor would also have direct impacts on three ecological sites of international importance including EC16, EC30 and EC32. This option corridor could also result in impacts of potentially national significance to the River Shannon. In addition to the above, this option corridor would also result in impacts on nine watercourses and seven ecological sites of local importance (higher value).

Dark Green Option Corridor

The Dark Green Option Corridor crosses a number of watercourses of local importance (higher value), including: an unnamed stream - Kilmaddoroe Lough to Bran Lough to Carrickevy Lough to the River Shannon, the Kilmaddaroe Stream, an unnamed stream - from the River Shannon at Annaghbeg to Drumlumman, the Lismoyle Stream, the Killasanowl Stream, the Kildorragh Stream and the Aghameeny Stream, all of which are tributaries of the River Shannon. In addition to the above, this option corridor also crosses the River Shannon, a watercourse of national importance, northeast of node B. The River Shannon is a large watercourse which runs through numerous counties intersecting a number of European sites upstream and in the downstream receiving environment of this option corridor, including the Lower River Shannon SAC [002165]. Habitats and species for which this and other European sites are designated for are likely to be present throughout the River Shannon watercourse.

The indicative fenceline would intersect a section of Lough Eidin pNHA, an ecologically important site at a national level. This pNHA site is composed of a mosaic of habitats including wet woodland, wet grassland, improved grassland, riparian woodland, marsh and raised bog. The indicative fenceline intersects a significant proportion of the pNHA and it is estimated that it could result in *c.* 4.2ha of direct habitat loss, with the majority of this comprising wet grassland and marsh vegetation. Areas of riparian woodland (with priority Annex I *91E0 habitat) have been confirmed within and adjacent to the pNHA boundary, as has a stand of Annex I 6410 *Molinia* grassland habitat, which is within the indicative fenceline intersecting the pNHA.

Between node B and the River Shannon, on the western side of Carrick-on-Shannon the Dark Green Option Corridor bisects ecological site EC16. This ecological site is valued as international importance due to the confirmed presence of priority Annex I *91E0 habitat. This site, located along the banks of the River Shannon, comprises broadleaved/wet woodland, scrub, marsh and wet grassland. The indicative fenceline associated with this option corridor is estimated to result in the direct loss of *c.*1.5ha of EC16, *c.* 0.35ha of which corresponds to priority Annex I *91E0 habitat.

Extending north towards Hartley Court, the Dark Green Option Corridor intersects two ecological sites of local importance (higher value), namely EC27 and EC28, which consist mostly of broadleaf/wet woodland and scrub as well as two other ecological sites of international importance (EC30 and EC32). Both EC30 and EC32 comprise broadleaved/wet woodland and scrub mosaics within the River Shannon floodplain, with potential for priority Annex I *91E0 habitat. It is estimated that the indicative fenceline associated with this option corridor would result in the direct loss of EC30 and EC32 (*c.* 0.2ha and 0.8ha respectively).

Continuing in an easterly direction, the Dark Green Option Corridor intersects EC49, which is a site valued as being of local importance (higher value) and is characterised by broadleaf/wet woodland and scrub.

Heading towards node J, the Dark Green Option Corridor bisects EC77 which is valued as international importance, on a precautionary basis due to the potential presence of *91D0 Bog Woodland habitat within this ecological site. EC77 comprises broadleaved woodland, scrub, semi-natural grassland and wet grassland and has potential for peatland habitats and associated Annex I habitats based on examination of orthophotography. EC77 was revisited on 3 September 2021 however due to the presence of cattle and flooded drainage ditches, access was limited, and evaluation is based on orthophototraphy, desktop knowledge and information obtained during this site survey. Vegetation present in accessible areas included willow tree species, a species that can be characteristic of priority Annex I *91EO (alluvial woodland) habitat and unmanaged areas of wet grassland. In light of this EC77 was valued as internationally important on a precautionary basis. The indicative fenceline would result in c. 1.9ha of direct habitat loss on EC77.

The final section of the Dark Green Option Corridor, between nodes E and J, crosses two additional ecological sites; namely EC87 and EC88, both of which are valued as being of local importance (higher value) and consist of broadleaf/conifer woodlands.

The Dark Green Option Corridor is assessed as being Major or Highly Negative with a PAG Score of 1 and is ranked as Least Preferred of the western option corridors from a biodiversity point of view, due to the fact that it is estimated that it would result in significant impacts on Lough Eidin pNHA (*c.* 4.2ha of direct habitat loss). Although not statutorily proposed for designation, pNHA's are afforded strict protection under Planning objectives contained within the County Development Plan 2015- 2021. Additionally, the Dark Green Option Corridor would also have direct impacts on four sites of international importance including EC16, EC30, EC32 and EC77 (this option corridor impacts the greatest number of internationally-valued ecological sites) and could also result in impacts of potentially national significance to the River Shannon. In addition to the above, this option corridor would also result in impacts on eight watercourses and five ecological sites of local importance (higher value).

As detailed for the Purple West Option Corridor described above, the primary reasoning behind the ranking of this option corridor is the interaction between it and the pNHA and the protection currently afforded to pNHA's under planning objectives contained within the Leitrim County Development Plan. This option corridor is ranked Least Preferred of the overall western option corridors and is

separated from the Purple West Option Corridor as it also interacts with four additional ecological sites of international importance.

Black Option Corridor

The Black Option Corridor intersects a single watercourse of local importance (higher value), namely, the Attifinlay stream which runs parallel to the L3408 Castlecara road. This watercourse drains into the River Shannon at Carrick-on-Shannon.

No ecological sites or designated sites are intersected by this option corridor.

The Black Option Corridor is assessed as being Minor or Slightly Negative and given a PAG Score of 3.

It is noted that no comparative assessment is supplied in respect to the Black Option Corridor as it could form part of the overall transport solution.

Table 8.8.9.4 Biodiversity Assessment Matrix of Stage 2 Options Corridor West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Significant impact on sites of International Importance (Major or Highly Negative)	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts	3 Major or Highly Negative impacts	4 Major or Highly Negative impacts		0 Major or Highly Negative impacts
Significant impact on sites of National Importance (Major or Highly Negative)	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts		0 Major or Highly Negative impacts
Significant impact on sites of County Importance (Moderately Negative)	1 Moderately Negative impact	1 Moderately Negative impact	0 Moderately Negative impacts	0 Moderately Negative impacts		0 Moderately Negative impacts
Significant impact on sites of Local Importance (Higher Value) (Minor or Slightly Negative)	15 Minor or Slightly Negative	12 Minor or Slightly Negative	16 Minor or Slightly Negative	12 Minor or Slightly Negative		1 Minor or Slightly Negative
Overall Assessment	There are 4 Major or Highly Negative impacts, 1 Moderately Negative and 15 Minor or Slightly Negative impacts associated with this option design	There are 4 Major or Highly Negative impacts, 1 Moderately Negative and 12 Minor or Slightly Negative impacts associated with this option design	There are 5 Major or Highly Negative impacts, 0 Moderately Negative and 16 Minor or Slightly Negative impacts associated with this option design	There are 6 Major or Highly Negative impacts, 0 Moderately Negative and 12 Minor or Slightly Negative impacts associated with this option design		There are 0 Major or Highly Negative impacts, 0 Moderately Negative and 1 Minor or Slightly Negative impacts associated with this option design

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Scoring						
Qualitative Assessment	Impacts on two internationally important sites with potential priority Annex I habitat, the River Shannon (a river of national importance), one ecological site of national importance (EC50), one watercourse of county importance and 15 ecological sites of local importance (higher value) including six ecological sites and nine watercourses. **Major** or **Highly Negative**	Impacts on two internationally important sites with potential priority Annex I habitat, the River Shannon (a river of national importance), one ecological site of national importance (EC50), one watercourse of county importance and 12 ecological sites of local importance (higher value) including five ecological sites and seven watercourses. **Major** or **Highly Negative**	Impacts on Lough Eidin pNHA (a nationally important site), three internationally important sites with potential priority Annex I habitat, the River Shannon (a river of national importance), and 16 ecological sites of local importance (higher value) including seven ecological sites and nine watercourses. **Major** or **Highly Negative**	Impacts on Lough Eidin pNHA (a nationally important site), four internationally important sites with potential priority Annex I habitat, the River Shannon (a river of national importance), and 12 ecological sites of local importance (higher value) including five ecological sites and seven watercourses. **Major** or **Highly Negative**		Impacts on one watercourses of local importance (higher value) **Minor** or **Slightly Negative**
Score / Impact Level	**1**	**1**	**1**	**1**		**3**
Preference	**Intermediate**	**Preferred**	**Least Preferred**	**Least Preferred**		**N/A**

Ecological Receptors East of Drumsna Junction (Node J)

The table below provides a summary of the number of ecological receptors impacted by each option corridor.

Table 8.8.9.5 No. of Biodiversity Impacts for each Option Corridor – East of Drumsna Junction (Node J)

Assessment Criteria	Yellow Option Corridor	Green Option Corridor	Purple East Option Corridor
Significant impact on sites of International Importance (Major or Highly Negative)	2	2	2
Significant impact on sites of National Importance (Major or Highly Negative)	0	0	0
Significant impact on sites of County Importance (Moderately Negative)	0	0	1
Significant impact on sites of Local Importance (Higher Value) (Minor or Slightly Negative)	4	4	4

<u>Yellow Option Corridor</u>

The indicative fenceline associated with the Yellow Option Corridor has a largely similar footprint as the indicative fenceline associated with the Green Option Corridor discussed below and therefore crosses the same watercourses (an unnamed stream - border of Annaduff and Gortinty, the Drumsna Stream and the Gortinty Stream) and ecological sites including two sites of international importance (EC99 and EC105) and one site of local importance (higher value): EC112.

The Yellow Option Corridor does however differ from the Green Option Corridor towards the southern end, between nodes G and H, where it deviates slightly from the existing N4 and crosses further into EC112 (a site of local importance (higher value)) than the Green Option Corridor.

The Yellow Option Corridor was assessed as being the joint Preferred alongside the Green Option Corridor. Although this option corridor would result in slightly more habitat loss at EC112, this is not considered to be significant as the additional landtake will be minor and this ecological site is valued as local importance (higher value).

<u>Green Option Corridor</u>

The indicative fenceline associated with the Green Option Corridor crosses two watercourses of local importance (higher value) between nodes J and F; an unnamed stream - border of Annaduff and Gortinty and the Drumsna Stream and

one watercourse of local importance (higher value) between nodes F and G – the Gortinity Stream.

As the Green Option Corridor begins southeast from node J, it partially interacts with two ecological sites of international importance prior to reaching node F, namely; EC99 and EC105. EC99 is a large site consisting of wet grassland, scrub and broadleaf/wet woodland with potential for priority Annex I *91E0 habitat to occur along the banks of the River Shannon. This ecological site extends alongside the existing N4 between the River Shannon and the "Masonite" industrial facility until it reaches the railway line in the south. Although this is a larger site, the indicative fenceline associated with the Green Option Corridor only cuts a small section of its northern border. EC105 comprises Grumgilra/Gortinity Lough as well as the surrounding wet grasslands, scrub and broadleaf/wet woodland. This site has been valued as international importance due to the potential for priority Annex I *91E0 habitat to occur there, as well as the presence of confirmed Birds Directive Annex I Whooper swan *Cygnus cygnus* feeding locations (observed within the wet grassland fields along the southeastern bank of the lake). As with EC99, this is a large ecological site, however the indicative fenceline associated with this option corridor only cuts a portion of the northern border.

There are no interactions between this option corridor and any ecological sites between nodes F and G.

At the final section of the Green Option Corridor, between nodes G and H, it crosses a small section of EC112, which is valued as being of local importance (higher value). EC112 consists of wet grassland and scrub with small areas of broadleaf/wet woodland.

The Green Option Corridor was assessed as being Preferred alongside the Yellow Option Corridor (East of Drumsna). Both option corridors follow a similar routing and interact with the same watercourses and ecological sites, albeit with a slight difference at EC112 (described below for the Yellow Option Corridor). Both the Green and Yellow Option Corridors interact with fewer ecological sites than the Purple East Option Corridor (Purple East Option Corridor also interacts with EC97, as described below) and thus have been assessed as joint Preferred.

Purple East Option Corridor

The majority of the indicative fenceline associated with the Purple East Option Corridor follows the existing N4, with the exception of an off-line deviation around the village of Aghamore between nodes F and G. It also includes a locally wider footprint to accommodate a proposed junction near Drumnsna. The Purple East Option Corridor intersects the same watercourses and ecological sites as the Green Option Corridor namely: two watercourses of local importance (higher value) between nodes J and F; an unnamed stream - border of Annaduff and Gortinty and the Drumsna Stream and one watercourse of local importance (higher value) between nodes F and G – the Gortinity Stream.

The Purple East Option Corridor interacts with the same ecological sites described for the Green Option Corridor including: EC99, EC105 and EC112. However, this option corridor differs in respect of potential loss of an additional ecological site south of node J: EC97, which is ranked as being of county importance. It is

estimated that this option corridor would result in an additional loss of c. 0.05ha of EC97.

The Purple East Option Corridor was assessed as being Least Preferred (east of Drumsna), due to the fact that it would involve slightly more landtake as well as interaction with an additional ecological site: EC97 (a site of county importance) compared with the Green and Yellow Option Corridors.

Table 8.8.9.6 Biodiversity Assessment Matrix of Stage 2 Option Corridors East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Significant impact on sites of International Importance (Major or Highly Negative)	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts	2 Major or Highly Negative impacts
Significant impact on sites of National Importance (Major or Highly Negative)	0 Major or Highly Negative impacts	0 Major or Highly Negative impacts	0 Major or Highly Negative impacts
Significant impact on sites of County Importance (Moderately Negative)	0 Moderately Negative impacts	0 Moderately Negative impacts	1 Moderately Negative impact
Significant impact on sites of Local Importance (Higher Value) (Minor or Slightly Negative)	4 Minor or Slightly Negative	4 Minor or Slightly Negative	4 Minor or Slightly Negative
Overall Assessment	There are 2 Major or Highly Negative impacts, 0 Moderately Negative and 4 Minor or Slightly Negative impacts associated with this option corridor	There are 2 Major or Highly Negative impacts, 0 Moderately Negative and 4 Minor or Slightly Negative impacts associated with this option corridor	There are 2 Major or Highly Negative impacts, 1 Moderately Negative and 4 Minor or Slightly Negative impacts associated with this option corridor
Scoring			
Qualitative Assessment	Impacts on two internationally important sites with potential priority Annex I habitat and four ecological sites of local importance (higher value) including one ecological site and three watercourses. **Major** or **Highly Negative**	Impacts on two internationally important sites with potential priority Annex I habitat and four ecological sites of local importance (higher value) including one ecological site and three watercourses. **Major** or **Highly Negative**	Impacts on two internationally important sites with potential *91E0 Annex I habitat, one ecological site of county importance and four ecological sites of local importance (higher value) including one ecological site and three watercourses. **Major** or **Highly Negative**
Score / Impact Level	**1**	**1**	**1**
Preference	**Preferred**	**Preferred**	**Least Preferred**

8.8.9.5 Summary

Key ecological receptors within the study area were identified and assigned an ecological value based on a geographic frame of reference ranging from international to local importance. The likely impacts of each of the alternatives and option corridors on the key ecological receptors were identified and assessed, indicating which, if any, of these are likely to be significant, and at what geographical level.

Alternatives

None of the proposed Alternatives will impact directly on any ecological sites, at any geographical scale. Additionally, given the nature and scale of the works as outlined in Section 8.8.9.3 none of these Alternatives are likely to result in indirect effects on any ecological sites.

Option Corridors

The impacts of each of the indicative designs associated with each option corridor on the key ecological receptors were identified and assigned an impact rating. The overall cumulative impact of each option corridor across all the key ecological receptors affected was then scored in accordance with the TII approach[2], on a seven-point scale (listed in Table 8.1.1). The scores attributed to each of the option corridors were assessed comparatively and assigned a preference ranking.

Table 8.8.9.7 and Table 8.8.9.8 outline which ecological receptors are impacted by each of the option corridors west of Drumsna Junction (Node J) and east of Drumsna Junction (Node J) respectively.

<u>West of Drumsna</u>

West of Drumsna Junction the Least Preferred Option Corridors from a biodiversity perspective are the Purple West and Dark Green Option Corridors. This is primarily due to the interaction between these option corridors and the pNHA and given the strict protection currently afforded to pNHA's under planning objectives contained within the Leitrim County Development Plan 2015- 2021. Additionally, the Purple West and Dark Green Option Corridors also interact with the highest number of internationally important sites (three and four respectively).

The Orange Option Corridor is Preferred given the lack of direct impact on the pNHA and the fact that the indicative fenceline associated with this option corridor interacts with the least number of ecological sites (including two sites of international importance, one site of national importance, two sites of county importance and 12 sites of local importance (higher value)).

The Cyan Option Corridor was ranked as Intermediate. Similar to the Orange Option Corridor this was ranked as more preferable than either the Purple West and Dark Green Option Corridors given the lack of interaction with the pNHA, however the indicative fenceline associated with this option corridor does interact with a higher number of sites of national importance and local importance (higher value) than the Orange Option Corridor and thus was ranked as Intermediate.

East of Drumsna

Both the Green and Yellow Option Corridors were assessed as joint Preferred as they interact with the same watercourses and ecological sites with any differences between them being minor. As the Purple East Option Corridor interacts with an additional ecological site (EC97) valued as county importance and as this option corridor will involve significantly more landtake than either the Green or Yellow Option Corridors, it was ranked as Least Preferred.

Table 8.8.9.7 Breakdown of the Key Ecological receptors which are Impacted by the Proposed Option Corridors – West of Drumsna Junction (Node J)

Option Corridor Fencelines West of Drumsna Junction				
Option Corridor	**Receptors of International Importance Impacted**	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Cyan Option Corridor	1. EC51 2. EC52	1. River Shannon 2. EC50	1. Killukin stream	1. EC12 2. EC62 3. EC63 4. EC78 5. EC87 6. EC88 7. Lismoyle_26 stream 8. Kilmaddaroe stream 9. Woodbrook House stream 10. Clooneigh_26 stream 11. Knockananima stream 12. Drumercool stream 13. Killasanowl stream 14. Kildorragh_26 stream 15. Kiltycarney stream
Orange Option Corridor	1. EC51 2. EC52	1. River Shannon 2. EC50	1. Killukin stream	1. EC62 2. EC63 3. EC78 4. EC87 5. EC88 6. Kiltycarney stream 7. Kilmaddaroe stream

Option Corridor Fencelines West of Drumsna Junction				
Option Corridor	**Receptors of International Importance Impacted**	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
				8. Knockadalteen_26 stream 9. Knockananima stream 10. Lismoyle_26 stream 11. Kildorragh_26 stream 12. Killasanowl stream
Purple West Option Corridor	1. EC16 2. EC30 3. EC32	1. Lough Eidin pNHA [001643] 2. River Shannon		1. EC27 2. EC28 3. EC47 4. EC49 5. EC78 6. EC87 7. EC88 8. Cornaslieve_26 stream 9. Kiltycarney stream 10. Lismoyle_26 stream 11. Kildorragh_26 stream 12. Unnamed stream - Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon 13. Kilmaddaroe stream 14. Killasanowl stream 15. Aghameeny stream 16. Unnamed stream - from the Shannon at Annaghbeg to Drumlumman

Option Corridor Fencelines West of Drumsna Junction				
Option Corridor	**Receptors of International Importance Impacted**	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Dark Green Option Corridor	1. EC16 2. EC30 3. EC32 4. EC77	1. Lough Eidin pNHA [001643] 2. River Shannon		1. EC27 2. EC28 3. EC49 4. EC87 5. EC88 6. Lismoyle_26 stream 7. Kilmaddaroe stream 8. Killasanowl stream 9. Kildorragh_26 stream 10. Aghameeny stream 11. Unnamed stream - from the Shannon at Annaghbeg to Drumlumman 12. Unnamed stream - Kilmaddoroe lough to Bran lough to Carrickevy lough to the River Shannon
Black Design				1. Attifinlay stream

Table 8.8.9.8 Breakdown of the Key Ecological Receptors which are Impacted by the Proposed Option Corridors – East of Drumsna Junction (Node J)

Option Corridors East of Drumsna Junction				
Option Corridor	**Receptors of International Importance Impacted**	**Receptors of National Importance Impacted**	**Receptors of County Importance Impacted**	**Receptors of Local Importance (Higher Value) Impacted**
Yellow Option Corridor	1. EC99 1. EC105			1. EC112 2. Drumsna stream 3. Unnamed stream - border of Annaduff and Gortinty 4. Gortinity stream
Green Option Corridor	1. EC99 2. EC105			1. EC112 2. Drumsna stream 3. Unnamed stream - border of Annaduff and Gortinty 4. Gortinity stream
Purple East Option Corridor	1. EC99 2. EC105		1. EC97	1. EC112 2. Drumsna stream 3. Unnamed stream - border of Annaduff and Gortinty 4. Gortinity stream

8.8.10 Hydrology

8.8.10.1 Introduction

This section details the Stage 2 Assessment of the alternatives and options in the context of the hydrological constraints identified in Section 4.13 Hydrology of this report.

The Stage 2 alternatives and options are described in Section 8.2. The Hydrology constraints are presented with the Stage 2 option corridors on figures 8.8.10.1.0 to 8.8.10.4.5.

Section 8.8.10.2 outlines the methodology utilised to carry out the assessment of alternatives and options, Section 8.8.10.3 provides and assessment of the Stage 2 Alternatives and Section 8.8.10.4 provides an assessment of the Stage 2 Options. A summary is presented in Section 8.8.10.5.

8.8.10.2 Methodology

The alternatives and options included in this assessment fall under the following headings:

The Alternatives which have been considered feasible for this Stage 2 appraisal comprise of public transport proposals and measures to improve active travel and demand management measures. The aim of these proposals is to encourage a shift away from private car usage, therefore reducing the number of private vehicles on the section of the N4 under consideration. This has the potential to relieve existing and forecast capacity issues in the study area. They can be categorised as follows:

- Alternative A : Active Travel
- Alternative B: Public Transport Improvements, including improved inter-urban bus services and improved local bus services in Cortober/Carrick-on-Shannon. Improvements to the railway station
- Alternative C: Demand Management

The detailed description of each of these measures is included in Section 8.2.

- Do-Something Road Based Options

A total of eight corridors with the potential for road based solutions have been taken forward to the Stage 2 Project Appraisal Matrix. Of these, five designs are located to the west of Node J at Drumsna Junction (Black, Pink, Orange, Purple and Grey) and three designs are to the east of Node J (Purple, Green and Yellow). The option corridors and corresponding designs are summarised in Table 8.8.10.1.

Table 8.8.10.1 Summary List of Corridors & Designs Considered in Stage 2

Option Name & Colour	Node	Design Colour	Carriageway
West of Drumsna Junction (Node J)			
Black Corridor	N/A	Black Design	Single Carriageway Urban Street
Cyan Option Corridor	A-J	Pink Design	Dual Carriageway
Orange Option Corridor	B-J	Orange Design	Dual Carriageway
Purple West Option Corridor	B-J	Purple Design	Dual Carriageway
Dark Green Option Corridor	B-J	Grey Design	Dual Carriageway
East of Drumsna Junction (Node J)			
Purple East Option Corridor	J-H	Purple Design	Dual Carriageway
Green Option Corridor	J-H	Green Design	Single Carriageway
Yellow Option Corridor	J-H	Yellow Design	Single Carriageway

The assessment methodology for Stage 2 does not differ from the Stage 1 assessment and is set out in Section 6.5.10.2 for the Alternatives and Section 7.5.10.2 for Options.

Assessment Criteria

The assessment criteria in respect to hydrology is as described in Section 7.5.10.3. The surface hydrological attributes that are considered in the Option assessment comprise of features such as watercourses (drains, streams and rivers), standing waterbodies (ponds and lakes), hydro ecological features (comprising wetland and peatland areas, springs and risings, groundwater fed fens), surface water resources (surface water abstractions and potable water supply sources), soft sediments indicating poor ground conditions and floodplains and flood risk area. The attribute importance was described in Section 7.5.10.2 in terms of local low, local high, county/regional, national and international status.

8.8.10.3 Hydrology Stage 2 Alternatives Assessment

The alternatives which have been considered at Stage 2 comprise of measures to improve active travel, public transport and demand management measures.

Alternative A: Active Travel

The improvements to cycling and walking facilities involves provision of a comprehensive cycle network including a new cycle and pedestrian bridge, improvement to pedestrian facilities and cycling facilities (improved crossings, footpath and cycle lane provision, cycle parking, e-bike parking, etc.) and pedestrianisation of key streets.

Alternative B: Public Transport

The improvement to public transport involving enhancement to the public transport network, increased frequency of public bus services (i.e. up to every 20minutes during peak hours), public services aimed at linking nearby urban settlements such as Boyle, Drumshanbo, Leitrim Village, Mohill, Elphin and Strokestown, provision of a mobility hub in Carrick-on-Shannon to facilitate interchange with other modes and demand responsive mini-bus services connecting isolated areas. Improvement to parking facilities at Carrick-on-Shannon railway Station and provision of demand responsive mini-bus services connecting isolated areas to Carrick-on-Shannon and Cortober.

Alternative C: Demand Management

Demand Management will focus on rationalising parking along the existing N4, car free town centre, provision of park and strides sites on periphery of town, provision of remote working hubs and delivery of town centre located mixed use developments.

Alternatives Impact Assessment

The impact of the alternatives with their many components on hydrology will essentially be aimed at reducing and managing traffic numbers. Such alternatives will result in reduction in private car numbers from the existing situation which potentially will reduce slightly the pollutant loads from the road drainage. The drainage currently is running off via outfalls and over the edge discharges to the watercourses and with reduced traffic numbers there may be a slightly reduced risk of traffic accidents and spillages that might contribute to a serious pollution incident from a HGV or smaller pollution risks from private vehicles. In terms of the effect on the water quality in the receiving watercourses and the downstream River Shannon the alternatives are unlikely to generate sufficient reduction in pollutant load as to register a perceptible impact on surface water quality due to the dilution available in this waterbody. However, the initiative is to take local private cars off the network entirely and replace with sustainable trips and may have a slightly more measurable positive impact on the smaller watercourses. Some components of the Alternative A will require some infrastructure works, however these will be located on existing road footprint areas, or brownfield sites and are already serviced by existing drainage networks, therefore there is no anticipated impact on hydrology as part of the Stage 2 Assessment of alternatives. (e.g. Park and stride facilities and new cycle/walking facilities). It is therefore considered that the alternatives overall which will achieve a small reduction on traffic numbers will not represent any perceptible benefit on water quality through a reduction in traffic pollution in road drainage waters and overall represents a Not Significant or Neutral impact on hydrology.

Table 8.8.10.2 Stage 2 Hydrological Assessment Matrix of Alternatives

ASSESSMENT CRITERIA	ALTERNATIVE A ACTIVE TRAVEL	ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS	ALTERNATIVE C DEMAND MANAGEMENT
Floodplains and Flood Risk	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
River Shannon	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Minor Watercourses	Not Significant or Neutral	Minor or Slightly Positive	Minor or Slightly Positive
Surface Water Resources	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Hydro-ecology	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Soft sediments	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral
Scoring			
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

8.8.10.4 Hydrology Stage 2 Options Assessment

Stage 2 Hydrological Assessment - Option Corridors West of Drumsna Junction (Node J)

Cyan Option Corridor

Table 8.8.10.3 Stage 2 Hydrological Assessment of Cyan Option Corridor

Hydrological Attribute	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	This option crosses the River Shannon floodplain 1.55km downstream of River Shannon Bridge at Attirory and upstream of Lough Corry. The Shannon Floodplain area encroached (based on the CFRAM 1000--year present day predicted flood extents) by the proposed design option fenceline is c3.83ha and the floodplain width encroached at the centreline of the corridor crossing is 542m.	This encroachment of the River Shannon floodplain area has a potential for loss of floodplain storage and causing upstream afflux by obstructing the conveyance. This potentially could result in increased flood levels upstream at Carrick-on-Shannon which has low-lying areas of the town at significant flood risk and requiring a flood relief scheme. The crossing is located immediately downstream of a natural narrowing of the floodplain which will reduce the impact on floodplain conveyance and upstream afflux. A major bridge structure is required at this crossing point to minimise upstream afflux effects on flood risk within Carrick-on-Shannon.
Killukin River Basin part of the Shannon Floodplain	The realignment of the local Attirory road as part of this option encroaches the Shannon Floodplain by 1.07ha. The option corridor crosses the Killukin River Basin that includes floodplain area of the River Shannon with an encroachment width of 218m along the alignment mainline and a total encroachment area to the fenceline design of 1.86ha. The cyan option with its proposed new link road to the R368 link road encroaches the Killukin Floodplain to the south of Cortober with an encroachment area of 1.63ha.	Storage loss may not result in significant impacts on the flooding regime in the River Shannon due to the very damped nature of the River Shannon flood hydrograph and the large storage available in the River Shannon at Carrick-on-Shannon. The potential loss of flood storage is considered to represent a Moderately Negative impact (2) on flooding and flood risk given the relatively small portion of the floodplain area encroached to the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. This represents a 0.50% reduction in floodplain area which is minor. The overall impact by this option on flooding in the River Shannon at Carrick-on-Shannon is rated as a Major or Highly Negative impact (1) given the existing upstream flood risk at Carrick-on-Shannon, the extensive floodplain area encroached and the potential for upstream afflux from the bridge crossing extending up to Carrick-on-Shannon.

Hydrological Attribute	Description	Impact
Knockananima Stream Flood Risk Area at	The CFRAM flood risk area associated with the Knockananima Stream is encroached by the proposed option upstream and downstream of the Rail line is encroached by the corridor with the total floodplain area within the indicative design fenceline at 0.316ha.	This has the potential to impact flooding locally from interference with floodplain conveyance and the loss of flood storage. This impact is rated as a Moderately Negative impact on flooding and flood risk (2) given its urban setting and existing flood risk at Shannon Gael housing Estate.
Water courses		
River Shannon (Morphology, Water Quality Impacts)	River Shannon catchment to the proposed option crossing is large with a catchment area of c. 1336km^2. The river channel width from bank to bank is 152m and the floodplain width is 530m at the proposed crossing point making it difficult to avoid the construction of in channel piers and floodplain infilling. Construction activities associated with River Shannon crossing and its floodplain have potential to generate significant pollution from construction activities and associated site runoff, including the potential for concrete and chemical (hydro carbon) spillages etc. Close proximity of corridor to the Shannon river channel near Tully downstream of Jamestown represent additional construction pollution risks for the River Shannon The entire length of the proposed road scheme will outfall eventually into the River Shannon via the road drainage outfalls discharging directly and via upstream watercourses introducing spillage risks and routine road drainage pollutant in the form of heavy metals.	It is likely that in channel piers will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers. Physical impact by the bridge structure on flow regime is rated as a local Moderately Negative impact (2). The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon channel and floodplain area this impact is rated as Moderately Negative (2). There is significant dilution available within the River Shannon throughout the year making the impact from routine road drainage discharges at operational stage are rated as Minor or Slighlty Negative (3). The risk of a serious accidental spillage at the operational phase remains but is of a relatively low risk given the road length, traffic numbers and road design and is rated as Moderately Negative (2).

Hydrological Attribute	Description	Impact
	There are jetties and moorings for leisure craft activities along the western river bank within the corridor which may be affected by the bridge crossing.	The impact on mooring facilities is considered to represent a Minor or Slightly Negative impact (3).
Minor Watercourses	The Woodbrook House Stream at Cloongownagh that flows into Lough Eidin is crossed at two locations having catchment areas of 2.13km^2 and 2.52km^2 respectively. Trib. Of the Knockanima stream (2.86km^2). Knockanima stream (5.43km^2).	Potential for flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 7km^2) and easily culverted providing full span of the stream channels to minimize disturbance. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as Minor or Slighlty Negative impact (3).
	Killukin River and floodplain crossed with catchment area of 35km^2. The Link Road Crosses a tributary of the Killukin River At 2 locations (small stream 1.2km^2 in area) Small Stream at Cooreen / Lisseeghan (1.0km^2). Kilmuddaroe Stream Lisseeghan (6.7km^2).	The Killukin River is classed as a small river at a catchment area of 35km^2 with medium importance, and with the flood basin backed up by flooding in the Shannon the hydrological impact is classed as Moderately Negative (2) possibly requiring large culverts or a bridge structure and the associated construction difficulties. All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local Minor or Slightly Negative impact (3).
	19 no. small drains (i.e. < 25ha in catchment areas) are intercepted.	The impact on the local drains is classed at a Minor or Slightly Negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This corridor crosses the River Shannon downstream of the Carrick-on-Shannon public water supply abstraction and at 2.5km downstream there will be no direct water quality impact on this high important abstraction source. A short section of the road corridor for 2.4km at the western	The River Shannon has significant sustained dilution available throughout the year from its large catchment and large upstream Lakes such that the impact on this attribute from the 2.4km section of road development at construction and operation is rated as a Minor or Slightly Negative impact (3). The routine Road Drainage discharges at operational stage represent a permanent

Hydrological Attribute	Description	Impact
	end is upstream of the abstraction and consequently has a potential for construction runoff to enter the River Shannon via the Woodfield House Stream, Lough Eidin and the River Shannon and therefore has the potential during construction to impact the water quality of the source. At operation phase routine runoff discharges or an accidental spillage has the potential to enter the River Shannon upstream of the abstraction also.	impact on a small proportion of the attribute and therefore given the very high attribute important this represents a Moderately Negative impact (2). The operational spillage risk from an accident involving a HGV on the abstraction point represents a Minor or Slighlty Negative impact.
Hydro-Ecology and Designated Sites		
Ecological Sites of Local Higher	Encroachment by Corridor of Sites EC35, EC 50, EC51, EC35 that represent wet woodland, wet Grassland and Marsh Habitats typical of large floodplain areas.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the road is unlikely to result in any significant dewatering and drainage of these wetland habitats and is considered to represent a Minor or Slightly Negative impact (3).
Designated sites of SAC, SPA, NHA and pNHA	The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such site and settling out.	There will be no direct impact on any designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a Minor or Slightly Negative impact (3).

Hydrological Attribute	Description	Impact
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the entire proposed road length 1.18km is in quaternary identified as Cut over peak and 0.80km is alluvium.	Soft sediments identified from the GSI Quaternary mapping represents 21.5% of the route. It is likely that actual amount encountered may be higher along the River Crossings. This is rated as representing a Minor or Slightly Negative impact (3).

Orange Option Corridor

Table 8.8.10.4 Stage 2 Hydrological Assessment of Orange Option Corridor

Orange Option Corridor	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	This orange option crosses the River Shannon channel and floodplain 1.50km downstream of River Shannon Bridge at Attirory and upstream of Lough Corry. The Shannon Floodplain area encroached (based on the 1000year present day predicted flooding extents) by the design proposed option fenceline is c2.92ha and the floodplain width encroached at the centreline of the corridor crossing is 420m (passing to the south of the housing estate at Attirory). The realignment of the local Attirory road as part of this option encroaches the Shannon Floodplain by 1.07ha.	This encroachment of the River Shannon floodplain area has a potential for loss of floodplain storage and causing upstream afflux by obstructing the conveyance. This potentially could result in increased flood levels upstream at Carrick-on-Shannon which has low-lying areas of the town at significant flood risk and requiring a flood relief scheme. The crossing is located immediately downstream of a natural narrowing of the floodplain which will reduces the impact on floodplain conveyance and upstream afflux. A major bridge structure is required at this crossing point to minimize upstream afflux effects on flood risk within Carrick-on-Shannon. The potential loss of flood storage is considered to represent a Moderately Negative impact (2) on flooding and flood risk given the relatively small portion of the floodplain area encroached to the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. This represent a 0.47% reduction in floodplain area which is minor. The overall impact by this option on flooding in the River Shannon at Carrick-on-Shannon is rated as a Major or Highly Negative impact (1) given the existing upstream flood risk at Carrick-on-Shannon, the extensive floodplain area encroached and the potential for upstream afflux from the bridge crossing extending up to Carrick-on-Shannon.
Killukin River Basin part of the Shannon Floodplain	The option corridor crosses the Killukin River Basin that includes floodplain area of the Shannon with an estimate encroachment width of 302m and an encroachment area of 2.42ha within the fenceline.	
Knockananima Stream Flood Risk Area	The CFRAM flood risk area associated with the Knockananima Stream flood risk is encroached by	This has the potential to impact flooding locally from interference with floodplain conveyance and the loss of flood storage.

Orange Option Corridor	Description	Impact
	the proposed option design downstream of the Rail line by 0.876ha based on the option design fenceline.	This impact is rated as a Moderately Negative impact (2) on flooding and flood risk given its urban setting and existing flood risk at Shannon Gael housing Estate.
Water courses		
River Shannon Channel	River Shannon to the Corridor crossing is large with a Catchment area of 1336km^2 The river channel width from bank to bank at the potential crossing point is 202m, which includes inlet channel to mooring basin on both banks, makes it difficult to avoid the construction of in-channel bridge piers. The floodplain width at the crossing point is 420m making it difficult to avoid encroachment of floodplain either as earthen embankments, abutments or support piers. Construction activities associated with River Shannon crossing and its floodplain have potential to generate significant pollution from construction site runoff and potential for concrete and chemical spillages etc. Close proximity of corridor to the Shannon River Channel near Tully downstream of Jamestown represent additional construction pollution risks for the River Shannon. The entire length of the proposed road scheme will outfall eventually into the River Shannon via the road drainage outfalls discharging directly and via upstream watercourses introducing spillage risks	It is likely that in channel piers will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers. Physical impact by the bridge structure on flow regime is rated as local Minor or Slightly Negative impact (3). The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon Channel and floodplain area this impact is rated as Moderately Negative (2). There is significant dilution available within the River Shannon throughout the year making the impact from routine road drainage discharges to be rated as Minor or Slightly Negative (3). The risk of a serious accidental spillage at the operational phase remains but is of a relatively low risk given the road length, traffic numbers and road design and is rated as Moderately Negative (2).

Orange Option Corridor	Description	Impact
	and routine road drainage pollutant in the form of heavy metals.	
Minor Watercourses	1 tributary stream at Meera / Tullyleague that flows into Lough Eidin c. 3 at 3.496km^2 in area. Knockanima Stream (5.52km^2) Killukin River and floodplain crossed with catchment area of 35km^2. Small Stream at Cooreen / Lisseeghan (1.0km^2). Kilmuddaroe Stream Lisseeghan (6.7km^2). 11 no. small drains intercepted.	Potential for Flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 7km^2) and easily culverted providing full span. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as Minor to Moderately Negative impact (2.5). The Killukin River is classed as a small river at a catchment area of 36km^2 and with the flood basin backed up by flooding in the Shannon the hydrological impact is classed as Moderately Negative (2) possibly requiring large culverts or a bridge structure. All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local Minor or Slightly Negative impact (3). The impact on the local drains is classed at a Minor or Slightly Negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This corridor is downstream of the Carrick-on-Shannon water supply abstraction and at 2.5km downstream there is unlikely to be any water quality impact on this important abstraction source. A short section of the road corridor for 0.6km at the western N4 tie-in is upstream of the abstraction and consequently has a potential for construction runoff to enter the River Shannon via a drainage	The River Shannon has significant dilution available throughout the year from its large catchment and large upstream lakes such that the impact on this attribute from the 0.6km section of road development at construction and operation is rated as a Minor or Slightly Negative impact (3). The routine Road Drainage discharge at operational stage represent a permanent impact on a small proportion of the attribute and therefore given the very high attribute important given to this feature the potential impact magnitude represents a Moderately Negative impact (2). The operational spillage risk from an accident involving an HGV on

Orange Option Corridor	Description	Impact
	channel and proximity of the River Shannon floodplain to the corridor and therefore has the potential during construction to impact the water quality upstream of the abstraction source. At operation phase routine runoff discharges or an accidental spillage has the potential to enter the River Shannon upstream of the abstraction also from this short 600m section of roadway.	the abstraction point represents a Minor or Slightly Negative impact (3) given its temporary nature.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors Ecological Sites of Local Higher Designated sites of SAC, SPA, NHA and pNHA	Encroachment by Corridor of Sites EC35, EC50, EC51, EC35 that represent wet woodland, wet Grassland and Marsh Habitats typical of large floodplain areas. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such site and settling out.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the Road is unlikely to result in any significant dewatering and drainage of these wetland habitats and is considered to represent a Minor or Slightly Negative impact (3). There will be no direct impact on any designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a Minor or Slightly Negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts	Soft sediments identified from the GSI Quaternary mapping represents 21.7% of the route. It is likely that actual amount encountered may be higher along the River Crossings.

Orange Option Corridor	Description	Impact
	and deposition of unsuitable construction material. Of the entire proposed road length 1.32km is in quaternary identified as Cut over peak and 0.30km is alluvium.	This is rated as representing a Minor or Slightly Negative impact (3).

Purple West Option Corridor

Table 8.8.10.5 Stage 2 Hydrological Assessment of Purple West Option Corridor

Hydrological Attribute	Description	Impact
Floodplains and Flood risk Areas		
River Shannon Floodplain	This corridor crosses the River Shannon floodplain 1.95km upstream of River Shannon Bridge at Corryolus. The River Shannon floodplain area encroached (based on the 1000-year present day predicted flooding extents) by the indicative design fenceline is 7.01ha encroaching the River Shannon floodplain at three locations along its route (Shannon mainline Crossing, River Shannon floodplain to the northeast at Corryolus and River Shannon floodplain further to the northeast, north of Lisnagat). The width of River Shannon mainline crossing at the centreline of the corridor is 401m.	This has potential for loss of floodplain storage and upstream afflux. The upstream afflux will not impact on the downstream flood risk area in Carrick-on-Shannon and the crossing is sufficiently downstream of Leitrim Village Flood Risk Area as not to be significant in terms of affecting flood risk there. The floodplain storage loss may not result in significant impacts on the flooding regime in the River Shannon due to the very damped nature of the River Shannon flood hydrograph and the large storage available in the River Shannon. The potential loss of flood storage represents a relatively small encroachment at 7.01ha of the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. This represents a 0.52% reduction in floodplain area. The potential loss of flood storage is considered to represent a permanent impact on a small proportion of the very high importance attribute and therefore represents a Major or Highly Negative impact (1) on flooding and flood risk.
Water courses		
River Shannon Channel	River Shannon to the Corridor crossing is large with a Catchment area of 1290km^2. The river channel width from bank to bank is 80m at the potential crossing point and the total floodplain width at the river channel crossing is 402m. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc.	It is likely multiple piers within the floodplain and channel will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers. Physical impact by the bridge structure on flow regime is rated as local Minor or Slightly Negative impact. No impacts on moorings Not Significant or Neutral (4). The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works

Hydrological Attribute	Description	Impact
	The entire length of the proposed road will outfall eventually to the River Shannon via the road drainage outfalls discharging directly and to upstream drains and tributaries.	and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon Channel and floodplain area this impact is rated as Moderately Negative (2). Pollution from the operation stage via the road drainage is rated as Minor or Slightly Negative (3).
Minor Watercourses	1 tributary stream at Meera / Tullyleague that flows into lough Eidin at 3.5km^2 in area. 1 small spring and drain. 1 small Stream at Lisnagat (<1km^2). 1 small stream at Cloonsheeban (1.4km^2). 1 small stream (Cloonmulligan) 3.15km^2. 1 small tributary stream of the Cloonmulligan (c .25km^2) 1 medium Stream at Greagh (5.75km^2). 1 small trib stream of Greagh at Minkill (1.26km^2). 1 small stream at Tully (< 1km^2). 20 drains encountered along route.	Potential for flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 7km^2) and easily culverted providing full span of the stream channels to minimize disturbance. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as Minor or Slightly Negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local Minor or Slightly Negative impact (3). The impact on the local drains is classed at a Minor or Slightly Negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This option is 910m upstream of Carrick-on-Shannon water supply abstraction intake with the corridor coming to within 680m of the abstraction point. Such close proximity allows very limited travel time and mixing / dilution of a potential spillage before reaching the abstraction point.	This corridor has the potential for significant impact both during construction of the road development and during its operation life through road drainage runoff and HGV spillage risk. This impact on an important and strategic public abstraction of regional importance is considered to represent both at construction

Hydrological Attribute	Description	Impact
	Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc. The road corridor for the first 6km drains to the River Shannon via numerous small streams and drains upstream of the public abstraction point and therefore vulnerable to pollution from both construction works and operation road drainage discharges and accidental spillage.	and operation a Major or Significant Negative impact (1). Mitigation through design can reduce the risk of spillage event reaching the intake point and provide water treatment and retention pond facilities to reduce the impact of routine runoff reducing the operation impact to a Moderately Negative.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors Ecological Sites of Local Higher Designated sites of SAC, SPA, NHA and pNHA	Encroachment by route option of a pNHA (Lough Eidin) on the northeast side of the River Shannon floodplain for almost 730m occurs. The route option encroaches ecological sites EC16, EC30 and EC32 that represent wet woodland, scrub and wet grassland Habitats within the Shannon Floodplain. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the road is unlikely to result in any significant dewatering and drainage impacts of these wetland habitats and is considered to represent a Minor or Slightly Negative impact (3) with the main impact of direct loss of habitat accounted for in the biodiversity section. The road development traverses through the Lough Eidin pNHA for c. 730m associated with encroachment into the River Shannon Floodplain Area. The impact on drainage of the associated wetland areas and River Shannon Callows will represent a Moderately Negative impact on the hydrological regime of a designated site of national importance. There will be no direct impact on any other designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a Minor or Slightly Negative impact (3).

Hydrological Attribute	Description	Impact
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the entire road mainline length, 0.99km is in quaternary identified as cut over peak, 0.34km as basin peat and 0.17km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 18.8% of the route. It is likely that actual amount encountered may be higher along the River Shannon crossings. This is rated as representing a Minor or Slightly Negative impact (3).

Dark Green Option Corridor

Table 8.8.10.6 Stage 2 Hydrological Assessment of Dark Green Option Corridor

Hydrological Attribute	Description	Impact
Floodplains and Flood Risk Areas		
River Shannon Floodplain	This corridor crosses the River Shannon floodplain 1.95km upstream of River Shannon Bridge at Corryolus. The River Shannon floodplain area encroached (based on the 1000-year present day predicted flooding extents) by the indicative design fenceline is 7.01ha encroaching the Shannon Floodplain at three locations along its route (Shannon mainline Crossing, Shannon Floodplain to the northeast at Corryolus, and Shannon Floodplain further to the northeast, north of Lisnagat). The width of River Shannon Mainline crossing at the centreline of the corridor design is 401m.	This has potential for loss of floodplain storage and upstream afflux. The upstream afflux will not impact on the downstream flood risk area in Carrick-on-Shannon and the crossing is sufficiently downstream of Leitrim Village Flood Risk Area as not to be significant in terms of affecting flood risk there. The floodplain storage loss may not result in significant impacts on the flooding regime in the River Shannon due to the very damped nature of the River Shannon flood hydrograph and the large storage available in the River Shannon. The potential loss of flood storage represents a relatively small encroachment at 7.01ha of the total floodplain area of c. 1350ha from Lough Eiden and Leitrim Village downstream to Jamestown. This represents a 0.52% reduction in floodplain area. The potential loss of flood storage is considered to represent a permanent impact on a small

Hydrological Attribute	Description	Impact
		proportion of the very high importance attribute and therefore represents a Major or Highly Negative impact (1) on flooding and flood risk.
Water courses		
River Shannon Channel	River Shannon to the Corridor crossing is large with a Catchment area of 1290km^2 The river channel width from bank to bank is 80m at the potential crossing point and the total floodplain width at the river channel crossing is 401m. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc. The entire length of the proposed road will outfall eventually to the River Shannon via the road drainage outfalls discharging directly and to upstream drains and tributaries.	It is likely multiple piers within the floodplain and channel will be required at this crossing which increases the potential impact during construction and operation with local changes in the bed morphology surrounding the piers. Physical impact by the bridge structure on flow regime is rated as local Minor or Slightly Negative impact. The crossing point cannot avoid the floodplain area which is wet for a large portion of the year and represents a significant pathway for impact on the river from construction works and a constraint on the period that construction works can take place. Given the scale of construction activities involved within the Shannon channel and floodplain area this impact is rated as Moderately Negative (2). Pollution from the operation stage via the road drainage is rated as Minor or Slightly Negative (3). No impacts on moorings Not Significant or Neutral (4).
Minor Watercourses	1 tributary stream at Meera / Tullyleague that flows into lough Eidin at 3.5km^2 in area. 1 small spring and drain. 1 small Stream at Lisnagat (<1km^2). 1 small stream at Cloonsheeban (1.4km^2). 1 small stream (Cloonmulligan) 3.15km^2. 1 small tributary stream of the Cloonmulligan (c .25km^2).	Potential for flow, morphology and flooding local impacts at these streams. All of the streams and drains intercepted are relatively small (max catchment area < 5km^2) and easily culverted providing full span of the stream channels to minimize disturbance. The disturbance impact of culverting and locally realigning the smaller streams and drains is rated as Minor or Slightly Negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local Minor or Slightly Negative impact (3).

Hydrological Attribute	Description	Impact
	1 small stream the Aghameeny Stream (1.2km^2). 1 small stream the KilMaddaroe Stream (2.75km^2) 1 small stream at Drishoge (< 0.5km^2) 21 drains encountered along route.	The impact on the local drains is classed at a Minor or Slightly Negative impact (3).
Surface Water Resources		
Carrick-on-Shannon Public Water Supply Abstraction	This option is 910m upstream of Carrick-on-Shannon water supply abstraction intake with the corridor coming to within 680m of the abstraction point. Such close proximity allows very limited travel time and mixing / dilution of a potential spillage before reaching the abstraction point. Construction activities associated with River Shannon crossing and its floodplain have potential to generate pollution from construction site runoff and potential for concrete spillages etc. The road corridor for the first 6km drains to the River Shannon via numerous small streams and drains upstream of the public abstraction point and therefore vulnerable to pollution from both construction works and operation road drainage discharges and accidental spillage.	This corridor has the potential for significant impact both during construction of the road development and during its operation life through road drainage runoff and HGV spillage risk. This impact on an important and strategic public abstraction of regional importance is considered to represent both at construction and operation a Major or Highly Negative impact (1). Mitigation through design can reduce the risk of spillage event reaching the intake point and provide water treatment and spillage retention area and water quality retention pond facilities to reduce the impact of routine runoff reducing the operation impact to Minor or Slightly Negative.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors Ecological Sites of Local Higher	Encroachment by route option of a pNHA (Lough Eidin) on the northeast side of the River Shannon floodplain for almost 730m occurs. The route option encroaches ecological sites EC16, EC30 and EC32 that represent wet	The potential impact on the hydrological regime from the construction of the road and the proposed drainage treatment of the Road is unlikely to result in any significant dewatering and drainage impacts of these wetland habitats and is considered to represent a Minor or Slightly Negative impact (3) with the main impact of direct loss of

Hydrological Attribute	Description	Impact
Designated sites of SAC, SPA, NHA and pNHA	woodland, scrub and wet grassland habitats within the River Shannon floodplain. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increase drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	habitat accounted for in the biodiversity section. The road development traverse through the Lough Eidin pNHA for c. 1.12km associated with encroachment into the River Shannon floodplain area. The impact on drainage of the associated wetland areas and River Shannon Callows will represent a Moderately Negative impact on the hydrological regime of a designated site of national importance. There will be no direct impacts on any other designated sites by the proposed road development and the only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential impact is considered given the dilution available in the Shannon, distance from the sites and the flow attenuation provided by the River Shannon to represent a Minor or Slightly Negative impact.
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the entire road mainline length 1.13km is in quaternary identified as cut over peak and 0.17km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the River Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 16.2% of the route. It is likely that actual amount encountered may be higher along the River Shannon crossings. This is rated as representing a Minor or Slightly Negative impact (3).

Black Option Corridor

The Black Option comprises a new urban street within Carrick-on-Shannon. The option provides connectivity by interconnecting the R280 to the Summerhill Road and on to the Castlecara Road. The option length is approximately 1.2km.

The lands adjacent to the Black Option drain via a number of small drainage channels south southwest to the River Shannon. The contributing catchment area draining by these streams is 1.3km^2. The flow capacity downstream is limited and therefore road drainage from the Black Option Corridor will require attenuation to prevent downstream impacts and increased flooding, this will be assessed in Phase 3. The western end of this route option encroaches slightly the 100-year flood risk area associated with the River Shannon and the Lisnagat stream. This represents a minor or slightly negative impact on flooding and flood risk. The watercourses intercepted by the route heading south southwest are three small streams and two minor drains. The disturbance of these watercourses is rated as a Minor or Slightly Negative impact.

This option does not intercept nor discharge directly to the River Shannon and its route drains via the local surface water drains, that downstream are culverted through Carrick-on-Shannon, outfalling to the River Shannon both upstream and downstream of the existing River Shannon Bridge. Importantly the Black Option Corridor drainage enters the River Shannon via the local drains downstream of the Carrick-on-Shannon Public Water Supply abstraction and therefore will not impact this high important regional public water supply source. There are no hydroecological sites along this option nor any impacted downstream.

The route to the north of the Summer Hill Road passes through poor draining peat lands. Soft ground in the form of peat for a length of 430m is present to the northwest of Summerhill Road and alluvium at the eastern end for 105m, almost 45% of the route underlain by potentially soft soil, representing a Minor or Slightly Negative impact.

The overall assessment gives a Minor or Slightly Negative impact (PAG Score 3) for this option associated with minor or slightly negative impacts on watercourses, flooding and soft soils.

Stage 2 Hydrological Assessment- Option Corridors East of Drumsna Junction (Node J)

Yellow Option Corridor

Table 8.8.10.7 Stage 2 Hydrological Assessment of Yellow Option Corridor

Hydrological Attribute	Description	Impact
Floodplains and Flood risk Areas		
Floodplains	This option follows the existing road alignment and therefore avoids direct encroachment into the floodplain area of the River Shannon and the floodplain areas	There is no direct encroachment into floodplain areas associated with this proposed route and the impact is classified as Not Significant or Neutral (4).

Hydrological Attribute	Description	Impact
	surrounding the lakes at Gortinty Lough and Gortconnellan Lough	
Water courses		
River Shannon Channel	In this eastern section the River Shannon channel is not crossed and the route option avoids its floodplain being an on-line route. However construction works are within close proximity to the floodplain area and the river channel along this section and therefore there is a potential for construction runoff if not controlled and adequately treated to enter the River Shannon via the local drains and streams and via overland routes. The River Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment.	Given the scale of construction activities involved in relatively close proximity to the River Shannon and its floodplain area the construction impact on water quality in the River Shannon is classified as a Moderately Negative impact (2). Pollution from the operation stage via the road drainage outfalls is rated as Minor or Slightly Negative (3).
Minor Watercourses	1 small stream at Drishoge (0.9km^2 in catchment area). 1 small stream (Foxborough) (3.78km^2). 1 small Stream at Crickeen (0.5km^2). 1 large stream Gortconnellan Lough Stream (17.1km^2). Gortinty Stream (5.6km^2). 1 small stream at antfield (0.3km^2). 1 small tributary stream of the Cloonmulligan (c .25km^2). 14 small drains encountered along route.	Potential for flow, morphology and flooding local impacts at these streams associated with culvert upgrades and extensions along the upgraded road to meet OPW Section 50 requirements. The disturbance impact of culverting and locally realigning is rated as Minor or Slightly Negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local Minor or Slightly Negative impact (3). The impact on the local drains is classed at a Minor or Slightly Negative impact (3).
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is 12km upstream of eastern options and will not be impacted by the proposed route option (Neutral 4).	The impact rating on the Carrick-on-Shannon surface water abstraction is Not Significant or Neutral (4). The impact rating on the downstream Lough Forbes surface water abstraction is Moderately Negative (2) arising from a temporary

Hydrological Attribute	Description	Impact
	The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km downstream of Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	potential HGV accidental spillage risk with the attenuation and storm water treatment included in the design.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA).	There will be no direct impact on any designated sites by the proposed options between Drumsna Junction and Faulties. The only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent a Moderately Negative impact (2), given the distance and attenuation provided by the River Shannon. The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a Moderately Negative impact. The impact of a major HGV Spillage on the water quality of the SAC is of low risk, but given the extremely high importance attribute of this receptor the impact is assessed as a Moderately Negative impact. Some slight encroachment of EC105 will occur. There is likely to be local drainage effects on these sites from the proposed road construction and road embankment drainage which may result in very localized drying of such habitat immediately adjacent to the road embankment and associated toe drains. This represents a Minor or Slightly Negative impact (3).
Ecological Sites of Local Higher	The route option runs adjacent to ecological sites EC99 representing wet woodland and	

Hydrological Attribute	Description	Impact
	wet grassland at Derryoughter and EC105 lake and associated wetland and wet woodland at Gortinty Lough. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	The potential construction impact on water quality within these sites is considered to represent a Minor or Slightly Negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the entire road mainline length 1.58km is in quaternary identified as Cut over peak and 0.414km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 20.2% of the route in section B. This is rated as representing a Minor or Slightly Negative impact (3).

Green Option Corridor

Table 8.8.10.8 Stage 2 Hydrological Assessment of Green Option Corridor

Hydrological attributes	Description	Impact
Floodplains and Flood Risk Areas		
Floodplains	This Option follows the existing road alignment and therefore avoids direct encroachment into	There is no direct encroachment into floodplain areas associated with this

Hydrological attributes	Description	Impact
	the floodplain area of the River Shannon and the floodplain areas surrounding the lakes at Gortinty Lough and Gortconnellan Lough.	proposed route and the impact is classified as Not Significant or Neutral (4).
Water courses		
River Shannon Channel	In this eastern section the River Shannon channel is not crossed and the route option avoids its floodplain being an on-line route. However construction works are within close proximity to the floodplain area and the river channel along this section and therefore there is a potential for construction runoff if not controlled and adequately treated to enter the River Shannon via the local drains and streams and via overland routes. The River Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment.	Given the scale of construction activities involved in relatively close proximity to the River Shannon and its floodplain area the construction impact on water quality in the River Shannon is classified as a Moderately Negative impact (2). Pollution from the operation stage via the road drainage outfalls is rated as Minor or Slightly Negative (3).
Minor Watercourses	1 small stream at Drishoge (0.9km^2 in catchment area) 1 small stream Foxborough (3.78km^2). 1 small Stream at Crickeen (0.5km^2). 1 large stream Gortconnellan Lough Stream (17.1km^2). Gortinty Stream (5.6km^2). 1 small stream at Antfield (0.3km^2). 1 small tributary stream of the Cloonmulligan (c .25km^2). 14 small drains encountered along route.	Potential for flow, morphology and flooding local impacts at these streams associated with culvert upgrades and extensions along the upgraded road to meet OPW Section 50 requirements. The disturbance impact of culverting and locally realigning is rated as Minor or Slightly Negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a local Minor or Slightly Negative impact (3). The impact on the local drains is classed at a Minor or Slightly Negative impact (3).

Hydrological attributes	Description	Impact
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is 12km upstream of the eastern options and will not be impacted by the proposed option. The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km from Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	The impact rating on the Carrick-on-Shannon surface water abstraction is **Neutral** (4). The impact rating on the downstream Lough Forbes surface water abstraction is Moderately Negative (2) arising from a potential HGV accidental spillage risk with the attenuation and storm water treatment included in the design.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA).	There will be no direct impact on any designated sites by the proposed route option between Drumsna Junction and Faulties. The only indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent a Moderately Negative impact (2), given the distance and attenuation provided by the River Shannon.
Ecological Sites of Local Higher	The route option runs adjacent to ecological sites EC99 representing wet woodland and wet grassland at Derryoughter and EC105 lake and associated wetland and wet woodland at Gortinty Lough. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading	The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a Moderately Negative impact. The impact of a major HGV Spillage on the water quality of the SAC is of low risk, but given the extremely high importance attribute of this receptor the impact is assessed as a Moderately Negative impact. Some slight encroachment of EC105 will occur. There is likely to be local drainage

Hydrological attributes	Description	Impact
	by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	effects on these sites from the proposed road construction and road embankment drainage which may result in very localized drying of such habitat immediately adjacent to the road embankment and associated toe drains. This represents a Minor or Slightly Negative impact (3). The potential construction impact on water quality within these sites is considered to represent a Minor or Slightly Negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the entire road mainline length 1.601km is in quaternary identified as Cut over peak and 0.414km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 20.6% of the route. This is rated as representing a Minor or Slightly Negative impact (3).

Purple East Option Corridor

Table 8.8.10.9 Stage 2 Hydrological Assessment of Purple East Option Corridor

Hydrological Attributes	Description	Impact
Floodplains and Flood risk Areas		
Floodplains	This option follows the existing road alignment but has a much wider footprint associated with it being a dual carriageway. The option slightly encroaches the River Shannon Floodplain at Tully and again to the south of Gortconnellan Lough and encroaches the northeastern flood area of Gortinty Lough.	The Encroachment of the River Shannon Floodplain and the floodplain of Gortinty Lough by this option represents a Minor or Slightly Negative impact on the flooding and the hydrological regime (3).

Hydrological Attributes	Description	Impact
Water courses		
River Shannon Channel	In this eastern section the River Shannon channel is not crossed and the route option avoids its floodplain being an on-line route. However construction works are within close proximity to the floodplain area and the river channel along this section and therefore there is a potential for construction runoff if not controlled and adequately treated to enter the River Shannon via the local drains and streams and via overland routes. The River Shannon provides significant dilution throughout the year due to its large upstream lakes and contributing catchment.	Given the scale of construction activities involved in relatively close proximity to the River Shannon and its floodplain area the construction impact on water quality in the River Shannon is classified as a Moderately Negative impact (2). Pollution from the operation stage via the road drainage outfalls is rated as Minor or Slightly Negative (3).
Minor Watercourses	1 small stream at Drishoge (0.9km^2 in catchment area). 1 small stream Foxborough (3.78km^2). 1 small Stream at Crickeen (0.5km^2). 1 large stream Gortconnellan Lough Stream (17.1km^2). Gortinty Stream (5.6km^2). 1 small stream at Antfield (0.3km^2). 1 small tributary stream of the Cloonmulligan (c .25km^2). 14 small drains encountered along route.	Potential for flow, morphology and flooding local impacts at these streams associated with culvert upgrades and extensions along the upgraded road to meet OPW Section 50 requirements. The disturbance impact of culverting and locally realigning is rated as a Minor or Slightly Negative impact (3). All of the classified watercourses within the study area are identified by the EPA under the EU water framework directive to be at Risk of deterioration in their water quality status. The potential impact on the water quality from a proposed road development construction and operation within the corridor on these watercourses is rated as a Minor or Slightly Negative impact (3). The impact on the local drains is classed at a Minor or Slightly Negative impact (3).
Surface Water Resources		
Public Water Supply Abstractions	The Carrick-on-Shannon Public Water Supply Abstraction location is many 12km upstream of Tully options and	The impact rating on the Carrick-on-Shannon surface water abstraction is Not Significant or Neutral (4).

Hydrological Attributes	Description	Impact
	will not be impacted by the proposed route option. The nearest public water abstraction point downstream is the Longford water supply scheme which abstracts water from Lough Forbes. This Lough is sufficiently downstream, almost 12km downstream of end of the scheme near Faulties and the supply is fully treated and disinfected and therefore will not be significantly impact by the proposed route option either during construction or operation phases.	The impact rating on the downstream Lough Forbes surface water abstraction is Moderately Negative (2) arising from a potential HGV accidental spillage risk with the attenuation and storm water treatment included in the design.
Hydro-Ecology and Designated Sites		
Hydro-Ecological Receptors SAC, SPA, NHA and pNHA	There is no direct encroachment by the route option of any designated site (SAC, pNHA, NHA or SPA).	There will be no direct impact on any designated sites by the proposed route option between Drumsna Junction and Faulties. The indirect impacts are likely to be from sediment laden construction runoff entering the River Shannon system and eventually reaching the downstream sites of Lough Boderg, Lough Bofin pNHA and Lough Forbes Complex SAC. The potential construction impact on water quality within downstream SAC is considered to represent a Moderately Negative impact (2) given the distance and attenuation provided by the River Shannon. The impact of the road drainage outfalls on the water quality of the downstream SAC is considered to represents a Moderately Negative impact. The impact of a major HGV Spillage on the water quality of the SAC is of low risk, but given the extremely high importance attribute of this receptor the impact is assessed as a Moderately Negative impact.
Ecological Sites of Local Higher	The route option runs adjacent to ecological sites EC99 representing wet woodland and wet grassland at Derryoughter and EC105 lake and associated	Some slight encroachment of EC105 will occur. There is likely to be local drainage effects on these sites from the proposed road construction and road embankment drainage which may result in very localized drying of such habitat immediately adjacent to the road embankment and

Hydrological Attributes	Description	Impact
	wetland and wet woodland at Gortinty Lough. The potential impact on hydrology of these habitats is potential drainage effects by the proposed road development involving collector and interceptor ditches, attenuation ponds and outfalls and loading by the road embankment on underlying saturated silt, peaty and alluvial soils resulting in increased drainage flows through displacement of pore water. Sediment laden construction runoff reaching such sites and settling out.	associated toe drains. This represents a Minor or Slightly Negative impact (3).
Soft Sediment and Poor Ground Conditions		
Soft sediments and poor ground conditions	Soft sediments of peat and alluvium can give rise to construction difficulties requiring either pilling or removal of such sediments with the potential for construction runoff impacts and deposition of unsuitable construction material. Of the entire road mainline length 1.35km is in quaternary identified as Cut over peak and 0.477km as alluvium. The soft sediment deposits are primarily located in the floodplain areas along this option with the majority of the soft sediment associated with the Shannon crossing.	Soft sediments identified from the GSI Quaternary mapping represents 19.7% of the route. This is rated as representing a Minor or Slightly Negative impact (3).

Table 8.8.10.10 Stage 2 Hydrology Summary Assessment Matrix of Options West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Floodplains and Flood Risk Areas	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative		Minor or Slightly Negative
River Shannon Watercourse	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative		Not Significant or Neutral
Minor Watercourses	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
Surface Water Resources	Moderately Negative	Moderately Negative	Major or Highly Negative	Major or Highly Negative		Not Significant or Neutral
Hydro-ecology and designated sites	Minor or Slightly Negative	Minor or Slightly Negative	Moderately Negative	Moderately Negative		Moderately Negative
Soft Sediments and Poor Ground Conditions	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative		Minor or Slightly Negative
Scoring						
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**		**Minor** or **Slightly Negative**
Score / Impact Level	**2**	**2**	**1**	**1**		**3**
Preference	**Intermediate**	**Preferred**	**Least Preferred**	**Least Preferred**		**N/A**

Table 8.8.10.11 Stage 2 Hydrology Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Floodplains and Flood Risk Areas	Not Significant or Neutral	Not Significant or Neutral	Minor or Slightly Negative
River Shannon Watercourse	Moderately Negative	Moderately Negative	Moderately Negative
Minor Watercourses	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative
Surface Water Resources	Moderately Negative	Moderately Negative	Moderately Negative
Hydro-ecology and designated sites	Moderately Negative	Moderately Negative	Moderately Negative
Soft Sediments and Poor Ground Conditions	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative
Scoring			
Qualitative Assessment	**Moderately Negative**	**Moderately Negative**	**Moderately Negative**
Score / Impact Level	**2**	**2**	**2**
Preference	**Preferred**	**Preferred**	**Intermediate**

8.8.10.5 Summary

Black Option Corridor Summary Assessment

The Black Option representing 1.2km Urban Street Improvement will have an overall Minor or Slightly Negative impact (PAG Score 3) on hydrology in terms of flooding and flood risk and minor or slightly negative impact in respect to watercourses and soft ground. It has been assessed as a stand-alone option and is not compared with other options in the section.

Summary Comparative Assessment of Option Corridors to the West of Drumsna Junction (Node J)

The four Option Corridors to the west of Drumsna Junction (Node J) are similar in terms of their overall hydrological impact quantitative rating of Major or Highly Negative (1) for the two upstream River Shannon Crossing options and Moderately Negative (2) for the two downstream Shannon Crossings. The key criteria that affect the differences between the northern options (Dark Green and Purple West Option Corridors) and the southern options (Orange and Cyan Option Corridors) preference is impact on flood risk, primarily associated with the Shannon floodplain and the impact on the Carrick-on-Shannon public water supply abstraction source from the River Shannon. The abstraction location is 1km upstream of the existing Carrick-on-Shannon Bridge and therefore driving the decision between crossing the River Shannon upstream or downstream of Carrick-on-Shannon. All crossings will involve a major bridge structure and local interference with the floodplain and potentially encroaching the river channel and banks at the crossing point. The crossings of the River Shannon both upstream and downstream will involve infilling and loss of floodplain area which will potentially impact on the Carrick-on-Shannon flood risk area. The downstream crossings, Orange and Cyan Options Corridor, through generation of bridge afflux will potentially impact the Carrick-on-Shannon flood risk area with a greater impact than the upstream crossings for Purple and Dark Green Option Corridors. However, given the “Very High” attribute status of the River Shannon floodplain and the Carrick-on-Shannon flood risk area the impacts of all upstream and downstream options and designs are quantified as a major or highly negative impact. From a flooding and flood risk only perspective the Preferred Option would be a crossing upstream with Dark Green and the Purple ranked equally in this regard. In respect to Surface Water Resources and the impact on the Carrick-on-Shannon drinking water abstraction and potential public health concerns, the upstream crossing options are Least Preferred as there is a much higher risk of water quality impact on the source both during construction and operation phases than the downstream crossing options which by virtue of being located well downstream represent minimal risk.

The Cyan and Orange Option Corridors can only potentially impact this water supply source via the short section of route at their respective western tie-in locations, that drain to the River Shannon via the small tributaries that enter the River Shannon. These enter the River Shannon on the opposite bank, upstream of the abstraction point, and therefore the impact assessed as moderately negative but significantly less impacting than the upstream options. Therefore, from a hydrological impact the preference is for a downstream crossing option with the

Orange Option Corridor being Preferred over the Cyan Option Corridor as the Orange Option Corridor has a smaller impact on the Knockananima Stream flood risk area and only a 600m corridor length draining the Shannon upstream of the abstraction point.

Summary Comparative Assessment of Option Corridors to the West of Drumsna Junction (Node J)

For the Eastern Section there are three Option Corridors -Yellow, Green and Purple East. The overall impact of these options is a Moderately Negative (PAG Score 2) for the three options. The Yellow and Green option being more on-line single carriageway and having a lesser footprint are considered equally the Preferred options with the Purple East given an Intermediate score.

Final Summary

There are no identified profound impacts associated with any of the Stage 2 Option Designs and the potential impact to the Carrick-on-Shannon public water supply abstraction source can be reduced through mitigation both at construction and operation phases. The impact on flooding caused by the River Shannon bridge crossing cannot be fully mitigated but can be reduced through the design phase to ensure that flood conveyance is not significantly impeded by any potential bridge structures required. This also applies to the various watercourse crossings in respect to provision of full spanning structures and the choice between culverts and bottomless structures.

8.8.11 Hydrogeology

8.8.11.1 Introduction

This section details the Stage 2 Assessment of the Alternatives and Options described in Section 8.2 with respect to the Hydrogeology constraints identified in Section 4.14 Hydrogeology of this report. The Stage 2 alternatives and the Hydrogeology constraints are presented in Figures 8.8.11.1.0 to 8.8.11.3.5. The alternatives are referenced as Stage 2 Cycling and Walking Proposals, Stage 2 Public Transport Proposals and Stage 2 Demand Reduction Proposals.

Section 8.8.11.2 outlines the methodology that was used to carry out the assessment of both alternatives and options, section 8.8.11.3 details the Stage 2 Assessment of alternatives and Section 8.8.11.4 details the Stage 2 Assessment of options. A summary is presented in section 8.8.11.5.

8.8.11.2 Methodology

The assessment methodology at Stage 2 is congruent with the Stage 1 methodologies, which for the alternatives is contained in Section 6.5.11 and for the options is contained in Section 7.5.11.

8.8.11.3 Hydrogeology Stage 2 Assessment of Alternatives

The components of Alternative A and Alternative B include superficial works in urban areas and do not present a significant impact on any hydrogeological receptors.

Alternative C may include the creation of Park and Stride sites on existing brownfield sites. This has the potential to present a temporary impact on a small proportion of the underlying regionally important aquifer. The regionally important aquifer is considered of high importance and therefore the potential impact is considered to be imperceptible.

Table 8.8.11.1 Stage 2 Hydrogeology Assessment of Alternatives

Assessment Criteria	**Alternative A: Active Travel**	**Alternative B: Public Transport Improvements**	**Alternative C: Demand Management**
Aquifer classification (groundwater quality)	Imperceptible impact	Imperceptible impact	Imperceptible impact
Qualitative Assessment	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**	**Not Significant** or **Neutral**
Score / Impact Level	**4**	**4**	**4**

8.8.11.4 Hydrogeology Stage 2 Assessment of Options

Karst

There are no significant karst features identified along any of the Option Corridors. Some karst spring type features were identified during the site walkover, however these were relatively minor drainage features and as such are not assigned a feature importance. Therefore, with regard to karst landforms and features all the corridors are considered Not Sinificant or Neutral.

Aquifer Classification and Groundwater Bodies

The aquifers identified in the constraints study are presented in Section 4.14 of the Constraints Study. The potential impact on the aquifer along each corridor is a combination of the type and extent of the aquifer, aquifer vulnerability and presence of deep cuttings (removal of soil and/or rock to road design elevations) along each corridor.

The corridors west of Node J are underlain by Regionally Important Aquifer where the bedrock is karstified and dominated by conduit flow (Rkc). East of Node J the area is underlain by a Regionally Important Aquifer, Locally Important Aquifer where the bedrock is generally moderately productive (Lm) and Poor Aquifer where the bedrock is generally unproductive only in local zones (Pl).

In this assessment the aquifer extent and type for the corridors are compared by the depth of cutting in each aquifer type. Cuts between 5 and 10m in depth are considered to be a permanent impact on a small proportion of the aquifer. Cuts greater than 10m in depth are considered to be a permanent impact on a significant proportion of the aquifer.

Roads constructed in deep cuttings can impact on the groundwater by causing dewatering of the groundwater in the vicinity. The deeper the cutting the more significant and more extensive the impact. In addition, the removal of the soil and bedrock in the excavation will increase the vulnerability of the aquifer at that location, as vulnerability is largely dependent on the depth and permeability of subsoil above the aquifer.

The assessment considers the increase in Extreme vulnerability areas as a result of development, and the total extent of the route option underlain by Extreme vulnerability aquifers.

The results of the assessment on the aquifers options west of Node J are summarised in Table 8.8.11.2 and results for the options east of Node J are summarised in Table 8.8.11.3.

West of Node J the Orange Option is associated with the least cuttings (100m) between 5m and 10m in depth and includes no cuttings >10m in depth. The Cyan Option includes cuttings >10m in depth, however, contains less cutting (310m) than the Purple and Dark Green Options. The Cyan Option also has a greater increase in extreme vulnerability compared to the Orange Option, but less than the Purple or Dark Green Options. The Dark Green and Purple West Options have the greatest length of cuttings >10m in depth, 540m and 600m respectively. These options also have the highest increase in extreme vulnerability.

East of Node J the Green Option does not have any cuttings >5m deep. The Purple East Option has more cutting between 5m and 10m in depth (280m) in Locally Important Aquifer (Lm) compared to the Yellow Option (50m). The Yellow Option has a small increase in extreme vulnerability in the Lm aquifer (30m), whereas there is no increase in extreme vulnerability associated with the Purple East Option.

Table 8.8.11.2 Aquifer Assessment Summary for the Options West of Drumsna Junction (Node J)

Criteria		Cyan Option Corridor	Orange Option Corridor	Purple West Option Corridor	Dark Green Option Corridor		Black Option Corridor
Assessment of impact on Aquifer classification	Aquifer Classification	Rkc	Rkc	Rkc	Rkc		Rkc
	Attribute importance	High	High	High	High		High
	Total length of cut 5 to 10m (m)	310	100	680	870		140
	Total length of cut >10m (m)	130	0	600	540		0
Assessment of the increase in aquifer vulnerability	Total length of extreme (E), existing conditions (m)	5,200	3,810	1,870	1,260		0
	Total length of extreme (E), proposed design conditions (m)	5,350	3,880	2,100	1,880		0
	Increase in extreme (E) vulnerability (m)	150	70	230	620		0
Assessment Summary	Significance Rating (TII Guidelines[29])	Significant	Moderate	Significant	Significant		Moderate
	Equivalent PAG (Description)	Major or Highly Negative	Moderately Negative	Major or Highly Negative	Major or Highly Negative		Moderately Negative
	Equivalent PAG (Value)	1	2	1	1		2

[29] TII (2009) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available from: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

Table 8.8.11.3 Aquifer Assessment Summary for the Options East of Drumsna Junction (Node J)

Criteria		Purple East Option Corridor			Green Option Corridor			Yellow Option Corridor		
Assessment of impact on Aquifer classification	Aquifer Classification	Rkc	Lm	Pl	Rkc	Lm	Pl	Rkc	Lm	Pl
	Attribute importance	High	Medium	Low	High	Medium	Low	High	Medium	Low
	Total length of cut 5 to 10m (m)	0	280	140	0	0	0	0	50	240
	Total length of cut >10m (m)	0	0	0	0	0	0	0	0	0
Assessment of the increase in aquifer vulnerability	Total length of extreme (E), existing conditions (m)	620	1620	910	610	1420	1060	610	1390	1020
	Total length of extreme (E), proposed design conditions (m)	620	1620	910	610	1420	1060	610	1420	1020
	Increase in extreme (E) vulnerability	0	0	0	0	0	0	0	30	0
Assessment Summary	Significance Rating (TII Guidelines[29])	Imperceptible	Slight	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Slight	Imperceptible
	Equivalent PAG (Description)	Not Significant or Neutral	Minor or Slightly Negative	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral	Not Significant or Neutral	Minor or Slightly Negative	Not Significant or Neutral
	Equivalent PAG (Value)	4	3	4	4	4	4	4	3	4

Groundwater Resources

Groundwater sources are not considered in the option comparison assessment as there are no high yield water supply springs and wells i.e. public water supplies or group water scheme supplies along the corridors. No Source Protection Zones associated with public or group groundwater supply schemes are located along the Option Corridors.

The majority of groundwater abstraction wells identified within the corridors are of low importance. The TII Guidelines suggests that little or no weighting should be given to the number of such wells along each corridor and/or their distance from the centre line when assessing relative impacts. In the case of low yielding water supply wells, the ranking of the level of potential impact is unnecessary, as wells will either have to be replaced or removed.

Groundwater Contamination

There are no discharge and emissions licenses facilities identified within any of the option corridors.

A number of abandoned and historical quarries and pits have been identified within the option corridors west of Node J. However, the potential for the contamination of groundwater from these quarries is expected to be insignificant and therefore with regard to groundwater contamination all the corridors are considered neutral.

Groundwater Flooding

There are no areas of historic groundwater flooding within any of the option corridors. Therefore, with regard to groundwater flooding all the corridors are considered neutral.

Hydro-ecology

Groundwater dependent habitats which are present within the assessment study area of the corridors comprise Lough Eidin proposed Natural Heritage Area (pNHA) and undesignated areas of Annex I Habitat including Alluvial Forests [*91E0], Transition Mires and Quaking Bogs [7140] and Bog Woodland [*91D0]. These undesignated areas are labelled “ECxx” with the xx being a numeral for each site. Biodiversity impacts on groundwater dependent habitats are assessed as part of the Biodiversity Option Corridors Assessment. The hydrogeological assessment of groundwater dependent habitats focuses on the groundwater components of the features i.e. changes to groundwater level which may impact recharge to the feature, or changes to groundwater quality.

The proximity of the habitat to the corridor is considered with regard to increased pollution risk from untreated surface water run-off or accidental spillage of fuel from the road affecting groundwater quality. However, as per Section 4.4 of the NRA Guidelines, the assessment has considered the application of standard mitigation and best practice during construction is unambiguous and success is highly likely. Therefore, it is assumed that standard drainage measures will be put in place to reduce the risk of run-off from the road affecting groundwater quality, reducing this risk.

Based on the potential dewatering assumption noted for the Aquifer Classification and Groundwater Bodies assessment, the presence of dewatering associated with deep cuttings is assessed in conjunction with the options located up or down gradient of the habitat for the potential impact to groundwater level.

If part of the habitat may be removed by a design option, impact to the general groundwater regime in this area is considered. Note: the area within the fenceline of the design option has been used to establish if an option may directly impact the habitat.

Deep cuttings and habitat removal are therefore considered the primary potential impact to groundwater dependent habitats and the local groundwater regime. Where the groundwater dependent habitat is located within the fenceline of the Option Corridor this is considered to be a permanent impact on a small proportion. Where there is a cutting of greater than 5m within 100m of the habitat this is considered to be a permanent impact on a significant proportion.

A conservative approach was taken regarding these habitats in advance of detailed survey and groundwater monitoring. These features have been assessed as if they are dependent on surface water and groundwater, refer to Section 8.8.10 for the Stage 2 Preliminary Options Assessment for Hydrology. The hydrogeological assessment of these habitats focuses on the groundwater components of the features i.e. changes to groundwater level which may impact recharge to the feature, or changes to groundwater quality.

Lough Eidin pNHA

Lough Eidin pNHA contains extensive areas of wet grasslands which flood in the winter. The pNHA is of national importance and classified to be of Very High importance.

Lough Eidin pNHA is located within the Cyan, Purple and Dark Green Option Corridors. The potential Annex I Alluvial Woodland [*91E0] is located within the Purple and Grey (Dark Green Corridor) Design Options. There are no cuttings greater than 5m associated with either Option and located within 100m of the Lough Eidin pNHA. Therefore, the impact of both the Purple and Grey (Dark Green) Options is considered to be a permanent impact on a small proportion of the attribute.

Annex I habitats

All the Priority Annex I Habitat [91E0*] Alluvial Woodlands identified within the study area are valued by the Project Biodiversity Specialist to be on a national scale. According to the NRA guidelines groundwater dependant habitats valued on a national scale are considered to be of Very High importance. There are pockets of alluvial woodland across the study area. For the purpose of this assessment, they are considered as one attribute as they make up a relatively small proportion of the national habitat.

A summary of the habitats and the impact due to the proposed Option Corridors is provided in Table 8.8.11.4. Refer to Figures 7.5.9.1.0 to 7.5.9.1.5. The potential hydro-ecology impact by the option corridors west of Node J are presented in Table 8.8.11.5. There are no hydro-ecology sites east of Node J and the impact on hydro-

ecology from the option corridors is considered to be neutral for all three Option Corridors.

Table 8.8.11.4 Hydrogeological Assessment of the Impact to Annex 1 Habitats

Habitat ID	Description	Corridor Reference	Impact	Justification for Impact
EC16	Broadleaved / wet woodland / scrub, marsh and wet grassland on the banks of River Shannon with areas of confirmed and potential Alluvial Woodland [*91E0] habitat.	Purple West and Dark Green Option Corridors.	A permanent impact on a small proportion of the attribute.	The habitat is located more than 100m from proposed cuts >5m deep.
EC28	Potential Alluvial Woodland [*91E0] identified by the Project Biodiversity Specialist.	Purple West and Dark Green Option Corridors.	A permanent impact on a significant proportion of attribute.	Both the Purple and Grey Design Options include cuttings >5m deep located within 20m of the habitat.
EC50	Marsh, wet grassland and scrub with the potential to develop into Alluvial Woodland [*91E0] habitat in the short to medium term.	Cyan and Orange Option Corridors.	A permanent impact on a small proportion of the attribute.	The habitat is located more than 100m from proposed cuts >5m deep.
EC51	Broadleaved / wet woodland, scrub and wet grassland with potential for peatland habitats as well as Alluvial Woodland [*91E0].	Cyan and Orange Option Corridors.	A permanent impact on a small proportion of the attribute.	The habitat is located more than 100m from proposed cuts >5m deep.
EC52	Broadleaved / wet woodland, scrub and wet grassland with potential for peatland habitats as well as Alluvial Woodland [*91E0].	Cyan and Orange Option Corridors.	A permanent impact on a small proportion of the attribute.	The habitat is located more than 100m from proposed cuts >5m deep.
EC88	Broadleaved and conifer woodland along the River Shannon with potential for Alluvial Woodland [*91E0].	Cyan, Orange, Purple West and Dark Green Option Corridors.	A permanent impact on a small proportion of the attribute.	The habitat is located more than 100m from proposed cuts >5m deep.

The assessed impacts to groundwater dependent habitats from each Option Corridor are summarised in Table 8.8.11.5.

Table 8.8.11.5 Hydro-ecology Assessment for the Options West of Drumsna Junction (Node J)

Option	Biodiversity features dependent on water	Attribute Importance	Potential impact: Temporary/permanent Impact on 'X' proportion of attribute (from Table 1.2) Box 4.4[29]	Box 4.4[29] Impact level	PAG qualitative ranking	PAG Value
Cyan Option Corridor (Pink Design Option)	Alluvial Woodlands [*91E0] habitat	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
Orange Option Corridor	Alluvial Woodlands [*91E0] habitat	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
Purple West Option Corridor	Lough Eidin pNHA	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
	Alluvial Woodlands [*91E0] habitat	Very High	Significant (Permanent)	Profound	Major or Highly Negative	1
Dark Green Option Corridor (Grey Deign Option)	Lough Eidin pNHA	Very High	Small (Permanent)	Significant	Major or Highly Negative	1
	Alluvial Woodlands [*91E0] habitat	Very High	Significant (Permanent)	Profound	Major or Highly Negative	1
Black Option Corridor	No groundwater dependant habitats within the Black Option Corridor	N/A	N/A	N/A	Not Significant or Neutral	4

8.8.11.5 Summary

All three alternatives were given a PAG Score of Not Significant or Neutral (4) in the assessment. Based on this, the expected overall impact on hydrogeological constraints is likely to be insignificant for the alternatives presented for this project.

All of the option corridors have been assessed for the hydrogeological constraints identified within each option corridor.

There are no karst features, sources of groundwater contamination or records of historical groundwater flooding identified within the option corridors. There are also no groundwater sources or groundwater abstractions which are considered greater than low importance within the option corridors. Therefore, these features are all considered neutral when comparing the option corridors.

The assessment is based on the impact to the aquifers and the impact on the groundwater dependant habitats/hydro-ecology.

Comparison Among Options West of Node J

West of Node J the Orange Option presents the Preferred option as it is associated with the least potential impact on hydro-ecology and the underlying aquifers. There are fewer large cuttings associated with the Orange Option Corridor compared to the other options and no significant cuttings within close proximity to groundwater dependant habitats.

The Cyan Option Corridor is the Intermediate option as it has deeper cuttings than the Orange Option Corridor and a greater increase in extreme vulnerability.

The Purple and Dark Green Option Corridors are Least Preferred as they are associated with the greatest length of deep cuttings and largest increase in extreme vulnerability. Both options also have significant cuts within relatively close proximity to alluvial woodland.

A summary of the assessment west of Node J is presented in Table 8.8.11.6.

Comparison among Options East of Node J

East of Node J there is little difference between the Purple, Green and Yellow Options. There are no potential groundwater dependant habitats east of Node J.

The Green Option is the Preferred option as it presents the least potential impact on the underlying aquifers as it is not associated with any cuttings greater than 5m.

The Yellow and Purple East Options are associated with cuttings between 5m and 10m in depth. Although the Yellow Option includes a very small increase in extreme vulnerability of an aquifer of medium importance, the Yellow and Purple East Option Corridors are considered comparable in their impact on hydrogeological receptors.

A summary of the assessment east of Node J is presented in Table 8.8.11.7.

Table 8.8.11.6 Hydrogeology Summary Assessment Matrix West of Drumsna Junction (Node J)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Assessment Criteria						
Aquifer Classification	Major or Highly Negative: Relatively moderate length of deep cuttings in high importance aquifer Small increase in extreme vulnerability	Moderately Negative: Relatively short length of deep cuttings in high importance aquifer and none greater than 10m deep Small increase in extreme vulnerability	Major or Highly Negative: Relatively long length of deep cuttings in high importance aquifer Relatively moderate increase in extreme vulnerability	Major or Highly Negative: Relatively long length of deep cuttings in high importance aquifer Relatively large increase in extreme vulnerability		Moderately Negative: Relatively small length of deep cuttings in high importance aquifer and none greater than 10m deep No increase in extreme vulnerability
Hydro-ecology	Major or Highly Negative: 1 No. habitat of national importance	Major or Highly Negative: 1 No. habitat of national importance	Major or Highly Negative: 2 No. habitats of national importance Cutting >5m deep located within 20m of Alluvial Woodlands [*91E0] habitat	Major or Highly Negative: 2 No. habitats of national importance Cutting >5m deep located within 20m of Alluvial Woodlands [*91E0] habitat		Not Significant or Neutral: No perceived impact on any groundwater dependant habitats
Scoring						
Qualitative Assessment	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**	**Major** or **Highly Negative**		**Moderately Negative**
Score / Impact Level	**1**	**1**	**1**	**1**		**2**
Preference	**Intermediate**	**Preferred**	**Least Preferred**	**Least Preferred**		**N/A**

Table 8.8.11.7 Hydrogeology Summary Assessment Matrix of Options East of Drumsna Junction (Node J)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Assessment Criteria			
Aquifer Classification	Minor or Slightly Negative: Relatively moderate length of deep cuttings in medium and low importance aquifers. No cuttings greater than 10m in depth. Small increase in extreme vulnerability	Not Significant or Neutral: No cuttings greater than 5m deep and no increase in extreme vulnerability	Minor or Slightly Negative: Relatively moderate length of deep cuttings in medium and low importance aquifers. No cuttings greater than 10m in depth. No increase in extreme vulnerability
Hydro-ecology	Not Significant or Neutral: No perceived impact on any groundwater dependant habitats	Not Significant or Neutral: No perceived impact on any groundwater dependant habitats	Not Significant or Neutral: No perceived impact on any groundwater dependant habitats
Scoring			
Qualitative Assessment	**Minor** or **Slightly Negative**	**Not Significant** or **Neutral**	**Minor** or **Slightly Negative**
Score / Impact Level	**3**	**4**	**3**
Preference	**Intermediate**	**Preferred**	**Intermediate**

8.8.12 Soils and Geology

8.8.12.1 Introduction

This section details the Stage 2 Assessment of the alternatives and options described in Section 8.2 with respect to the Soils and Geology constraints identified in Section 4.15 Soils and Geology of this report.

The Stage 2 Options in conjunction with the Soils and Geology constraints are presented on Figures 8.8.12.1.0 to 8.8.12.4.5.

The alternatives are referenced as Alternative A: Active Travel, Alternative B: Public Transport Improvements and Alternative C: Demand Management. In assessing the option corridors, consideration was given to the indicative fenceline for the design scenarios with the maximum potential impact within each option corridor as set out in Table 8.2.2. Therefore, the dual carriageway design scenarios are assessed in instances were dual and single carriageway design scenarios exist as options within a corridor. The options are referenced as the Stage 2 Black Design, Pink Design, Orange Design, Purple West Design, Grey Design, Stage 2 Yellow Design, Purple East and Green Design. These Stage 2 design scenarios and indicative fencelines will be assessed for each option corridor with respect to Soils and Geology.

Section 8.8.12.2 outlines the methodology that was used to carry out the Stage 2 Assessments of the alternatives and options, Section 8.8.12.3 details the assessment of the Stage 2 Alternatives while Section 8.8.12.4 details the assessment of the Stage 2 Options. A summary is presented in Section 8.8.12.5

8.8.12.2 Methodology

The Stage 2 Assessment has been prepared in accordance with the following guidance:

- Transport Infrastructure Ireland (TII) guidance, formally National Roads Authority (NRA) guidance, Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology on National Road Schemes (herein referred to as NRA Guidelines).[30]
- The Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.[31]

[30] National Roads Authority, 2009. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, Ireland: s.n. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

[31] Environmental Protection Agency, 2017. Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft. Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed: 17 February 2021]

- Transport Infrastructure Ireland (TII) guidance, formally National Roads Authority (NRA). Environmental Impact Assessment of National Road Schemes – a Practical Guide.[32]

The Stage 2 Assessment was informed by the Phase 2 Geotechnical Investigation which was designed to determine the vertical and horizontal extents of areas of potential soft ground, establish the strength of soils, determine the depth to bedrock as well as its strength, establish if there are karst features, establish the reusability of the soils and rock, determine the depth to groundwater, direction of groundwater flow, static groundwater levels and water quality and finally investigate areas of potential contaminated ground. The factual report for the Phase 2 GI is contained in Appendix A.8.8.12.1.

Methodology for the Assessment of Alternatives

The NRA Guidelines provide useful criteria for rating of the identified soils and geology constraints (herein referred to as Criteria) that are presented in Table 4.15.11 of the Soils and Geology Chapter of the Constraints Study and in subsequent sections of this report. Each criterion comprises of individual attributes which have been assigned an Importance using Box 4.1 of the NRA Guidelines. The Importance ratings are listed in Table 8.8.12.1.

Table 8.8.12.1 Rating of Significant Environmental Impacts (from Box 5.4 of NRA Guidelines)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

The ‘Magnitude of Impact’ assesses the impact that each alternative has on each criterion attribute, a ‘Magnitude of Impact’ is assigned using Box 5.1 of the NRA Guidelines as presented in the table above. The magnitude of the potential impacts that may arise for each criterion attribute have been assessed based on the information that is currently available.

A ‘Significance of Impact’ has then been determined from table above based on the ‘Importance of Attribute’ and the ‘Magnitude of Impact’. The terminology adopted in the assessment of the alternatives in Table 8.8.12.2 to describe the significance

[32] National Roads Authority, 2008. Environmental Impact Assessment of National Road Schemes – a Practical Guide. Available at: https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf

of an impact is that used in Box 5.4 of the NRA Guidelines as it is more succinct and more appropriate for the purposes of this assessment.

It should be noted that the alternatives are assessed separately in their own right as stand-alone entities and are not assessed against each other.

The negative potential impacts of the alternatives on Soils and Geology have been considered in the analysis. The positives were taken into account by reducing the overall negative impacts of individual attributes.

Once a significance of impact was determined for each associated criterion attribute for each alternative, an overall impact rating was assigned to that criterion using the TII Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 – Multi-Criteria Analysis (MCA)[2]. The scoring system to rate the alternatives as set out in PAG Unit 7.0 is listed in Table 8.1.1 of this report.

Methodology for the Assessment of Options

The NRA Guidelines were also utilised for the Stage 2 options assessment. The Importance ratings are listed in Table 8.8.12.1 above. The assessment differentiates among the options through the 'Magnitude of Impact'.

The 'Magnitude of Impact' assesses the impact that each option has on each criterion attribute, a 'Magnitude of Impact' is assigned using Box 5.1 of the NRA Guidelines as presented in Table 8.8.12.1. The magnitude of the potential impacts that may arise for each criterion attribute have been assessed based on the information that is currently available.

A 'Significance of Impact' has then been determined from the table below based on the 'Importance of Attribute' and the 'Magnitude of Impact'. The terminology adopted in the summary tables for the assessment of the options (i.e. Table 8.8.12.16 and Table 8.8.12.17) to describe the significance of an impact is that used in Box 5.4 of the NRA Guidelines as it is more succinct and more appropriate for the purposes of this assessment.

The negative and positive potential impacts of the options on Soils and Geology have been considered in the analysis. The positives were taken into account by reducing the overall negative impacts of individual attributes. Once a significance of impact was determined for each associated criterion attribute for each option, an overall impact rating was assigned to that criterion using the TII Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 - Multi-Criteria Analysis (MCA)[2]. The scoring system to rank the options is outlined in Section 2.4 of the TII PAG and listed above in the methodology for the assessment of alternatives.

Alternatives Assessment Criteria

A sensitivity analysis was not undertaken for the alternatives assessment as these have been assessed as stand-alone assessments in which the criteria identified as part of the constraints study is considered. The soils and geology criteria which have been considered as part of the Stage 2 Assessment of alternatives are as follows:

- Soil Deposits (well-drained soil types which are important for agriculture)

- Bedrock (Karst)
- Bedrock (Volcanic Geology)
- Landslide Susceptibility
- Contaminated Sites
- Economic Geology
- Geological Heritage
- Earthworks

Options Assessment Criteria

A preliminary sensitivity analysis of each criterion identified as part of the constraints study was undertaken as part of the Stage 1 Preliminary Options Assessment in Section 7.5.12.3. The purpose of this sensitivity analysis was to identify the criteria that are key differentiators between each of the Stage 1 Option Corridors.

A review of the key differentiators from Stage 1 has been undertaken by assessing these against the indicative fencelines for the Stage 2 option corridors; the outcome of this review is as follows:

- The contaminated sites criterion remains a key differentiator between the options west of Drumsna Junction when assessing this against the indicative fencelines for the Stage 2 option corridors. Therefore, contaminated sites will be assessed as part of the Stage 2 Assessment for the options west of Drumsna Junction.
- In Stage 1 the contaminated sites criterion was not identified as a key differentiator between the Stage 1 Option Corridors east of Drumsna Junction, however, when assessing contaminated sites against the indicative fencelines for the Stage 2 option corridors this criterion becomes a key differentiator and will be assessed as part of the Stage 2 Assessment for the options east of Drumsna Junction.
- The contaminated sites sub-criteria ‘licenced industrial sites’ has been removed from the assessment as the identified sites are not impacted by the indicative fencelines for the Stage 2 option corridors.
- The economic geology criterion is no longer a key differentiator between the options when assessing this against the indicative fencelines for the Stage 2 option corridors. Therefore, economic geology will not be assessed as part of the Stage 2 Assessment.

The criteria assessed for the indicative fencelines for the Stage 2 Option corridors west and east of Drumsna Junction are presented in Section 8.8.12.4.

Assumptions

The following assumptions have been adopted as part of the Stage 2 Assessment of the options:

1. A buffer zone outside of each of the options has not been adopted as the indicative fencelines for the Stage 2 option corridors are considered to be all-inclusive aside from the contaminated land criterion where a buffer zone of 50m was considered around historic industrial sites and historic pits and quarries point features.
2. All area measurements that are provided as part of the assessment have been rounded up to the nearest 1,000m^2.
3. Earthwork volumes (i.e. bulk cut/fill and surplus/deficit volumes) have been estimated based on the current carriageway designs produced as part of the Stage 2 options development with the following assumptions:
    a. Cut volumes are based on 1V:2H slopes
    b. Fill volumes are based on 1V:2H slopes
    c. Volumes are based on 100mm depth of topsoil on slopes and verges
    d. Volumes are based on a 700mm pavement box (250mm bituminous layer, 150mm Clause 804 layer and a 300mm capping layer), including on-line realignments. This pavement box arrangement would be broadly consistent with a subgrade California Bearing Ratio (CBR) of 4.0%
    e. Volumes reported are for mainline and major junctions and link roads only (i.e. volumes exclude excavated material for utilities, gantries, structures and minor side roads)
    f. Volumes do not consider topsoil removal, over-excavation in soil and rock, temporary works or construction compounds
    g. Volumes do not consider any earthwork requirements associated with the River Shannon Bridge crossing, including foundations and abutments
    h. Bulk earthwork volumes do not include for excavate and replace volumes associated with soft soils; soft soil excavate and replace volumes will be considered separately
    i. Bulk earthwork volumes do not include for excavate and replace volumes associated with made ground areas (Class U2); made ground has been considered separately under contaminated sites and has been assessed in terms of area (m^2)
    j. Volumes relate to in-situ volumes only, material bulking factors have not been applied
    k. Volumes have been rounded up to the nearest 1,000m^3
    l. In the calculation of the bulk earthwork volumes, it has been assumed that all existing pavement will not be reused and a new pavement will be constructed
    m. The earthwork volumes for the mainline Pink Design, Orange Design, Purple West Design and Grey Design are calculated for a dual carriageway. The indicative fenceline is based on a carriageway width in accordance with TII Road Type and Cross-Section Type 2 Dual Carriageway, Publication Number CC-SCD-00005, April 2017

n. The earthwork volumes for the mainline Stage 2 Green Design and Stage 2 Yellow Design to the east of Drumsna are calculated for a single carriageway. The indicative fenceline for the single carriageway width is in accordance with TII Road Type and Cross-Section Type 1 Single Carriageway, Publication Number CC-SCD-00001, December 2017

o. The earthwork volumes for the Stage 2 Black Design are calculated based on a total carriageway width of 18m

4. The new bridge crossing the River Shannon will not be constructed prior to commencement of earthworks. Hence opportunities to move material across the Shannon will be limited.
5. Cut material and material not suitable for reuse excavated on either side of the River Shannon will not be hauled from east to west of the River Shannon through Cortober and Carrick-on-Shannon until the new River Shannon Bridge crossing is constructed.
6. The haulage of acceptable earthworks materials from cuts to fills will be undertaken along the corridor length within the Lands Made Available (LMA).
7. Soft soils, if intersected by the options, are assumed to be treated by excavation and replacement.
8. The temporary side slopes which are used to provide stability during the excavation of soft soils are assumed to be 1V:2H for the downslope from the outside edge of verge and 1V:1H for the upslope from the toe of the downslope. This is presented in Plate 8.8.12.1.

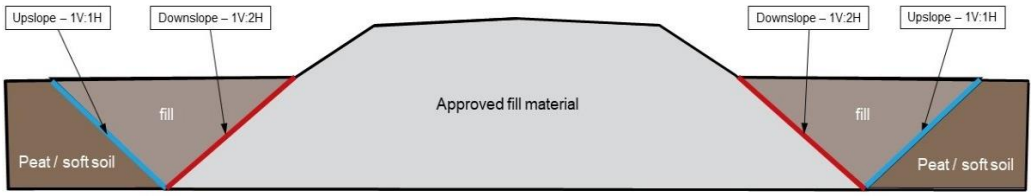

Plate 8.8.12.1 Assumed Soft Soil Excavate and Replace Section

9. The material from identified potentially contaminated sites (landfills, waste related sites, historic heavy industrial sites, historic quarries and pits and areas of made ground) are considered to require excavation and disposal to an appropriate licenced facility if intersected.
10. The horizontal extents of soft soil have been determined using the GSI Quaternary sediment mapping (refer to Figures 8.8.12.4.0 to 8.8.12.4.5), the existing ground investigation information and the 2021 Phase 2 ground investigation. The depths are based on available existing ground investigation and the 2021 Phase 2 ground investigation.
11. Soft soil volumes reported are for mainline, major junctions and link roads only (i.e. volumes exclude excavated material for utilities, gantries, structures and minor side roads).

12. The soft soil volumes have been calculated for a dual carriageway section for the mainline Pink Design, Orange Design, Purple West Design and Grey Design.
13. A factor of 0.2 has been applied to the soft soil volumes calculated for portions of design scenarios which include a dual carriageway which run along the existing N4, as approximately 80% of the dual carriageway width has already been constructed as part of the existing N4. It is assumed that the soft soil volumes underlying the existing N4 have been excavated and replaced as part of the construction of the existing road.
14. The soft soil volumes for portions of single carriageway design scenarios that run along the existing N4 (i.e. Green Design Option and Yellow Design Option) are assumed to have been excavated and replaced as part of the construction of the existing road, therefore, these soft soil volumes have not been reported.
15. The soft soil volumes have been calculated for the Stage 2 Black Design based on a total carriageway width of 18m.

8.8.12.3 Soils and Geology Stage 2 Alternatives Assessment

The assessment of the alternatives is presented in the table below. Based on the information available the alternatives will have a minor/slightly negative or not significant/neutral impact on soils and geology.

Table 8.8.12.2 Soils and Geology Assessment Matrix of Stage 2 Alternatives

Assessment Criteria	**ALTERNATIVE A** **ACTIVE TRAVEL**	**ALTERNATIVE B** **PUBLIC TRANSPORT**	**ALTERNATIVE C** **DEMAND MANAGEMENT**
Soil Deposits	The impact on soil types that are important for agriculture (well drained) is Imperceptible.	The impact on soil types that are important for agriculture (well drained) is Imperceptible.	The impact on soil types that are important for agriculture (well drained) is Imperceptible.
Bedrock (Karst)	Imperceptible impact on karst features.	Imperceptible impact on karst features.	Imperceptible impact on karst features.
Bedrock (Volcanic Geology)	Imperceptible impact on volcanic bedrock formations.	Imperceptible impact on volcanic bedrock formations.	Imperceptible impact on volcanic bedrock formations.
Landslide Susceptibility	Imperceptible.	Imperceptible.	Imperceptible.
Contaminated Sites	Potential new pedestrian / cycle links will have a Moderate / Slight impact on some historical quarry and pit sites and areas of made ground across Carrick-on-Shannon.	The improved parking facilities at Carrick-on-Shannon railway station will have a slight impact on an area of potential contamination.	The impact on contaminated sites is Imperceptible.
Economic Geology	As works are predominately throughout Carrick-on-Shannon / Cortober the impact on economic geology is Imperceptible.	The impact on economic geology is Imperceptible.	The impact on economic geology is Imperceptible.
Geological Heritage	The impact on Geological Heritage areas is Imperceptible.	The impact on Geological Heritage areas is Imperceptible.	The impact on Geological Heritage areas is Imperceptible.
Earthworks	The impact on earthworks is expected to be Imperceptible.	The impact on earthworks is expected to be Imperceptible.	The impact on earthworks expected to be Imperceptible.
Scoring			
Qualitative Assessment	Slight impact on identified contaminated sites. **Minor** or **Slightly Negative**	Minimal impact on 1 identified contaminated site. **Not Significant** or **Neutral**	No impact on Soils and Geology. **Not Significant** or **Neutral**
Score / Impact Level	**3**	**4**	**4**

8.8.12.4 Soils and Geology Stage 2 Options Assessment

The following criteria shall be brought forward to the Stage 2 Assessment to assist in determining the preferred solution for the N4 Carrick-on-Shannon to Dromod Project:

- ***Criteria considered for Options West of Drumsna Junction (Node J):***
  - Contaminated sites comprising of horizontal extent of made ground, landfills and waste related sites, historic industrial sites and historic quarries and pits.
  - Earthworks comprising of bulk cut and fill volumes, volume of unsuitable soft soils, volume of unsuitable glacial till cut volume and overall earthwork balance.
- ***Criteria considered for Options East of Drumsna Junction (Node J):***
  - Contaminated sites comprising of horizontal extent of made ground, landfills and waste related sites and historic quarries and pits.
  - Earthworks comprising of bulk cut and fill volumes, volume of unsuitable soft soils, volume of unsuitable glacial till cut volume and overall earthwork balance.

Plate 8.8.12.2 shows the assessment criteria and associated attributes that will form part of the MCA for the Stage 2 Assessment.

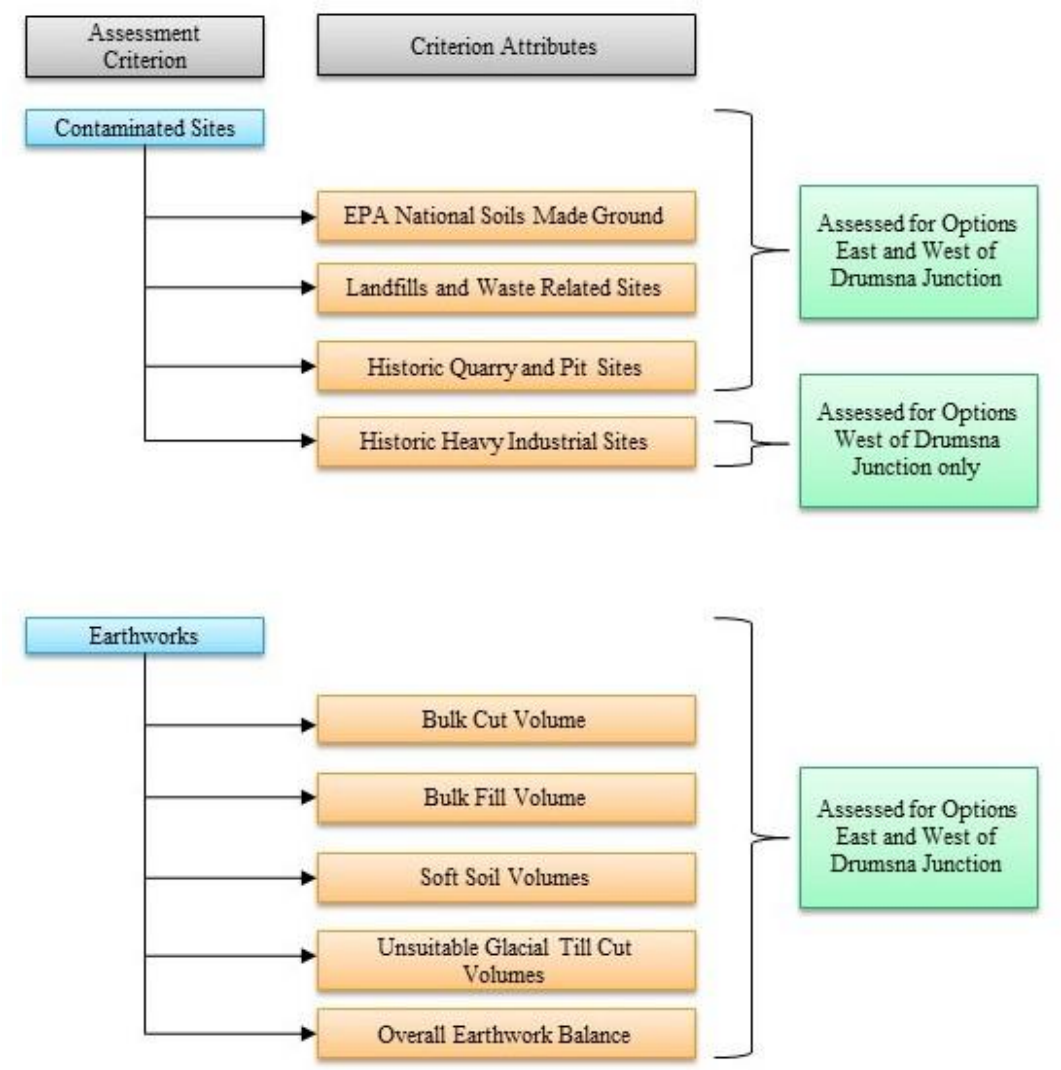

Plate 8.8.12.2 Assessment Criteria and Associated Attributes

Contaminated Sites

A number of sites of potential contamination have been identified through consultation with the relevant authorities and the Constraints Study. The history, contents and volumes of these areas are not known sufficiently to confirm and provide accurate quantities of contaminated material, a review of limited available ground investigation at these sites has been conducted and is included in the assessment. A conservative approach has been taken, considering the entire plan area identified as comprising potentially contaminated material, as this type of material would require excavation and disposal to an appropriate licenced facility if intersected.

Importance of Attribute

The made ground deposits recorded on the EPA National Soils mapping have been assessed as part of the contaminated sites assessment. Made ground deposits are considered to be of high importance due to the possible amount of material requiring excavation, its unsuitability for reuse and the material being potentially contaminated, which is considered to have a high significance on a local scale.

Landfills, waste related sites, historic heavy industrial sites, historic quarry and pit sites are considered to be of high importance as the nature of the material at these locations is unknown and these sites are considered to potentially contain material that will need to be disposed to an appropriate licenced facility, this is considered significant on a local scale.

Magnitude of Impact

The extent of the made ground for each option has been calculated by clipping the plan area of made ground in the EPA National Soils mapping with each of the indicative fencelines for the Stage 2 option corridors in GIS software ArcMap. The extents and impact of made ground are therefore based on area (m^2). The area of made ground intersected by the indicative fencelines options west and east of Drumsna Junction range between 13,000m^2 and 43,000m^2 and are all less than 5.0% of the total area within the indicative fencelines for the design scenarios within the option corridors. Therefore, the impact on made ground is considered to be small adverse.

The identified historic heavy industrial sites and historic quarry and pit sites have been assessed based on whether or not they are intersected by any of the indicative fencelines of the option corridors. Note that the historic heavy industrial sites and historic quarry and pit sites are available as point features, therefore, to account for the horizontal extents a 50m buffer has been applied to these sites in ArcMap as part of the assessment.

Of the seven historic heavy industrial sites identified in the Constraints Study, one will be impacted by the indicative fencelines of the Stage 2 option corridors:

- Carrick-on-Shannon Rail Station - located on the western side of Carrick-on-Shannon (E: 592993, N: 798776). This site is still in use as a train station and has been in use since the late 1800's to early 1900's and may contain contaminated ground. This site sits outside and immediately adjacent to the Stage 2 Pink and Orange Designs, however, any contamination present at this site may extend into the indicative fencelines of the option corridors, this is considered a small adverse impact.

The impact on the identified waste related sites has been undertaken by clipping the plan area of identified waste related sites within each of the indicative fencelines of the option corridors in GIS software ArcMap. The extents and impact on identified waste related sites are therefore based on area (m^2).

Of the 17 landfill or waste related sites identified in the Constraints Study, five are impacted by the indicative fencelines of the option corridors:

- Two old permit sites in the Cloongownagh Townland between Hughestown and Cuiltyconeen along the existing N4, approximately 2.5km West of Carrick-on-Shannon. These are thought to have been used for the recovery and disposal of material as part of the N4 realignment. Available ground investigation at these sites describes the made ground as a mixture of gravelly sandy silty CLAY, peat and cobbles with some plastic, no signs of hazardous material noted. Approximately 61,000m^2 of this site is intersected by the Pink Design, this is considered a moderate adverse impact.

- A waste permit site south of Carrick-on-Shannon railway station. The historic use of the permitted site is unknown and there is no available ground investigation at this site. Approximately 100m² of this site is intersected by the Pink Design, this is considered a small adverse impact.
- The Carrick-on-Shannon Landfill, Ballynamoney – Active Licence Number W0064, this site is likely to contain hazardous material, there is no available ground investigation at this site. Approximately 2,000m² of this site is intersected by the Stage 2 Purple West and Grey Designs, this is considered a moderate adverse impact.
- A large waste site located close to Finnalaghta with an area of 26,690m^2 located parallel to the existing N4. Available ground investigation at this site describes the material as comprising sandy gravelly CLAY with anthropogenic materials such as plastic, PVC pipe, pottery and glass, no signs of hazardous material noted. The entire waste site is expected to be removed as part of the construction of the Stage 2 Purple Design which is considered a large adverse impact. Approximately 1,000m² of this site is also intersected by the Stage 2 Green and Yellow Designs, this is considered a small adverse impact.

Of the 40 historic quarry and pit sites identified in the Constraints Study, nine will be impacted by the indicative fencelines of the option corridors. The Stage 2 Options west of Drumsna Junction impact five sites and the Stage 2 Options east of Drumsna Junction impact four sites. Available ground investigation at two of the impacted historic quarry and pit sites show the backfill material as comprising a mixture of sandy gravelly CLAY, decomposing organic matter, cobbles, boulders and anthropogenic materials such as pottery, brick, coal and glass, no signs of hazardous material noted. As the area of these sites are small in comparison to the overall area wihtin the indicative fencelines of the Stage 2 Options the impact on these is considered small adverse.

The assessment of potential sites containing contaminated material is presented the following tables.

Table 8.8.12.3 Summary of Contaminated Sites Assessment for the Options West of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Cyan Option Corridor (Pink Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	43,000 m^2	High	Small Adverse	Moderate / Slight	Major or Highly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	61,000m^2	High	Moderate Adverse	Significant / Moderate	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Rail Station	Intersected	High	Small Adverse	Moderate / Slight	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	3 No.	High	Small Adverse	Moderate / Slight	
Orange Option Corridor (Orange Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	43,000 m^2	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	0 m^2	High	Negligible[1]	Imperceptible	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Rail Station	Intersected	High	Small Adverse	Moderate / Slight	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	3 No.	High	Small Adverse	Moderate / Slight	
Dark Green Option Corridor (Grey Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	26,000 m^2	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	2,000m^2	High	Moderate Adverse	Significant / Moderate	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Rail Station	Not Intersected	High	Negligible*	Imperceptible	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	2 No.	High	Small Adverse	Moderate / Slight	

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple West Option Corridor (Purple West Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	32,000 m^2	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	2,000m^2	High	Moderate Adverse	Significant / Moderate	
		Historic Heavy Industrial Sites	Carrick-on-Shannon Rail Station	Not Intersected	High	Negligible*	Imperceptible	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	1 No.	High	Small Adverse	Moderate / Slight	

* *A negligible magnitude of impact is assigned when an identified potentially contaminated site is not intersected by an Option Corridor.*

Table 8.8.12.4 Summary of Contaminated Sites Assessment for the Options East of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Area or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple East Option Corridor (Purple East Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	13,000 m^2	High	Small Adverse	Moderate / Slight	Major or Highly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	19,000m^2	High	Large Adverse	Severe / Significant	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	4 No.	High	Small Adverse	Moderate / Slight	
Green Option Corridor (Green Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	15,000 m^2	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	1,000 m^2	High	Small Adverse	Moderate / Slight	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	3 No.	High	Small Adverse	Moderate / Slight	
Yellow Option Corridor (Stage 2 Yellow Design)	Contaminated Sites	EPA National Soils Made Ground	Extent of Made Ground	15,000 m^2	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
		Landfills and Waste Related Sites	Extent of Sites Impacted	1,000m^2	High	Small Adverse	Moderate / Slight	
		Historic Quarry and Pit Sites	Historic Quarries and Pits	3 No.	High	Small Adverse	Moderate / Slight	

Earthworks

An earthworks assessment has been carried out to estimate the potential bulk cut/fill, soft soil and unsuitable glacial till cut earthwork volumes for the options. The assumptions that were used for this assessment are presented in Section 8.8.12.2.

Bulk Earthwork Volumes

The bulk earthwork volumes for each of the options are presented in the two tables below.

Table 8.8.12.5 Bulk Earthwork Volumes for the Options West of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	West of River the River Shannon			East of the River Shannon		
	Sum of Cut m^3	Sum of Fill m^3	Bulk Deficit / Surplus m^3	Sum of Cut m^3	Sum of Fill m^3	Bulk Deficit / Surplus m^3
Cyan Option Corridor (Pink Design)	241,000	473,000	232,000 (deficit)	39,000	337,000	298,000 (deficit)
Orange Option Corridor (Orange Design)	94,000	231,000	137,000 (deficit)	41,000	349,000	308,000 (deficit)
Dark Green Option Corridor (Grey Design)	2,000	100,000	98,000 (deficit)	714,000	610,000	104,000 (surplus)
Purple West Option Corridor (Purple West Design)	2,000	100,000	98,000 (deficit)	732,000	552,000	180,000 (surplus)

Table 8.8.12.6 Bulk Earthwork Volumes for the Options East of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Sum of Cut m^3	Sum of Fill m^3	Bulk deficit / surplus m^3
Purple East Option Corridor (Purple East Design)	190,000	145,000	45,000 (surplus)
Green Option Corridor (Green Design)	80,000	55,000	25,000 (surplus)
Yellow Option Corridor (Stage 2 Yellow Design)	174,000	113,000	61,000 (surplus)

As is presented in the tables above there are large cut and fill requirements for all options west of Drumsna (Node J). In addition to this there are substantial deficits east (98,000m^3 to 232,000m^3) and west (298,000m^3 & 308,000m^3) of the River Shannon for the options west of Drumsna Junction. As outlined in the assumptions the River Shannon is a significant constraint to undertaking the Earthworks for the project.

Soft Soil Volumes

An additional challenge for the earthworks material balance are the volumes of soft soils (alluvium, peat and lacustrine) for all of the options which will be required to be excavated and replaced with suitable material. Table 8.8.12.7 and Table 8.8.12.8 summarise the volumes of soft soils for each of the options west and east of Drumsna Junction. The soft soil volumes have been calculated based on the 2021 Phase 2 ground investigation, existing ground investigation information and the GSI Quaternary sediment mapping.

Table 8.8.12.7 Soft Soil Volumes for the Mainline Options West of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	West of River the River Shannon	East of the River Shannon	Total Soft Deposit (m^3)
	Soft Soil Volume m^3	Soft Soil Volume m^3	
Cyan Option Corridor (Pink Design)	181,000	178,000	359,000
Orange Option Corridor (Orange Design)	139,000	178,000	317,000
Dark Green Option Corridor (Grey Design)	34,000	413,000	447,000
Purple West Option Corridor (Purple West Design)	37,000	286,000	323,000

Table 8.8.12.8 Soft Soil Volumes for the Mainline Options East of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	West of River the River Shannon
	Soft Soil Volume m^3
Purple East Option Corridor (Purple East Design)	68,000
Green Option Corridor (Green Design)	0
Yellow Option Corridor (Stage 2 Yellow Design)	0

Soft soils are extensive across the study area, occurring on the low-lying ground in between drumlin features and on the flood plain of the River Shannon. They will be excavated from areas where they exist under the formation of the proposed options in order to achieve a suitable bearing stratum. Given this, the volume of soft soils along each of the options are considered as having a high importance.

The following methodology has been adopted in the determination of the soft soil volumes:

1. Soft soil polygons for Alluvium, Lacustrine and Peat deposits have been developed using the GSI Quaternary Sediment map, the 2021 Phase 2 ground investigation information and any available existing ground investigation data. The plan area of the soft soils considered in this assessment are taken over the entire carriageway width plus the verge and the embankment slope plus the temporary side slopes (as per Plate 8.8.12.1) with the centre line taken as the middle of the option.
2. The average depth of the soft soils has been calculated at each identified soft soil area and has been used in the volume calculation. The average depths of the soft soils have been estimated using the following available ground investigations:
    a. N4 Carrick-on-Shannon to Dromod Project - Phase 2 Ground Investigation, Project No. 23255, IGSL 2021
    b. N4 Slope Remediation Ground Investigation, Report No. P16048, Priority Geotechnical Limited 2016
    c. N4: Carrick-on-Shannon to Dromod Preliminary Ground Investigation – Contract 1, Factual Report No. PC9081, Priority Geotechnical Limited 2010
    d. N4 Carrick-on-Shannon Bypass Geotechnical Ground Investigation, Factual Report No. PC6044, Priority Geotechnical Limited 2006
    e. Carrick On Shannon Bypass Ground Investigation, Report No. 7435, IGSL, 2002

Unsuitable Glacial Till Cut Volumes

In addition to the unsuitable soft soil volumes there will be a portion of the glacial till cut volumes that will be unsuitable for reuse as engineered fill. Table 8.8.12.9

and Table 8.8.12.10 below summarise the mainline volumes of unsuitable glacial till cut material for the options west and east of Drumsna Junction,

3D modelling has been complete to calculate the glacial till cut volumes using the available ground investigation information.

A reusability assessment has been undertaken using the available laboratory testing information (i.e. particle size distribution, natural moisture contents, moisture condition value, CBR, optimum moisture content and maximum dry density). The soils have been classified and assessed in accordance with Table 6/1 of TII Specification for Road Works CC-SPW-00600 (March 2013).

Based on the reusability assessment 20% of the upper 2m of glacial till is considered directly reusable or marginal (reusable if treated by drying) and 70% of the glacial till below 2m is considered directly reusable or marginal.

Unsuitable glacial cut material will either require significant treatment for reuse or disposal. Given this, the volume of unsuitable glacial cut material is considered as having a high importance.

Table 8.8.12.9 Unsuitable Glacial Till Cut Material Volumes for the Mainline Options West of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	West of River the River Shannon	East of the River Shannon	Total Unsuitable Glacial Till Cut Material (m^3)
	Unsuitable Glacial Till Cut Material (m^3)	Unsuitable Glacial Till Cut Material (m^3)	
Cyan Option Corridor (Pink Design)	81,000	22,000	103,000
Orange Option Corridor (Orange Design)	46,000	22,000	68,000
Dark Green Option Corridor (Grey Design)	0	288,000	288,000
Purple West Option Corridor (Purple West Design)	0	305,000	305,000

Table 8.8.12.10 Unsuitable Glacial Till Cut Material Volumes for the Mainline Options East of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Unsuitable Glacial Till Cut Material (m^3)
Purple East Option Corridor (Purple East Design)	93,000
Green Option Corridor (Green Design)	25,000
Yellow Option Corridor (Stage 2 Yellow Design)	69,000

Summary

The tables below summarise the overall earthwork balance when considering the bulk cut and fill volumes, volumes of soft soils and volumes of unsuitable glacial cut material. It is evident that there is a large deficit in suitable engineering fill for all options.

Table 8.8.12.11 Overall Earthwork Deficit for the mainline Options West of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Overall Earthwork Deficit West of the River Shannon (m^3)	Overall Earthwork Deficit East of the River Shannon (m^3)
Cyan Option Corridor (Pink Design)	494,000	498,000
Orange Option Corridor (Orange Design)	322,000	508,000
Dark Green Option Corridor (Grey Design)	132,000	597,000
Purple West Option Corridor (Purple West Design)	135,000	411,000

Table 8.8.12.12 Overall Earthwork Deficit for the mainline Options East of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Overall Earthwork Deficit (m^3)
Purple East Option Corridor (Purple East Design)	116,000
Green Option Corridor (Green Design)	0
Yellow Option Corridor (Stage 2 Yellow Design)	8,000

Potential Borrow and Repository Areas

The availability of suitable engineering fill and the reuse/repurpose of unsuitable material for the construction of all of the options both west and east of Drumsna Junction is a potential constraint. At this stage of the assessment, a conservative approach has been adopted and the cost to source this material from a licensed quarry has been included in the costs for all options. However, the environmental impacts of sourcing and transporting this fill material could be significantly reduced if this material is sourced within or in the vicinity of these options. As this is applicable to all options, design development during Phase 3 will investigate potential borrow and repository areas which will then be assessed by all environmental specialists. Drumlin features in proximity to options could be a potential source of suitable material and thereafter serve as repository areas for unsuitable material. Disused quarries in the study area also could be a potential repository location for unsuitable earthwork material. Other potential repository areas could include noise embankments and landscaping of embankment side slopes.

Importance of Impact

The importance of the Earthworks criterion attributes for the options is rated as high due to the significance of the volumes of the bulk earthworks, soft soils and unsuitable glacial till across all of the options on a local scale.

Magnitude of Impact

The magnitude of the impact of the bulk earthworks, soft soil and unsuitable glacial till cut volumes have been assessed based on the following limits which are considered appropriate for small, moderate and large earthwork requirements:

- Small Adverse – less than 100,000m³
- Moderate Adverse – between 100,000m³ and 350,000m³
- Large Adverse – greater than 350,000m³

West of Drumsna Junction (Node J)

West of Drumsna Junction the options have been assessed as follows:

- The large cut volumes of the Purple West Design (734,000m³) and the Grey Design (716,000m³) have been assigned a large adverse impact. The Pink Design (280,000m³) and Orange Design (135,000m³) have been given a moderate adverse magnitude of impact.
- The Pink Design has the highest volume of fill (810,000m³) followed by the Grey Design (710,000m³), Purple West Design (652,000m³) and then the Orange Design (580,000m³). Considering the magnitude of these volumes these have all been assigned a large adverse magnitude of impact.
- All options have significant soft soil volumes. The Grey Design (447,000m³) and Pink Design (359,000m³), have both been assigned a large adverse impact. The Purple West Design (323,000m³) and Orange Design (317,000m³) have both been assigned a moderate adverse impact.

- In terms of unsuitable glacial till cut material, the Grey (288,000m³), Purple West (305,000m³) and Pink (103,000m³) have been assigned a moderate adverse impact. The lesser unsuitable glacial till cut volume of 68,000m³ on the Orange Design has been assigned a small adverse impact.
- When looking at the overall earthwork balance (cut, fill and soft soil volumes) the Pink Design has a deficit of 992,000m³, the Orange Design has a deficit of 830,000m³, the Grey Design has a deficit of 729,000m³ and the Purple West Design has a deficit of 546,000m³ and have all been assigned a large adverse magnitude of impact.

East of Drumsna Junction (Node J)

East of Drumsna Junction the options have been assessed as follows:

- The Purple East Design and Stage 2 Yellow Design have the largest cut volumes (190,000m³ and 174,000m³, respectively) and are assigned a moderate adverse impact. The Green Design has a cut volume of 80,000m³ and is therefore given a small adverse impact.
- For the volumes of fill the Purple East Design (145,000m³) and Stage 2 Yellow Design (113,000m³) have a moderate adverse impact and the Green Design (55,000m³) has a small adverse impact.
- The Purple East Design has the largest soft soil volume (68,000m³) and has been assigned a small adverse impact. The Stage 2 Green and Yellow Designs both have a soft soil volume of 0m³ as they are both single carriageways and predominately follow the existing N4, therefore, they have been assigned a negligible impact.
- All options have an unsuitable glacial till cut volume of less than 100,000m³ and have all been assigned a small adverse impact.
- The Purple East Design has the largest overall earthwork deficit, 116,000m³ and has been assigned a moderate adverse impact. The Stage 2 Yellow Design has an overall earthwork deficit of 8,000m³ and has been assigned a small adverse impact. The Green Design has an overall earthwork deficit of 0m³ and has been assigned a negligible impact.

Table 8.8.12.13 Summary of the Earthworks Assessment for the Options West of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Volume (m^3) or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Cyan Option Corridor (Pink Design)	Earthworks	Bulk Earthworks	Cut (m^3)	280,000	High	Moderate Adverse	Significant / Moderate	Major or Highly Negative
			Fill (m^3)	810,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	359,000		Large Adverse	Severe / Significant	
			Unsuitable Glacial Till Cut Material (m^3)	103,000		Moderate Adverse	Significant / Moderate	
			Overall Deficit (m^3)	992,000		Large Adverse	Severe / Significant	
Orange Option Corridor (Orange Design)	Earthworks	Bulk Earthworks	Cut (m^3)	135,000	High	Moderate Adverse	Significant / Moderate	Major or Highly Negative
			Fill (m^3)	580,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	317,000		Moderate Adverse	Significant / Moderate	
			Unsuitable Glacial Till Cut Material (m^3)	68,000		Small Adverse	Moderate / Slight	
			Overall Deficit (m^3)	830,000		Large Adverse	Severe / Significant	
Dark Green Option Corridor (Grey Design)	Earthworks	Bulk Earthworks	Cut (m^3)	716,000	High	Large Adverse	Severe / Significant	Major or Highly Negative
			Fill (m^3)	710,000		Large Adverse	Severe / Significant	

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Volume (m^3) or Quantity	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
			Soft Soil (m^3)	447,000		Large Adverse	Severe / Significant	
			Unsuitable Glacial Till Cut Material (m^3)	288,000		Moderate Adverse	Significant / Moderate	
			Overall Deficit (m^3)	729,000		Large Adverse	Severe / Significant	
Purple West Option Corridor (Purple West Design)	Earthworks	Bulk Earthworks	Cut (m^3)	734,000	High	Large Adverse	Severe / Significant	Major or Highly Negative
			Fill (m^3)	652,000		Large Adverse	Severe / Significant	
			Soft Soil (m^3)	323,000		Moderate Adverse	Significant / Moderate	
			Unsuitable Glacial Till Cut Material (m^3)	305,000		Moderate Adverse	Significant / Moderate	
			Overall Deficit (m^3)	546,000		Large Adverse	Severe / Significant	

Table 8.8.12.14 Summary of the Earthworks Assessment for the Options East of Drumsna Junction (Node J)

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Volume (m^3)	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple East Option Corridor (Purple East Design)	Earthworks	Bulk Earthworks	Cut (m^3)	190,000	High	Moderate Adverse	Significant / Moderate	Moderately Negative
			Fill (m^3)	145,000		Moderate Adverse	Significant / Moderate	
			Soft Soil (m^3)	68,000		Small Adverse	Moderate / Slight	
			Unsuitable Glacial Till Cut Material (m^3)	93,000		Small Adverse	Moderate / Slight	
			Overall Deficit (m^3)	116,000		Moderate Adverse	Significant / Moderate	
Green Option Corridor (Green Design)	Earthworks	Bulk Earthworks	Cut (m^3)	80,000	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
			Fill (m^3)	55,000		Small Adverse	Moderate / Slight	
			Soft Soil (m^3)	0		Negligible	Imperceptible	
			Unsuitable Glacial Till Cut Material (m^3)	25,000		Small Adverse	Moderate / Slight	
			Overall Deficit (m^3)	0		Negligible	Imperceptible	
Yellow Option Corridor (Stage 2 Yellow Design)	Earthworks	Bulk Earthworks	Cut (m^3)	174,000	High	Moderate Adverse	Significant / Moderate	Moderately Negative
			Fill (m^3)	113,000		Moderate Adverse	Significant / Moderate	
			Soft Soil (m^3)	0		Negligible	Imperceptible	

Option Corridor (Stage 2 Design)	Criterion	Criterion Attributes	Description	Volume (m^3)	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
			Unsuitable Glacial Till Cut Material (m^3)	69,000		Small Adverse	Moderate / Slight	
			Overall Deficit (m^3)	8,000		Small Adverse	Moderate / Slight	

Stage 2 Black Design Option

A standalone assessment has been undertaken of the Stage 2 Black Design to determine the baseline impacts on the Soils and Geology within this option. A summary of the assessment for each of the criteria is provided in the table below.

Table 8.8.12.15 Standalone Assessment Table – Stage 2 Black Design

Assessment Criteria	Stage 2 Black Design
Soil Deposits (well-drained soil types which are important for agriculture)	The Stage 2 Black Design does not intersect any soil types that are important for agriculture (well drained), therefore the significance of the impact on agricultural soils is **Imperceptible**.
Bedrock (Karst)	The Stage 2 Black Design does not intersect any karst features, therefore the significance of the impact on karst features is **Imperceptible**.
Bedrock (Volcanic Geology)	The Stage 2 Black Design does not intersect any volcanic bedrock formations, therefore the significance of the impact on volcanic geology is **Imperceptible**.
Landslide Susceptibility (Moderately high to high susceptibility)	The Stage 2 Black Design does not intersect any areas of moderately high to high landslide susceptibility, therefore the significance of the impact on landslide susceptibility is **Imperceptible.**
Contaminated Sites	Approximately 2.0% of the Stage 2 Black Design intersects made ground with no identified potentially contaminated sites intersected. Due to the unknown nature of the material across made ground areas these areas are considered to have a high importance. Given the small percentage of the Stage 2 Black Design that is underlain by made ground the magnitude is considered to be small adverse. Therefore, the significance of the impact on contaminated sites is considered to be **Moderate / Slight**.
Economic Geology	Approximately 5.0% of the Stage 2 Black Design intersects areas of high to very high crushed rock aggregate potential, with no high to very high granular aggregate potential areas, active quarries or pits or mineral localities intersected. Areas of high to very high crushed rock aggregate potential are considered to have a medium importance as these areas do not have a high significance on a local scale. Given the small percentage of the Stage 2 Black Design that is underlain by high to very high crushed rock aggregate potential the magnitude is considered to be small adverse. Therefore, the significance of the impact on economic geology is considered to be **Slight**.

Assessment Criteria	Stage 2 Black Design
Geological Heritage	The Stage 2 Black Design does not intersect any recorded geological heritage areas, therefore the significance of the impact on geological heritage is considered to be **Imperceptible**.
Earthworks	The earthwork requirement for the Stage 2 Black Design is considered to have a high importance. The earthwork volumes for the Stage 2 Black Design are as follows, the magnitude of impact is considered to be small adverse: Bulk Cut Volume = 40,000m^3 Bulk Fill Volume = 54,000m^3 Soft Soil Volume = 66,000m^3 Unsuitable Glacial Till Cut Material = 17,000 m^3 Overall Deficit = 66,000m^3 Therefore, the significance of the impact on earthworks is considered to be **Significant / Moderate**.
Qualitative Assessment	**Significant earthwork requirement when considering the short corridor length.**
Score / Impact Level	**1**
PAG Description	**Major** or **Highly Negative**

8.8.12.5 Summary

Summary of Alternatives Assessment

Each of the alternatives have been assessed against the Soils and Geology criteria. Alternative A is considered as having a Minor or Slightly Negative impact due to the intersection of potential new pedestrian/cycle links with identified historic quarry or pit sites and made ground areas, the impact of Alternatives B and C on Soils and Geology is considered Not Significant or Neutral.

West of Drumsna Junction

West of Drumsna Junction (see Table 8.8.12.16) the Purple West Design is the Preferred option, the Grey Design and Orange Design are of Intermediate preference, and the Pink Design is the Least Preferred.

The reasons are as follows:

- The Pink Design intersects the largest number of identified potentially contaminated sites including the Cloongownagh between Hughestown and Cuiltyconeen disused waste permit site, resulting in a significant impact on soils and geology. This option also intersects the largest area of made ground. With respect to earthworks, the Pink Design has the largest overall earthwork deficit (992,000m^3) when combining bulk earthworks, the soft soil volumes and the unsuitable glacial till cut material. The Pink Design is considered the least preferred option west of Drumsna Junction.

- The Orange Design intersects the largest area of made ground and a number of identified potentially contaminated sites. In terms of earthworks, the Orange Option Corridor has the second largest overall earthwork deficit (829,000m³) when combining bulk earthworks, soft soil volumes and unsuitable glacial till cut material. The Orange Design is considered intermediate west of Drumsna Junction.
- The Grey Design has the third largest overall earthwork deficit (729,000m³) when combining bulk earthworks, soft soil volumes and unsuitable glacial till cut material. The Grey Design is considered intermediate west of Drumsna Junction.
- The Purple West Design intersects the least number of identified potentially contaminated sites. In terms of earthworks, the Purple West Design Option has the smallest overall earthwork deficit (546,000m³) when combining bulk earthworks, soft soil volumes and unsuitable glacial till cut material. The Purple West Design is considered the preferred option west of Drumsna Junction.
- Although the earthwork requirement on the Stage 2 Grey and Purple West Designs are significant the majority of the alignment is east of the River Shannon. Meaning that the River Shannon does not pose as significant a constraint to the Stage 2 Grey and Purple West Designs as it does to the Stage 2 Pink and Orange Designs.
- The undulating topography north of Carrick-on-Shannon results in a reduced haulage requirement between cuts and fills on the Stage 2 Grey and Purple West Designs, the topography to the north also results in more opportunities for borrow and repository areas. To the south of Carrick-on-Shannon the topography of the Stage 2 Pink and Orange Designs is less variable and comprises low-lying floodplains namely east of the River Shannon. This constrains opportunities to win and haul material across these options.
- The Black Option Corridor has a significant earthwork requirement when considering the short corridor length and area and is considered to have a Major or Highly Negative impact.

Table 8.8.12.16 Comparative Assessment Table for the Option West of Drumsna Junction (Node J)

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST OPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLACK OPTION CORRIDOR
	Pink Design Option Dual Carriageway	Orange Design Option Dual Carriageway	Purple West Design Option Dual Carriageway	Grey Design Option Dual Carriageway	Black Design Single Carriageway Urban Street
Contaminated Sites	Major or Highly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Minor or Slightly Negative	Moderate / Slight
Earthworks	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Major or Highly Negative	Significant / Moderate
Scoring					
Qualitative Assessment	Largest impact on potential contaminated sites and largest overall earthwork deficit (992,000m³). **Major or Highly Negative**	Second largest impact on potential contaminated sites and second largest overall earthwork deficit (829,000m³). **Moderately Negative**	Smallest overall earthwork deficit (546,000m³). **Moderately Negative**	Third largest overall earthwork deficit (729,000m³). **Moderately Negative**	Significant earthwork requirement when considering the short corridor length. (66,000m³). **Major or Highly Negative**
Score / Impact Level	**1**	**2**	**2**	**2**	**1**
Preference	**Least Preferred**	**Intermediate**	**Preferred**	**Intermediate**	**N/A**

East of Drumsna Junction (Node J)

East of Drumsna Junction (see Table 8.8.12.17) the Green Design is the Preferred Option, the Stage 2 Yellow Design is of Intermediate preference, and the Purple East Design is the Least Preferred.

The reasons are as follows:

- The Purple East Design intersects a significant portion of a disused waste site and has the largest overall earthwork deficit (116,000m³) when combining bulk earthworks, soft soil volumes and unsuitable glacial till cut material. This results in the Purple East Design being the Least Preferred option east of Drumsna Junction.
- The Stage 2 Yellow Design has the second largest overall earthwork deficit (8,000m³) when combing bulk earthworks, soft soil volumes and unsuitable glacial till cut material. The Stage 2 Yellow Design is considered Intermediate east of Drumsna Junction.
- The Green Design has no overall earthwork deficit (0m³) when combining bulk earthworks, soft soil volumes and unsuitable glacial till cut material. As a result, the Green Design is considered the Preferred option east of Drumsna Junction.

Table 8.8.12.17 Comparative Assessment Table for the Options East of Drumsna Junction (Node J)

Assessment Criteria	YELLOW OPTION CORRIDOR	GREEN OPTION CORRIDOR	PURPLE EAST OPTION CORRIDOR
	Yellow Design Option Single Carriageway	Green Design Option Single Carriageway	Purple East Design Option Dual Carriageway
Contaminated Sites	Minor or Slightly Negative	Minor or Slightly Negative	Major or Highly Negative
Earthworks	Moderately Negative	Minor or Slightly Negative	Moderately Negative
Scoring			
Qualitative Assessment	Second largest overall earthwork deficit (8,000m³). **Moderately Negative**	No overall earthwork deficit (0m³). **Minor or Slightly Negative**	Intersects significant portion of a disused waste site and has the largest overall earthwork deficit (116,000m³). **Major or Highly Negative**
Score / Impact Level	**2**	**3**	**1**
Preference	**Intermediate**	**Preferred**	**Least Preferred**

8.8.13 Environmental Summary Matrix

8.8.13.1 Introduction

The following Table 8.9.13.1 to Table 8.9.13.3 provide summaries of the preferences determined under each of the environmental topics covered in sections 8.8.1 to 8.8.12. The tables also provide an overall preference for the environmental section as a whole.

During the course of the assessment process *Population and Health, Material Assets – Non Agricultural, Biodiversity*, *Hydrology* and *Soils and Geology* were identified as disciplines which had key significant constraints. For example, impacts on population such as communities and residential property acquisitions and impacts on biodiversity such as on European designated sites were all key significant constraints which required further consideration during the decision making process. Therefore, these disciplines are shown in italics in the summary tables and are referred to as "key environmental disciplines" below.

The overall ranking for each option corridor in terms of the environment took into consideration the overall number of Preferred, Intermediate and Least Preferred rankings and is based on professional judgement and not the average of the individual scores for each sub-criterion.

8.8.13.2 Stage 2 Alternatives

As shown in Table 8.9.13.1 all three alternatives were summarised as having a Minor or Slightly Positive impact overall.

8.8.13.3 Stage 2 Options

Of the Stage 2 options west of Drumsna Junction (Node J), as per Table 8.9.13.2 the Dark Green Option Corridor containing the Grey Design Option was identified as Preferred with the Cyan Option Corridor containing the Pink Design Option and the Purple West Option Corridor containing the Purple West Design Option identified as Intermediate and the Orange Option Corridor containing the Orange Design Option) was found to be Least Preferred. The Black Option Corridor containing the Black Design was found to have a Moderately Negative impact.

Of the Stage 2 options east of Drumsna Junction (Node J), as per Table 8.9.13.3, the Green Option Corridor containing the Green Design Option was determined as Preferred, the Yellow Option Corridor containing the Yellow Design Option was found to be Intermediate while the Purple East Option corridor containing the Purple East Design Option was found to be Least Preferred.

Table 8.9.13.1 Environmental Summary Matrix – Stage 2 Alternatives (PAG Score in Brackets)

Environmental Assessment Topic	**ALTERNATIVE A ACTIVE TRAVEL**	**ALTERNATIVE B PUBLIC TRANSPORT IMPROVEMENTS**	**ALTERNATIVE C DEMAND MANAGEMENT**
Population	Major or Highly Positive (7)	Minor or Slightly Positive (5)	Moderately Positive (6)
Human Health	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Material Assets Non-Agriculture	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Material Assets Agriculture	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Air Quality	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Climate	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Noise and Vibration	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Archaeology, Architecture and Cultural Heritage	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Moderately Positive (6)
Landscape and Visual	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Biodiversity	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Hydrology	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Hydrogeology	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Soils and Geology	Minor or Slightly Negative (3)	Not Significant or Neutral (4)	Not Significant or Neutral (4)
Summary			
Summary Environmental Impact	**Minor** or **Slightly Positive (5)**	**Minor** or **Slightly Positive (5)**	**Minor** or **Slightly Positive (5)**

Table 8.9.13.2 Environmental Summary Matrix- Stage 2 Options West of Drumnsa Junction (Node J) (PAG Score in Brackets)

Option Corridor	**Cyan Option Corridor**	**Orange Option Corridor**	**Purple West Option Corridor**	**Dark Green Option Corridor**		**Black Option Corridor**
Design Scenario	Pink Design Option	Orange Design Option	Purple West Design Option	Grey Design Option		Black Design Urban Street
Cross-section	Dual Carriageway	Dual Carriageway	Dual Carriageway	Dual Carriageway		Urban Street
Environmental Assessment Topic						
*Population**	Intermediate (3)	Least Preferred (2)	Preferred (4)	Preferred (4)		Moderately Positive (6)
*Human Health**	Preferred (4)	Preferred (4)	Intermediate (4)	Intermediate (4)		Not Significant or Neutral (4)
*Material Assets Non-Agriculture**	Least Preferred (2)	Least Preferred (2)	Intermediate (3)	Preferred (3)		Minor or Slightly Negative (3)
Material Assets Agriculture	Intermediate (3)	Preferred (3)	Intermediate (3)	Least Preferred (3)		Not Significant or Neutral (4)
Air Quality	Least Preferred (3)	Least Preferred (3)	Intermediate (3)	Preferred (3)		Moderately Negative (2)
Climate	Preferred (1)	Least Preferred (1)	Intermediate (1)	Preferred (1)		Moderately Negative (2)
Noise and Vibration	Intermediate (2)	Intermediate (2)	Preferred (3)	Preferred (3)		Moderately Negative (2)
Archaeology, Architecture and Cultural Heritage	Least preferred (1)	Least Preferred (1)	Intermediate (2)	Preferred (2)		Not Significant or Neutral (4)
Landscape and Visual	Intermediate (1)	Least Preferred (1)	Intermediate (1)	Preferred (1)		Moderately Negative
*Biodiversity**	Intermediate (1)	Preferred (1)	Least Preferred (1)	Least Preferred (1)		Minor or Slightly Negative (3)
*Hydrology**	Intermediate (2)	Preferred (2)	Least Preferred (1)	Least Preferred (1)		Minor or Slightly Negative (3)
Hydrogeology	Intermediate (1)	Preferred (1)	Least Preferred (1)	Least Preferred (1)		Moderately Negative (2)
*Soils and Geology**	Least Preferred (1)	Intermediate (2)	Preferred (2)	Intermediate (2)		Major or Highly Negative (1)
Summary						
Summary Environmental Preference	**Intermediate (2)**	**Least Preferred (2)**	**Intermediate (2)**	**Preferred (2)**		**Minor** or **Slightly Negative (3)**

**Environmental Disciplines written in italics are considered to be key environmental disciplines in this study area of this particular project*

Table 8.9.13.3 Environmental Summary Matrix- Stage 2 Options East of Drumsna Junction (Node J) (PAG score in brackets)

Option Corridor	**Yellow Option Corridor**	**Green Option Corridor**	**Purple East Option Corridor**
Design Scenario	Yellow Design Option	Green Design Option	Purple East Design Option
Cross-section	Single Carriageway	Single Carriageway	Dual Carriageway
Environmental Assessment Topic			
Population *	Intermediate (4)	Least Preferred (3)	Preferred (6)
Human Health *	Intermediate (4)	Preferred (4)	Preferred (4)
Material Assets Non-Agriculture *	Intermediate (3)	Preferred (3)	Least Preferred (2)
Material Assets Agriculture	Intermediate (3)	Preferred (3)	Least Preferred (3)
Air Quality	Least Preferred (2)	Intermediate (2)	Preferred (2)
Climate	Intermediate (1)	Preferred (1)	Least Preferred (1)
Noise and Vibration	Intermediate (3)	Intermediate (3)	Preferred (3)
Archaeology, Architecture and Cultural Heritage	Intermediate (1)	Preferred (2)	Least Preferred (1)
Landscape and Visual	Preferred (2)	Preferred (2)	Least Preferred (1)
*Biodiversity**	Preferred (1)	Preferred (1)	Least Preferred (1)
*Hydrology**	Preferred (2)	Preferred (2)	Intermediate (2)
Hydrogeology	Intermediate (3)	Preferred (4)	Intermediate (3)
*Soils and Geology**	Intermediate (2)	Preferred (3)	Least Preferred (1)
Summary			
Summary Environmental Preference	**Intermediate (2)**	**Preferred (2)**	**Least Preferred (2)**

**Environmental Disciplines written in italics are considered to be key environmental disciplines in this study area of this particular project*

8.9 Summary of the Stage 2 Assessment

8.9.1 Introduction

In accordance with the PAG Unit 7.0[2] the MCA appraisal process was carried out on the Stage 2 Alternatives and Options using the project appraisal matrix (comprising of the Common Appraisal Framework Criteria of Economy, Safety, Environment, Accessibility & Social Inclusion and Integration).

As outlined in Section 8.2 four option corridors are compared relative to each other west of Node J at Drumsna Junction (Cyan, Orange, Purple West and Dark Green) and three option corridors are compared against each other east of Node J (Purple East, Green and Yellow). Separately, the Black Option Corridor is also west of Drumsna but is not compared to the other option corridors.

The following MCAs compile the determinations of each of the appraisals detailed in Sections 8.3 to 8.8 into an overall matrix for the alternatives Table 8.9.2.1 and the option corridors Table 8.9.2.2 in Section 8.9.2.

The Preferred Option Corridor identified for the road alternative from the Stage 2 Project Appraisal Matrix (PAM) is further tested by undertaking a pair-wise comparison which is detailed in Section 8.9.3. The purpose of the pair-wise comparison is to compare the assessment determinations of the two preferred corridors to see if anything stands out. Following this, an incremental assessment was undertaken, as detailed in Section 8.9.4, to determine the level of intervention most appropriate for the road alternative to form part of the transport solution to be taken froward to the Stage 3 Project Appraisal Balance Sheet (PABS).

8.9.2 Stage 2 Project Appraisal Matrix

The outcome of the assessment under the above six criteria is combined in the PAM. The overall ranking for the alternatives and option corridors is based on professional judgement and is not an average of PAG scores for each of the CAF criteria. The Project Appraisal Matrix of Alternatives is shown in Table 8.9.2.1 and the Project Appraisal Matrix of options is shown in Table 8.9.2.2.

Table 8.9.2.1 Project Appraisal Matrix of Alternatives

Assessment Criteria	Alternative A: Active Travel	Alternative B: Public Transport Improvements (Bus)	Alternative C: Demand Management
Economy	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Moderately Positive (6)
Environment	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
Safety	Major or Highly Positive (7)	Slightly Positive (5)	Major or Highly Positive (7)
Accessibility and Social Inclusion	Minor or Slightly Positive (5)	Not Significant or Neutral (4)	Minor or Slightly Positive (5)
Integration	Not Significant or Neutral (4)	Not Significant or Neutral (4)	Minor or Slightly positive (5)
Physical Activity	Major or Highly Positive (7)	Minor or Slightly Positive (5)	Moderately Positive (6)
Scoring			
Overall Scoring	**Not Significant** or **Neutral (4)**	**Not Significant** or **Neutral (4)**	**Minor** or **Slightly positive (5)**

Note: PAG Score in brackets

Table 8.9.2.2 Stage 2 Project Appraisal Matrix Option Corridor Assessment

Criteria	West of Drumsna Junction (Node J)					East of Drumsna Junction (Node J)		
	CYAN OPTION CORRIDOR	**ORANGE OPTION CORRIDOR**	**PURPLE WEST OPTION CORRIDOR**	**DARK GREEN OPTION CORRIDOR**	**BLACK OPTION CORRIDOR**	**YELLOW OPTION CORRIDOR**	**GREEN OPTION CORRIDOR**	**PURPLE EAST OPTION CORRIDOR**
	Pink Design (Dual Carriageway)	Orange Design (Dual Carriageway)	Purple West Design (Dual Carriageway)	Grey Design (Dual Carriageway)	Black Design	Yellow Design (Single Carriageway)	Green Design (Single Carriageway)	Purple East Design (Dual Carriageway)
Economy	Preferred (4)	Least Preferred (3)	Intermediate (3)	Intermediate (3)	N/A (4)	Intermediate (3)	Preferred (3)	Least Preferred (3)
Environment	Intermediate (2)	Least Preferred (2)	Intermediate (2)	Preferred (2)	N/A (3)	Intermediate (2)	Preferred (2)	Least Preferred (2)
Safety	Preferred (6)	Preferred (6)	Preferred (6)	Preferred (6)	N/A (7)	Preferred (6)	Preferred (6)	Preferred (7)
Accessibility & Social Inclusion	Preferred (6)	Preferred (6)	Preferred (6)	Preferred (6)	N/A (7)	Intermediate (6)	Intermediate (6)	Intermediate (6)
Physical Activity	Preferred (5)	Intermediate (4)	Intermediate (4)	Intermediate (4)	N/A (5)	Intermediate (5)	Intermediate (5)	Preferred (6)
Integration	Preferred (7)	Preferred (7)	Preferred (7)	Preferred (7)	N/A (6)	Preferred (7)	Preferred (7)	Preferred (7)
Scoring								
Overall Scoring / Ranking	**Preferred (2)**	**Least Preferred (2)**	**Intermediate (2)**	**Intermediate (2)**	**N/A (4)**	**Intermediate (2)**	**Preferred (2)**	**Least Preferred (2)**

Note: PAG Score in brackets

8.9.3 Pair-wise Comparison of the Option Corridors

The assessment is split at Drumsna Junction as this defines two clear sections of the Project, each of which required a decision. West of Drumsna Junction, the decision is whether to go north or south of Carrick-on-Shannon and east of Drumsna Junction the decision is whether to stay on-line or move off-line. A pair-wise comparison has been undertaken to aid the decision making by taking the best performing options for each assessment scenario and comparing them against each other. The outcome of this comparison is then compared with the 2012 Emerging Preferred Route Corridor which was reserved in the Leitrim County Development Plan 2015-2021 as outlined in Section 1.3.2.

8.9.3.1 West of Drumsna – North or South of Carrick-on-Shannon?

There are two option corridors west of Drumsna that are to the north of Carrick-on-Shannon (Purple and Dark Green Option Corridors) and two option corridors that are to the south (Cyan and Orange Option Corridors). A comparison of the best performing option to the north of Carrick-on-Shannon versus the best performing option to the south is used to inform the decision making.

As shown in the overall PAM in Table 8.9.2.2, the preferred option corridor to the north is the Dark Green Option Corridor and the preferred option corridor to the south of Carrick-on-Shannon is the Cyan Option Corridor. Environment is a key differentiator factor favouring the Dark Green Option Corridor whilst Economy is a key differentiator favouring the Cyan Option Corridor. Physical Activity also favours the Cyan Option Corridor.

A comparison of the key Environmental sub-criteria assessed which received a Least Preferred score identified the following:

- *Material Assets Non-Agriculture* favoured the Dark Green Option Corridor over the Cyan Option Corridor due to the lesser number of home acquisitions. (Dark Green Option Corridor is preferred).
- *Biodiversity* ranked the Dark Green Option Corridor as Least Preferred primarily due to the interaction with the pNHA and it interacts with four internationally important sites. Conversely the Cyan Option Corridor does not interact with the pNHA and interacts with two internationally important sites. (Cyan Option Corridor is preferred).
- *Hydrology* favoured the Cyan Option Corridor due to the minimal risk to the Carrick-on-Shannon drinking water abstraction and potential public health concerns arising from a water quality impact on the source both during construction and operation phases by virtue of being located well downstream of the abstraction point. The Dark Green Option Corridor was ranked Least Preferred. (Cyan Option Corridor is preferred).
- *Soils and Geology* favoured the Dark Green Option Corridor over the Cyan Option Corridor due to the earthworks deficit. Whilst the Dark Green Option Corridor involves more cutting and placement of material, all this

material is available within the indicative design. (Dark Green Option Corridor is preferred).

A comparison of the Economy criteria identified that the Cyan Option Corridor is preferred over the Dark Green Option Corridor as it has a better benefit to cost ratio whereas the Dark Green Option Corridor is showing a negative value . In terms of affordability, the Cyan Option Corridor offers more opportunity to phase the spending than the Dark Green Option Corridor. The Cyan Option Corridor achieves the crossing of the River Shannon and the re-connection back to the existing N4 at a lesser cost than the Dark Green Option Corridor and achieves a better benefit to cost ratio for it.

With respect to Physical Activity the Cyan Option Corridor is the preferred option primarily due to the greater reduction in through traffic in Carrick-on-Shannon therefore freeing road space for non-motorised road users.

Based on this pair-wise comparison, the Cyan Option Corridor is the Preferred Option to the West of Drumsna Junction due to the lesser risk to the water supply, lesser impacts on biodiversity and the overall positive economic assessment of it. However, there will be a greater impact on residential homes associated with it.

8.9.3.2 East of Drumsna – On-line or Off-line?

There are two on-line option corridors east of Drumsna (Yellow and Green Option Corridors) and one off-line option corridor (Purple East Option Corridor). As shown in the overall PAM in Table 8.9.2.2, the Green Option Corridor is preferred over the Yellow Option Corridor and as such is the preferred on-line option. Therefore, the Green Option Corridor is compared with Purple East Option Corridor. These two options rank equally under the criteria of Safety, Accessibility and Social Inclusion and Integration, A comparison of these two options under the remaining criteria Economy, Environment and Physical Activity identified the following:

- **Economy** – the Purple East Option Corridor is Least Preferred given the scale of the cost of it in comparison to the Green Option Corridor. (Green Option Corridor is preferred)
- **Environment** - the Purple East Option Corridor is Least Preferred given the environmental impacts associated with construction of a new off-line section in comparison to the on-line option. (Green Option Corridor is preferred)
- **Physical Activity** - the Purple East Option Corridor is Preferred as it bypasses Aghamore allowing for improved measures within the village. (Purple East Option Corridor is preferred)

Comparing these two options, the Preferred Option is the Green Option Corridor.

8.9.3.3 Comparison to Previous Preferred Corridor

The 2012 Emerging Preferred Route Corridor (EPRC) which was reserved in the Leitrim County Development Plan 2015-2021 is shown in purple underlaying the

Preferred Option Corridors for the West of Drumsna Junction and East of Drumsna Junction on Plate 8.9.1.

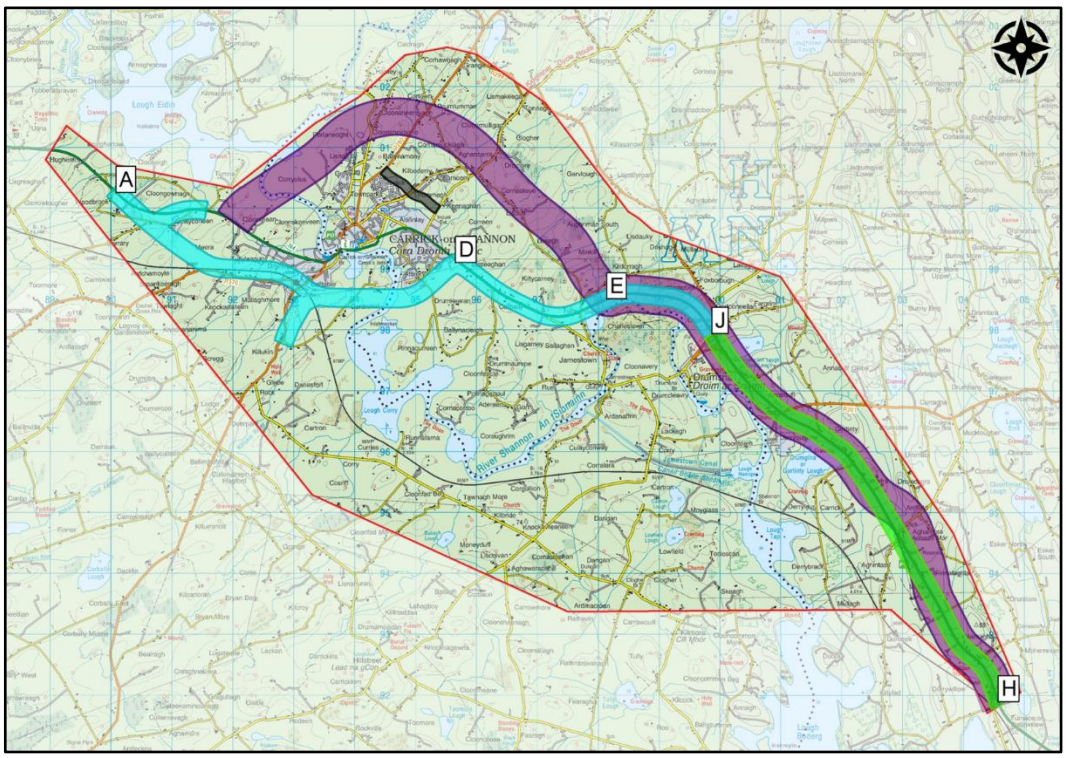

Plate 8.9.1 Preferred Option Corridor West and East of Drumsna Junction versus 2012 Emerging Preferred Route Corridor

The key difference between the current preferences and the 2012 EPRC is the decision to go south of Carrick-on-Shannon instead of going north of Carrick-on-Shannon. There are many factors which informed and influenced this decision.

The traffic analysis which was undertaken to inform the 2012 EPRC utilised manual origin and destination surveys using roadside surveys. For the current analysis, the project design team had the 2011 Census data available which gave in depth detail on place of work and place of education (POWSCAR) for every single home in the study area. The transport model which was available to create the Local Area Model is the Western Regional Model which is capable of modelling walking, cycling and public transport in addition to private vehicle trips, whereas the previous model for the 2012 EPRC was not capable of modelling public transport, walking or cycling. This level of data together with the more sophisticated modelling techniques identified that the congestion problems experienced in Carrick-on-Shannon were not solely attributable to by-passable traffic. Therefore, with a better understanding of the transportation problem, the Preferred Transport Solution has changed from the 2012 EPRC to move closer to the urban area.

In addition to the above, planning policy has changed significantly since 2012 with the publication of the National Planning Framework, NIFTI and the Climate Action Plan; all of which promote sustainable development, compact growth and include population projections with growth assigned to the urban areas. Such policies favoured a solution which maximises the reuse of existing infrastructure with minimum additional journey length and enables the delivery of active travel and

public transport improvements. As the southern bypass route is closer to the urban area, there is a larger transfer of traffic to it than the northern bypass route, thus enabling reallocation of existing road space to other modes. Furthermore, the southern bypass route is approximately 1km shorter in trip length than the northern bypass route which is preferrable both from a construction and operation perspective when considering the carbon footprint of the project.

Environmental considerations also influenced this decision, with a key consideration being Hydrology which favoured the southern bypass route as opposed to the northern bypass route due to the minimal risk to the Carrick-on-Shannon drinking water abstraction and potential public health concerns by virtue of being located well downstream of the abstraction point. Biodiversity also favoured the southern bypass route due to the lesser impacts on the pNHA and four internationally important sites. It is acknowledged however, that the southern bypass route does impact on more homes.

In terms of the on-line section, both studies concluded that the existing demand is best served with reusing the existing N4, with the difference being that the 2012 EPRC favoured a bypass for Aghamore. Given the policy changes mentioned above, and the significant environmental issues associated with the off-line, the on-line option is more favourable.

8.9.5 Incremental Assessment

8.9.5.1 Introduction

This assessment considers the incremental build-up of the Project from the Stage 2 Alternatives and Options under consideration, which include various cross-sections, various design speeds and various project extents in order to determine the most suitable level of intervention to be progressed as the Preferred Transport Solution. This incremental analysis has been completed in accordance with TII Project Appraisal Guidelines (PAG) Unit 4[33], reference PE-PAG-02013. Decisions as to the appropriate level of service i.e. carriageway cross-section, level of intervention, access requirements, design speed and the extents of the Project are considered and detailed in this section of the report. However, it should be noted that the final decision on the carriageway cross-section, access requirements and design speed will be made during Phase 3 of the Project.

8.9.5.2 Methodology

As detailed in Chapter 2, National Investment Framework for Transport in Ireland (NIFTI) is the Department of Transport's high-level, strategic framework for future investment in the land transport network. The purpose of the NIFTI is to support the delivery of the National Planning Framework (NPF).

The NIFTI states that *"future transport investment will have to demonstrate alignment with NIFTI and, by extension, support the delivery of the NPF and the National Strategic Outcomes (NSOs)."*

The NIFTI commits to investing in the delivery of *"… a safe and sustainable and transport network which supports prosperous communities, promotes balanced development and helps to realise our climate change goals."*

This framework promotes utilising the most appropriate sustainable solution to a given problem with the four investment priorities focussing on decarbonisation, protection and renewal, mobility of people and goods in urban areas and enhanced regional and rural connectivity. These four investment priorities will be utilised to identify projects for advancement and are further supplemented by modal and intervention hierarchies which establish the types of solutions that are preferred from both an environmental and cost-effectiveness perspective.

This is in line with the *Common Appraisal Framework for Transport Projects and Programmes* (CAF) which states "*the need for an intervention should then be clearly set out and justified. If an intervention is appropriate, a number of options should be generated with a view to developing a range of alternative measures that look likely to achieve the specific objectives that the Project is seeking to address. A Base Case must first be established and then options for investment should be identified and appraised in comparison to this. In line with the Public Spending Code, this requires the analyst to generate a range of realistic options so that benefits and costs can be compared relative to a scenario where very little or no*

[33] Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 4.0 - Consideration of Alternatives and Options. Available at: https://www.tiipublications.ie/library/PE-PAG-02013-01.pdf

change has taken place. A preliminary assessment of the costs and benefits should be undertaken of the options. The options are then sifted for the better performing options to be taken on to the detailed appraisal stage."

This also aligns with TII Project Management Guidelines, document reference PE-PMG-02042 Project Manager's Manual for Major National Road Projects and TII PAG Unit 4.

8.9.5.3 Incremental Analysis

The starting point in terms of transport infrastructure provision is prioritisation of walking and cycling measures and improvements to public transport, followed by optimisation of the existing infrastructure before advancing to new infrastructure.

The Stage 2 Assessment of Alternatives concluded that in isolation they cannot achieve the Project Objectives but may form part of the overall transport solution. In addition, the Stage 1 transport assessment indicated a 10% decrease in private vehicle trips arising from the demand management measures, therefore a 'suite of complementary measures' were combined with all of the road based option corridors as part of the Stage 2 transport assessment to further enhance the transport offering. This is in line with the hierarchy of intervention whereby every effort is utilised to reduce trip demand initially, which in turn promotes an uptake on active travel modes, before progressing to new infrastructure. This first step in the incremental build-up, i.e. assessing the inclusion of the active travel and demand management measures with the option corridors. It should be noted that all Option Corridors will provide improved transport infrastructure for use by public transport bus routes which serves to integrate transport modes.

The Stage 2 Option Corridors as shown in Plate 8.9.2 are also assessed incrementally. Various scenarios are tested for added value utilising the principle of incremental build-up of both cross-section and overall project i.e. start with the lowest cost intervention and incrementally add cost and check it against the benefit accrued. The minimal intervention of all the Stage 2 Option Corridors is the Black Option Corridor. Following on from this, the shortest of all the option corridors which achieves a crossing of the River Shannon is the portion of the Orange Option Corridor from B to D to the south of the town. This is closely followed in terms of length by the Cyan Option Corridor from A to D, also on the south of the town. An extension of both of these option corridors brings them to point J by utilising the section of the existing N4. This is then assessed against an equivalent option corridor to the north of the town which provides a connection from B to J via the Dark Green Option Corridor. The relative merits of an extension of the better performing of these option corridors from point J to H is then assessed. This will then demonstrate an incremental build-up of the project based on each additional section adding value.

The environmental assessment undertaken across the option corridors is also used in this comparative assessment to ensure a holistic transport solution is achieved.

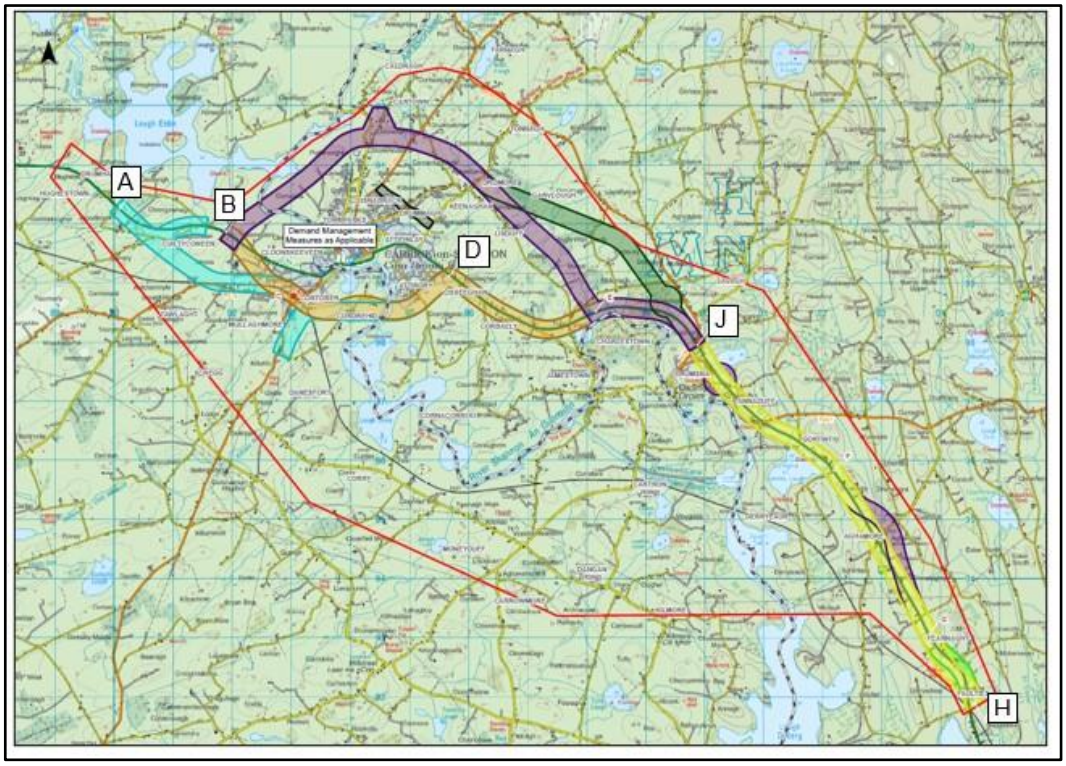

Plate 8.9.2 Stage 2 Option Corridors

A summary of the incremental assessment is outlined below:

1. Assessment of the minimal intervention, the Black Option Corridor, showed that it did not meet the overarching project objective of congestion relief in Carrick-on-Shannon and relief to the existing River Shannon bridge crossing. It was not carried forward in isolation but retained for consideration in combination with another option corridor.

2. Assessment of the minimal length of option required to provide relief to the existing River Shannon bridge crossing which in turn provides relief to the town, Orange Option Corridor from B to D, showed that it was Least Preferred from an environmental perspective due to the impacts on the population, material assets non-agriculture, landscape and visual, and also Least Preferred from an economic perspective. It was not carried forward.

3. The next shortest crossing of the River Shannon, Cyan Option Corridor from A to D was assessed, both as a single and a dual carriageway. This showed an improved benefit to cost ratio and was carried forward.

4. The Cyan Option Corridor was extended from D to J and included full control of accesses and junctions with associated parallel roads as necessary. The additional cost of this segment reduced the benefit to cost ratio slightly, but it remained greater than 0.

5. The Green Option Corridor from J to H was added to the Cyan Option Corridor from A to D to J. This had the effect of further reducing the BCR for the full corridor, albeit the BCR remained greater than 0. The assessment also showed that 95% of the benefits are associated with the western section of the project

and the additional cost with only 5% improvement on benefits accruing from the eastern section. However, the incremental assessment is a holistic assessment, and the resolution of the transport issues along the full extent of the N4 in the study area is necessary to meet the strategic function of this corridor.

6. Given the cost of the option corridors to the north of the town were less expensive than those to the south of the town a comparison was undertaken to check whether the best performing northern option as illustrated in the PAM (Dark Green Option Corridor) was preferable to the southern Cyan Option Corridor. The Dark Green Option Corridor was assessed from A to J to ensure equivalence. As the benefit to cost ratio for this option corridor was negative, there was little justification to select a northern option over the southern option.

7. To check equivalence over the full length, single and dual carriageway designs from J to H were tested with the northern option. The BCRs decreased further. Therefore, there is little justification to select a northern option over the southern option and then add further costs with the eastern section.

8. Given all of the above, the emerging Preferred Option Corridor is the Cyan Option Corridor from A to J coupled with the Green Option Corridor from J to H.

9. Finally, given that the Black Option Corridor offers benefits in terms of traffic distribution around the town, it was tested in conjunction with the emerging Preferred Option Corridor. The BCR increased significantly with the addition of the Black Option Corridor. Therefore, the Black Option Corridor is retained as part of the Preferred Transport Solution. Further detail on the testing of the Black Option is provided in the Traffic Modelling Report in Appendix A.3.2.1.

The recommendation of the incremental assessment is that the Preferred Transport Solution comprises:

- Active Travel and Demand Management Measures in Carrick-on-Shannon and Cortober
- The Black Option Corridor (new street in Carrick-on-Shannon)
- The Cyan Option Corridor from A to J
- The Green Option Corridor from J to H

The build-up of the incremental assessment is depicted in Plate 8.9.3.

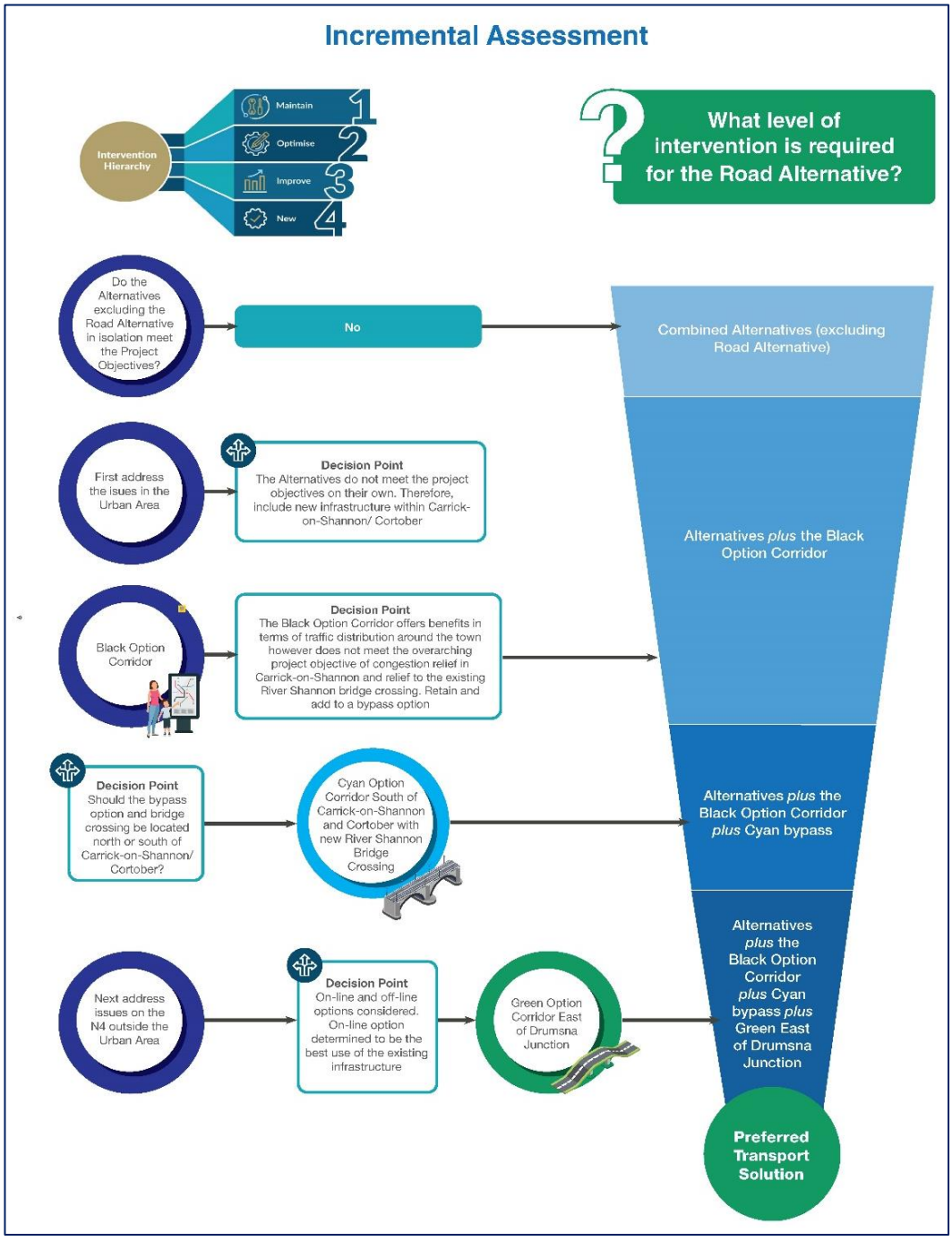

Plate 8.9.3 Incremental Assessment Summary

8.10 Recommendation

The appraisal process presents a robust assessment of the various alternatives and options under the six criteria with the results presented above in the Project Appraisal Matrix (PAM). The conclusion of the PAM is that the Cyan Option Corridor is the preferred option to the west of Drumsna Junction and the Green Option Corridor is the preferred option to the east of Drumsna Junction . A pair-wise comparison also supports this conclusion. Furthermore, the incremental analysis supports this conclusion as shown above and demonstrates a further benefit from the inclusion of the Black Option Corridor in the overall solution.

The recommendations of this Option Selection Report are:

1. Progress the active travel and demand management measures with the Black Option Corridor plus the Cyan Option Corridor to the west of Drumsna plus the Green Option Corridor to the east of Drumnsa which meets the Project Objectives outlined in Chapter 1 of this report
2. Review the extent of provision of road infrastructure necessary within the Preferred Option Corridor in conjunction with the wider transport strategy for Carrick-on-Shannon and Cortober which identifies the level of service requirements for each mode of transport, including walking, cycling, public transport and private vehicle

The identification of this preferred transport solution will ensure delivery of an overall sustainable transport solution which caters for all modes. This aligns with the hierarchy of intervention whereby every effort is utilised to reduce trip demand initially, which in turn promotes an uptake on active travel modes, before progressing to new infrastructure, noting that the new infrastructure also includes for active travel and caters for public transport. Furthermore, this enables the placemaking of Carrick-on-Shannon and Cortober, whilst also delivering on NSO 2 of the National Planning Framework connecting the regions, which aligns with the core Project Objectives.

9 Stage 3 Preferred Option and Preparation of Project Appraisal Balance Sheet (PABS)

Stage 3 of the Phase 2 Options Selection process consists of the final detailed appraisal of the emerging Preferred Transport Solution developed and analysed at Stage 2. A description of the Preferred Transport Solution (PTS) is provided in Section 9.1, and an overview of the public display is contained in Section 9.2. The cost estimate range of the PTS is provided in Section 9.3. The completion of a summary appraisal is presented in Section 9.4 with the recommendation of the PTS contained in Section 9.5.

9.1 Description of the Preferred Transport Solution

Upon completion of the project appraisal, the Preferred Transport Solution was developed as an amalgamation of different alternatives and options within the study area which includes the Carrick-on-Shannon/Cortober urban area west of Drumsna Junction and the existing N4 to the east Drumsna Junction which ties to the existing N4 Dromod Roosky Bypass at the eastern end of the project.

The Preferred Transport Solution comprises the Cyan Option Corridor and the Black Option Corridor to the west of Drumsna Junction plus the Green Option Corridor to the east of Drumsna Junction , plus a suite of active travel and demand management measures within the urban area consisting of the following components:

- 30km/h speed limit along the existing N4 as indicated by the red line on Figure 8.7.3.0
- New formal pedestrian crossings as part of signalisation of existing junctions
- Conversion of six at-grade roundabout junctions in Carrick-on-Shannon/Cortober to signalised junctions
- Extended signal timings at pedestrian crossings in town to facilitate longer pedestrian/cyclist crossing times

In the amalgamation of the individual option corridors to create the road component of the Preferred Transport Solution, cognisance was taken of the Stage 2 assessments. Minor modifications were made to reduce the impact of the combined solution as follows with further design to be completed at Phase 3 Design and Environmental Evaluation:

1. Cyan Option Corridor at the western tie-in to the N4 and at the tie-in to the N4 in the townland of Lisseeghan modified to minimise impacts on homes
2. Green Option Corridor at Aghamore modified to minimise impacts on homes

Whilst Active Travel measures did not contribute significantly to mode shift, the Preferred Transport Solution will make provision for Active Travel taking

cognisance of the guidance provided in PE-PMG-02045 and the work carried out on the project to date noting the following:

- *"Where the development of feasible active travel options is being undertaken as part of the development and delivery of a major and minor national road project, the Designer will determine how best to integrate the national road with the existing or proposed active travel network within the study area"*
- *"For major and minor national road projects, the emerging preferred option will include the appropriate active travel intervention"*

The primary objective of such provision is to ensure that the infrastructure is provided to enable purposeful journeys to be completed by active means where demand for such exists.

The Preferred Transport Solution comprises an off-line alignment to the south of the existing N4 which commences at Node A at Cloongownagh and immediately deviates from the existing N4. It continues eastwards hugging the north of the railway line, crosses over the R368 to the east of the railway station and includes a new link road at Node C to connect south to the R368 (Elphin Road), before crossing the River Shannon at Cordrehid. It re-joins the existing N4 with a roundabout junction at Node D at Lissenghan. An on-line upgrade of the existing alignment is proposed between Node D at Lissenghan to Node J at Drumsna Junction and on to Node H at Faulties. This on-line alignment will include a rationalisation of the existing junctions and accesses to improve safety and the standard of the existing carriageway. Refer to Plate 9.1.1 and Figures 9.1.1.0 to 9.1.1.7. The level of intervention within this corridor will be determined at Phase 3 Design and Environmental Evaluation.

The Preferred Transport Solution also includes the Black Option Corridor which provides a necessary connection between the R280 and Summerhill and onto the Castlecarra Road as it offered improvements to the overall transport solution when combined with the other elements.

In summary, the road component of the Preferred Transport Solution i.e., the Preferred Option Corridor, includes the following:

- An urban road to the northeast of the town of length 1km from the R280 Leitrim Road to Summerhill the Castlecarra Road
- A southern off-line corridor from west of Cortober to east of Carrick-on-Shannon of length 5.5km
- An on-line corridor from east of Carrick-on-Shannon to join the existing N4 Dromod Roosky Bypass of length 12.5km

This Preferred Option Corridor for the N4 seeks to optimise and improve the existing infrastructure for approximately 70% of its length which is in line with current national and international policy in terms of sustainability and climate change.

Furthermore, this Preferred Option Corridor follows the same path as the previous Emerging Preferred Option Corridor (EPRC) developed in 2012 from the townland of Tully east of Carrick-on-Shannon along the N4 to west of Aghamore and, again, from east of Aghamore to the join the existing N4 Dromod Roosky Bypass, a total length of overlap of approximately 8km or 44%.

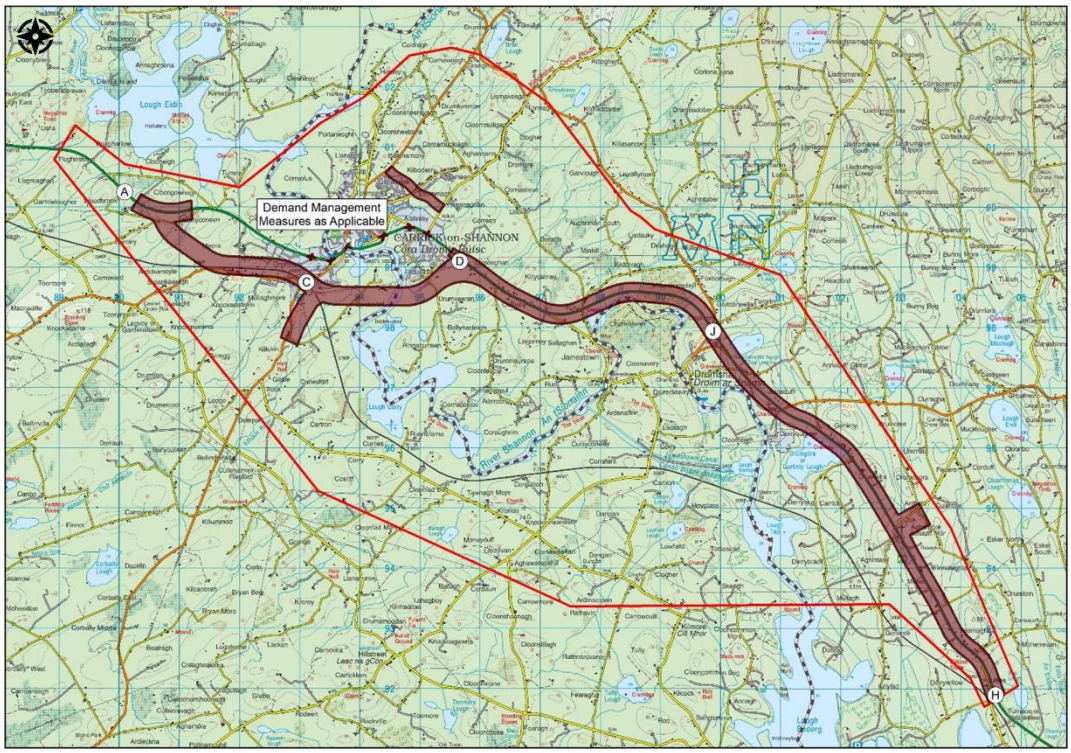

Plate 9.1.1 Preferred Transport Solution

9.2 Public Display of Preferred Transport Solution

The Preferred Transport Solution for the project went on public display at an in-person event on 18 and 19 May 2022 in the Landmark Hotel, Carrick-on-Shannon, Co. Leitrim to inform the public of the Preferred Transport Solution. A report detailing the outcomes from the display is contained in Appendix A.9.1.1.

9.3 Cost Estimate of the Preferred Transport Solution

The Preferred Transport Solution, namely the Black, Cyan and Green Option Corridors plus demand management measures, demonstrates the best value for money.

The cost estimate range for the Preferred Transport Solution, which is a combination of demand management measures including provision for active travel, the Black Option Corridor, the Cyan Option Corridor and the Green Option Corridor is in the Category D cost range i.e. €250M to €500M.

9.4 Project Appraisal Balance Sheet of the Preferred Transport Solution

The Project Appraisal Balance Sheet (PABS) is a summary appraisal of the impacts of the project; and is based on the results of the numerous assessments carried out during the foregoing stages of the project. The PABS is utilised as a tool to summarise the expected impacts of the proposed capital investment. The PABS is completed at the end of the Option Selection phase on the Preferred Transport Solution and is updated again during the ensuing stages of the project.

The PABS is based on both a qualitative and quantitative evaluation of a range of criteria and elements as outlined in the Department of Transport Common Appraisal Framework namely, Environment, Safety, Economy, Accessibility and Social Inclusion, Integration and Physical Activity. A detailed multi-criteria analysis of each criterion was completed on the various alternatives and options under consideration in Chapter 8. This summary assessment is now completed using the PABS template on the Preferred Transport Solution.

The PABS is comprised of four sections as follows:

1. Part A: This contains general information on the project
2. Part B: This section deals only with the environmental appraisal of the project. A summary rating of the scale of impact on each of the environmental elements is proposed. At the end of the spreadsheet, a summary ranking for the environment section is automatically generated based on the individual scales presented for each element
3. Part C: This section includes an assessment of each of the remaining five appraisal criteria namely, Safety, Economy, Accessibility and Social Inclusion, Integration and Physical Activity
4. Part D: This is the PABS Summary Sheet which is automatically populated based on Part A, B and C inputs

A copy of the completed Project Appraisal Balance Sheet is included in Appendix A.9.4.1.

9.4.1 PABS Part A

This section contains some general background on the project being assessed, including a brief project description, funding possibilities, project cost and project management information.

9.4.2 PABS Part B

This section deals only with the environmental impacts of the project. The environmental assessments included in Chapters 6, 7 and 8 are used to inform the compilation of Part B. The Environment criterion is an accumulation of many disciplines with the emphasis and importance of the different disciplines varying depending on the particular association and interaction with the receiving environment.

At the conclusion of Phase 2, the overall qualitative scale of impact of the Preferred Transport Solution as extracted from the PABS Part B for Environment is as follows:

- Highly Negative

The following paragraphs identify the key environmental receptors potentially impacted.

Based on the existing baseline and in the absence of considering mitigation measures, the following receptors could potentially be impacted by the Preferred Transport Solution:

- Archaeology, Architectural and Cultural Heritage – There is one profound impact which is a mound located south of the existing N4 in Tully, 37 very significant impacts, 10 moderately negative impacts and 29 slightly negative impacts to a range of heritage assets including archaeological and built heritage sites on the Preferred Transport Solution. The on-line upgrade requires the least amount of previously undisturbed greenfield.
- Hydrology – The key criteria in the selection of the southern bypass option as part of the Preferred Transport Solution is the impact on flood risk associated with the loss of the River Shannon floodplain and the impact on the Carrick-on-Shannon public water supply abstraction source from the River Shannon. The abstraction location is 1km upstream of the existing River Shannon Bridge in Carrick-on-Shannon and therefore driving the decision to cross the River Shannon downstream of Carrick-on-Shannon. The southern option will therefore provide limited risk of water quality impact on the source.
- Climate – The northern options generate more emissions than the southern options. The Cyan Option Corridor was preferred over the Orange Option Corridor due to less operational emissions being generated. The recommended on-line corridor to the east is strongly preferred from a climate perspective, with a significantly lower quantity of embodied carbon associated with its construction.
- Material Assets Non-Agriculture – 10 no. residential properties and 1 no. commercial properties are potentially impacted with 4 no. residential acquisitions from Nodes A-D, 2 no. residential acquisitions from Nodes D to J and 4 no. residential acquisitions from Node J to H. There are potentially five impacts to 110kV electrical lines, and two impacts to high voltage underground lines.
- Biodiversity – Given the protection currently afforded to pNHAs under planning objectives contained within the Leitrim County Development Plan and the high impact on internationally important sites, the northern options were less preferred than the southern options.

In making this recommendation, it is acknowledged that the Preferred Transport Solution to the west of Drumsna has residential and commercial impacts. The Stage 2 indicative designs remain relatively conservative at this stage, with scope to refine the design and lessen the potential environmental impact during Phase 3. The project also offers opportunities to enhance the receiving environment and deliver

mutual gains which may serve to mitigate the potential negative impacts that such a project may cause, and this will be developed during Phase 3.

9.4.3 PABS Part C

Part C of the PABS deals with the remaining five criteria for the assessment, namely, Safety, Economy, Accessibility and Social Inclusion, Integration and Physical Activity. Each of these is discussed in the following sections.

9.4.3.1 Safety

The speed reductions in the urban area proposed as part of the demand management measures in the Preferred Transport Solution and the reduction in congestion through the urban area will reduce both the likelihood and severity of collisions. A substantial number of direct accesses off the existing N4, in particular between Nodes D and H are typically sub-standard. Many of these accesses are inconsistent in layout and exhibit sub-standard design elements, including restricted visibility and inadequate provision for safe movements onto the existing N4.

The rationalisation of accesses and junctions between Nodes D and H along the existing N4 is expected to contribute to a safer environment for active travel as a result of the proposed scheme. It is proposed that active travel facilities provided as part of the scheme will, in conjunction with other Local Authority schemes, contribute to the provision of an integrated active travel network which is safe, inclusive and connected.

The provision of the urban street to the north of Carrick-on-Shannon removes additional traffic from the north-eastern area of the town further increasing the safety of all users.

The value of accident reduction as output from COBALT, and reflected in the Part C and D of the PABS is represented as close to zero. The marginally negative benefits can be attributed to how COBALT calculates benefits i.e. it uses a simplistic approach whereby collisions are calculated on the basis of an assumed collision rate which varies across a very minimal range of link types, and does not include for the expected lower collision risk in the section of 30km/h through Carrick-on-Shannon and Cortober arising from the implementation of the demand management measures.

At the conclusion of Phase 2, the overall qualitative scale of impact for Safety is Highly Positive.

9.4.3.2 Economy

The specific road based interventions will better manage congestion by improving the national, regional and local road infrastructure to better support the strategic N4 route by reallocating many local vehicle trips and catering for these trips utilising a more efficient and appropriate mode.

The Preferred Transport Solution represents good value for money by providing benefits to both road based public transport vehicles and private/commercial

vehicles. It also provides an opportunity to enhance the social value of Carrick-on-Shannon and Cortober that will benefit from reduced congestion and enhanced walking, cycling and public transport. An improvement in AM and PM peak period journey times is anticipated by virtue of the proposed transport solution.

A measure of economic efficiency is the Benefit to Cost Ratio, which shows how projects could increase overall welfare after allowing for the cost of implementation of the project. The total benefits of the Preferred Transport Solution derived from the assessment indicate a return for investment.

At the conclusion of Phase 2, the overall qualitative scale of impact for Economy is Slightly Positive.

9.4.3.3 Accessibility and Social Inclusion

The components of the Preferred Transport Solution, including the road based and demand management measures, will improve accessibility between the northwest and east, with the inclusion of new parallel linkages between Lisseeghan and Drumsna Junction. It is expected to provide greater opportunity to enhance the fragmented regional and local road network along the N4. Moreover, these parallel links should generate significant positive effects for certain vulnerable groups, including pedestrians and cyclists whilst also improving the connectivity to public transport within the study area.

The implementation of the demand management measures within Carrick-on-Shannon will alleviate congestion by removing up to 10% of the current traffic volumes from the town centre. The rationalisation of parking within Carrick-on-Shannon town centre will encourage a modal shift and generate a more inclusive and vibrant community. The introduction of the new urban street to the north of Carrick-on-Shannon will also remove traffic from the town further improving access and connectivity within Carrick-on-Shannon and Cortober.

At the conclusion of Phase 2, the overall qualitative scale of impact for Accessibility and Social Inclusion is Slightly Positive.

9.4.3.4 Integration

The Preferred Transport Solution supports the objectives of national, regional and local planning policy and is compatible with adopted land-use objectives. The enhancements proposed within the Preferred Transport Solution meets the objectives of the TEN-T network by delivering greater efficiency through the removal of bottlenecks, the bridging of missing links within the strategic transport network and by ensuring safe, secure and high-quality standards for both passenger and freight transport. The project will further strengthen access to key ports in line with the objectives of the Regional Spatial and Economic Strategy

The Preferred Transport Solution will ultimately facilitate the delivery of a project which addresses an existing deficiency gap in the national primary network which greatly improves connectivity of the strategic road network. The improved N4 link also provides a vital link from Dublin and the east of the country to the northwest region. The Preferred Transport Solution will provide improved transport

infrastructure for use by public transport bus routes which serves to integrate transport modes. The provision of supporting facilities for active travel modes also offers benefits to the overall integration of the ultimate transport solution.

Overall, the Preferred Transport Solution is considered highly positive in terms of realising the goals of the NPF, particularly in relation to the key policy objective of "Enhanced Regional Accessibility".

At the conclusion of Phase 2, the overall qualitative scale of impact for Integration is Highly Positive.

9.4.3.5 Physical Activity

The Preferred Transport Solution achieves a significant reduction in traffic levels in the town centre area of Carrick-on-Shannon and Cortober, where there is a high prevalence of recreation activities along the River Shannon, and in doing so improves access to such facilities and encourage road users to make trips by walking and/or cycling.

The Preferred Transport Solution also offers opportunity to improve on physical activity by improving safety for cyclists over the section of the proposed online upgrade to the existing N4.

At the conclusion of Phase 2, the overall scale of impact for Physical Activity is considered Moderately Positive.

9.4.4 PABS Part D

Part D of the PABS is a summary statement of the assessment which is compiled on the basis of the input to Parts A, B and C. The summary provides an overall scale of impact for the six CAF criteria of Economy, Safety, Accessibility and Social Inclusion, Integration and Physical Activity .

A copy of the completed Project Appraisal Balance Sheet is included in Appendix A.9.4.1.

9.5 Recommendation of Preferred Transport Solution

As detailed in Chapter 2, NIFTI is the Department of Transport's high-level, strategic framework for future investment in the land transport network in Ireland. The purpose of the NIFTI is to support the delivery of the National Planning Framework (NPF). It aligns with the *Common Appraisal Framework for Transport Projects and Programmes* (CAF), with TII Project Management Guidelines, and TII Project Appraisal Guidance. Therefore, the starting point in terms of transport infrastructure provision was to determine what can be achieved by the alternatives (modal hierarchy) to meet the project objectives. Thereafter, optimisation of the existing infrastructure was considered before advancing to the provision of new infrastructure (intervention hierarchy).

As detailed in Chapter 8, the alternatives i.e. active travel measures, public transport improvement measures (bus and rail) and demand management measures in isolation do not meet the project objectives. Therefore, consideration was next given as to what level of intervention for the road alternative is necessary to meet the project objectives.

The initial step in the intervention hierarchy is reutilise as much of the existing road as possible. The Preferred Transport Solution incorporates 12.5km of upgrades to existing road infrastructure to the east of Carrick-on-Shannon. A new urban street (1km) in the northeast of the town forms part of the Preferred Transport Solution to relieve congestion in that quadrant of the town. Finally, new road infrastructure (5.5km) is included in the Preferred Transport Solution to bypass the town to the south.

Project appraisal of the N4 Carrick-on-Shannon to Dromod Project has demonstrated that the Preferred Transport Solution has a positive scaling statement on five of the six assessment criteria, and a negative scaling statement on one criterion. The economic assessment has demonstrated that, based on the scheme costs developed to date and the associated forecast performance of the transport network, the Preferred Transport Solution represents value for money. During Phase 3 (Design and Environmental Evaluation), work will focus on undertaking further assessments to ascertain risks to key constraints and where such risks manifest, to refine and develop the design such that impacts to sensitive receptors can be avoided or minimised.

The recommendation of this Phase 2 Option Selection Report is to advance the Preferred Transport Solution shown in Figures 9.1.1.0 to 9.1.1.7 and demand management measures in Figure 8.7.3.0 as the optimum option to meet the project objectives outlined in Chapter 1 of this report. Table 9.1 outlines in summary how the Preferred Transport Solution for the N4 project delivers on the project objectives.

Table 9.1 Preferred Transport Solution and Project Objectives

Objective Criteria	Project Specific Objectives	Preferred Transport Solution
	• To provide a reliable transport system over the N4 corridor extents under consideration and to contribute to efficient connectivity between the Northern and Western Regions with Dublin and the Eastern and Midland Regions to balance regional development • To provide a solution that offers good value for money and reduces the cost of travel • To provide opportunities to enhance the future tourism and economic prospects of Carrick-on-Shannon and the wider northwest regions of Roscommon, Leitrim, Sligo and Donegal	The specific road based interventions will better manage congestion by improving the national, regional and local road infrastructure to better support the strategic N4 route by removing many local trips and catering for these in a more efficient and appropriate mode. The preferred transport solution achieves a value for money scheme, which provides benefits to road users and public transport users alike. An improvement in AM and PM peak period journey times is anticipated by virtue of the interventions proposed.
	• To reduce the potential for collisions and severity of collisions by providing a safer travelling environment for all road users over the N4 corridor extents under consideration supporting the RSA Road Safety Strategy 2013 – 2020 • To reduce the potential for conflict with vulnerable road users within built-up areas of Carrick-on-Shannon, Cortober and Aghamore	The safety of road users is expected to be significantly improved as a result of the interventions proposed along the corridor. An intrinsic element of the Preferred Transport Solution is the rationalisation of the existing junctions and accesses along the N4, many of which are non-standard and presently inhibit the safe operation of this strategic route. The relocation of strategic traffic onto the proposed off-line bypass significantly reduces the number of conflict points on the strategic route. The introduction of the new urban street to the north of Carrick-on-Shannon removes additional traffic from the north-eastern area of the town further increasing the safety of all users. The inclusion of the new urban street to the north of Carrick-on-Shannon and parallel roads as part of the measures along with the application of signalised junctions further reduce conflict with vulnerable road users.

Objective Criteria	Project Specific Objectives	Preferred Transport Solution
	• To provide opportunities to enhance the local amenity and heritage value of the area • To ensure consideration of sustainable development principles and measures to minimise the effects on the environment to support the government's Climate Action Plan • To minimise impacts on designated Natura 2000 sites in the vicinity of the study area • To minimise the impact to local watercourses and associated flood plains, in particular the River Shannon • The proposed scheme will seek to reduce noise and air impacts in the various settlements along the corridor	The Preferred Transport Solution remains close to Carrick-on-Shannon and Cortober environs providing connectivity to the local amenities, whilst the eastern section predominantly utilises the existing N4 corridor for the most, thus maximising the value and sustainable use of existing infrastructure. The recommended on-line corridor is strongly preferred from a climate perspective, with a significantly lower quantity of embodied carbon associated with its construction. Detailed assessments of predicted noise impacts will be undertaken during Phase 3 (Design & Environmental Evaluation). Opportunities exist along the corridor to incorporate noise mitigation measures as part of the improvement works which have the potential to result in positive impacts to existing properties and receptors. Impacts on watercourses and floodplains have been limited where possible with the highest risk of potential contamination during the construction phase. The preferred transport solution does not impact on any heritage sites of national importance.
	• Improve accessibility to key facilities, such as employment, education, transport and healthcare to satisfy transport demand for all trip types for all modes of transport on the national road transport network • To provide opportunities to enable the successful creation of place making and generation of a vibrant community in Carrick-on-Shannon • Facilitate the enhancement of sustainable travel and improved connectivity to public transport opportunities • To improve connectivity across the River Shannon and in turn support social and economic development within this regional strategic town and its hinterland	The components of the Preferred Transport Solution, including road based and demand management measures will improve accessibility between the northwest and east, with the inclusion of new parallel linkages between nodes D and J, expected to provide greater opportunity to enhance the fragmented regional and local road network along the N4. Moreover, these parallel links should generate significant positive effects for certain vulnerable groups, including pedestrians and cyclists whilst also improving the connectivity to public transport within the study area. The implementation of the demand management measures within Carrick-on-Shannon will alleviate congestion by removing up to 10% of the current traffic volumes from the town centre. The rationalisation of parking within Carrick-on-Shannon town centre will encourage a modal shift and generate a more inclusive and vibrant community. The introduction of the new urban street to the north of Carrick-on-Shannon will also remove traffic from the town further improving access and connectivity within Carrick-on-Shannon.

Objective Criteria	Project Specific Objectives	Preferred Transport Solution
	• To support sustainable growth in Carrick-on-Shannon through the creation of an attractive environment to encourage sustainable trips • To achieve the goals of the TEN-T comprehensive network by providing high quality links which will contribute to enhancing social cohesion within Ireland and across the EU, further supporting the integration of all transport modes within the wider region, integrating with regional public transport facilities • To support the integration objectives to balance the social and economic development in the Northwest Region as set out in national and regional policies	The Preferred Transport Solution will ultimately facilitate the delivery of a project which addresses an existing deficiency gap in the national primary network which greatly improves connectivity of the strategic road network. The improved N4 link also provides a vital link from Dublin and the east of the country to the northwest region. The Preferred Transport Solution will provide improved transport infrastructure for use by public transport bus routes which serves to integrate transport modes. The provision of supporting facilities for active travel modes also offers benefits to the overall integration of the ultimate transport solution. The enhancements proposed within the Preferred Transport Solution meets the objectives of the TEN-T network by delivering greater efficiency through the removal of bottlenecks, the bridging of missing links within the strategic transport network and by ensuring safe, secure and high-quality standards for both passenger and freight transport. The scheme will further strengthen access to key ports in line with the objectives of the Regional Spatial and Economic Strategy. The Preferred Transport Solution supports the objectives of national, regional and local planning policy and is compatible with adopted land-use objectives.
	• To enable walking and cycling opportunities in a safer environment for the communities along the corridor • To create a healthy environment conducive to active travel for the communities along the corridor	The Preferred Transport Solution achieves a significant reduction in traffic levels in the town centre area, where there is a high prevalence of recreation activities along the River Shannon, and in doing so improves access to such facilities and encourages road users to make trips by walking and/or cycling. It also offers an opportunity to improve on physical activity by improving safety for cyclists over the existing N4

Glossary of Terms

Alluvial soils	Are located adjoining rivers, streams and lakes and have been formed due to the deposition of soil particles from periodic flooding events. These soils may have restricted uses due to periodic flooding but are often fertile and suitable for grassland and tillage.
Ambient noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
Annex I Bird species	Annex I of the Birds Directive lists 193 bird species and sub-species which are: i) in danger of extinction, ii) vulnerable to specific changes in their habitat, iii) considered rare because of small populations or restricted local distribution and / or, iv) require particular attention for reasons of the specific nature of habitat. Article 4 of the Birds Directive has classified a number of Special Protection Areas (SPAs) for regularly occurring migratory birds and those birds listed on Annex I of the directive.
Annex I Habitat (including Priority)	Habitat types whose conservation requires the designation of Special Areas of Conservation. Priority habitats, which are in danger of disappearing within the EU territory, are highlighted with an asterisk.
Annex II Species	Animal and plant species whose conservation requires the designation of Special Areas of Conservation.
Appropriate Assessment	An Appropriate Assessment involves a case by case examination of the implications of a development or activity for a Natura 2000 site and its conservation objectives. The EU Habitats Directive (92/43/EEC) placed an obligation on Member States of the EU to establish the Natura 2000 Network. The Natura 2000 Network is a network of important ecological sites across the European Union and include Special Areas of Conservation (SACs) established under the Habitats Directive and Special Protection Areas (SPAs) established under the EU Birds Directive (79/409/EEC).
Architectural Conservation Areas	An Architectural Conservation Area (ACA) is defined as: “A place, area, group of structures or townscape, taking account of building lines and heights, that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or that contributes to the appreciation of a protected structure, and whose character it is an objective of a development plan to preserve.” Chapter 2 of Part 4 of the Planning and Development Act 2000, as amended outlines that all development plans must now include objectives for preserving the character of ACA’s. As such ACA’s are subject to statutory protection and are a key constraint.
Baseline	Work done to collect and interpret information on the condition / trends of the existing environment. This can be used to establish a baseline state against which future change is measured.
Biodiversity	Contraction of “biological diversity”. Biodiversity reflects the number, variety and variability of living organisms. The number and variety of species found in a given area in a region.
Birds Directive	Directive 2009/147/EC of the European Parliament & of the Council of 30 November 2009 on the conservation of wild birds.
Brown Earth Soils	Well drained soils with distinctly coloured horizons (layers). These soils are fertile and productive from an agricultural perspective being suited to tillage and grassland.
Buffer zone	The region adjacent to the border of a protected area; a transition zone between areas managed for different objectives.

Bullaun stone	The term 'bullaun' (from the Irish word 'bullán', which means a round hollow in a stone, or a bowl) is applied to boulders of stone or bedrock with hemispherical hollows or basin-like depressions, which may have functioned as mortars. They are frequently associated with ecclesiastical sites and holy wells and so may have been used for religious purposes. Other examples which do not appear to have ecclesiastical associations can be found in bedrock or outcrop in upland contexts, often under blanket bog, and are known as bedrock mortars. They date from the prehistoric period to the early medieval period (5^{th}-12^{th} centuries AD).
Burial ground	An area of ground, set apart for the burial of the dead, not associated with a church. These date from the medieval period (5^{th} - 16^{th} centuries AD) onwards.
Burial mound	An earthen or earthen and stone mound which contains burials. This classification is applied specifically to burial mounds which are medieval or later in date. For prehistoric examples see barrows.
Burnt mound	A circular or irregularly shaped mound of material consisting of burnt stones, ash and charcoal with no surface evidence of a trough or depression. Levelled examples can appear as a spread containing burnt stones. These can be of any date from the Bronze Age (c. 2400-500 BC) to the early medieval period (5^{th} - 12^{th} century AD). See also Fulacht fia.
Burnt pit	A subcircular or sub-rectangular pit which has evidence of in situ burning and contains a mixture of charcoal and/or fire-cracked stones. These pits have been also been called fire pits, roasting pits and boiling pits. They are part of a cooking/industrial tradition which continues from the Bronze Age up to the medieval period (c. 2400 BC - 16th century AD).
Burnt spread	An area of charcoal-enriched soil indicative of an activity associated with burning. These may be of any date from prehistory onwards.
Castle - motte	An artificial, steep-sided, earthen mound on or in which is set the principal tower of a castle. Constructed by the Anglo-Normans in the late 12th and early 13^{th} century AD.
Castle - motte and bailey	An early form of castle consisting of a flat-topped, steep-sided, earthen mound supporting a wooden tower, with an associated courtyard or bailey, which is often raised and enclosed by a bank and fosse. Constructed by the Anglo-Normans in the late 12^{th} and early 13^{th} century AD.
Castle - tower house	A fortified residence in the form of a tower, usually four or five storeys high, and for the most part slightly more rectangular than square in plan. They were constructed by a lord or landholder and were often partially or completely enclosed by a bawn. The majority date to the 15^{th} and 16^{th} centuries AD.
Cist	A rectangular or polygonal structure used for burial purposes, constructed from stone slabs set on edge and covered by one or more horizontal slabs or capstones. Cists may be built on the surface or sunk into the ground or set within a cemetery cairn or cemetery mound. They date to the Bronze / Iron Ages (c. 2400 BC - AD 400).
CO	Carbon Monoxide
DAU	Development Applications Unit at NPWS – the division of NPWS for which all official communications (with the exception of Wildlife licencing Unit) in respect of planning enquiries consultations are submitted.
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
Demesne Landscapes	The first edition Ordnance Survey map of Counties Leitrim and Roscommon shows the extent of demesne landscapes across the landscape as shaded areas of land. These were established as a naturalised landscaped setting for the large houses of the landed gentry. Later early 20th century OS mapping can also

	indicate demesne extent, although they are not shaded. Not all demesne landscapes are subject to statutory protection. However, where a demesne exists in association with a protected structure (dependant on the preservation of the landscape), protection can be interpreted as extending to the limits of the curtilage and as such falls within the remit of the Planning and Development Act 2000, as amended.
Designed landscape - tree-ring	A wall, bank, fosse or an earthwork platform, or any combination of these, usually circular or oval in plan, used to define or enclose a cluster of ornamental trees. These date from the 17th to the 19th century AD.
Designated Site	A geographically defined area through legal or other effective means, which is designated or regulated and managed to achieve specific conservation objectives.
Ecclesiastical enclosure	A large oval or roughly circular area, usually over 50m in diameter, defined by a bank/banks and external fosse/fosses or drystone wall/walls, enclosing an early medieval church or monastery and its associated areas of domestic and industrial activity. These date to the early medieval period (5th-12th centuries AD).
Ecology	The branch of science concerned with the interrelationship of organisms and their environment; the study of ecosystems.
Enclosure	An area defined by an enclosing element (e.g. bank, wall, fosse, scarp), or indicated as such cartographically, and occurring in a variety of shapes and sizes, possessing no diagnostic features which would allow classification within another monument category. These may date to any period from prehistory onwards. Enclosures with a diameter greater than 70m should be classed as Large Enclosure.
ETS	Emissions Trading Scheme
Excavation - miscellaneous	A feature or group of features of indeterminate function revealed by excavation that cannot be assigned to a particular monument class. These may date to any period from prehistory onwards.
Fauna	All of the animals found in a given area.
Flat cemetery	Three or more individual burials, in pits or cists, related to one another by rite, grave goods or simply by their close proximity to one another. These are not covered by a mound and are dated to the Bronze Age (c. 2400 - 500 BC).
Flora	All of the plants found in a given area.
Fulacht fia	A horseshoe-shaped or kidney-shaped mound consisting of fire-cracked stone and charcoal-enriched soil built up around a sunken trough located near or adjacent to a water supply, such as a stream or spring, or in wet marshy areas. The first recorded use of the Irish term 'fulacht fiadh/fia' (cooking pit of the deer or of the wild) as relating to ancient cooking sites was in the 17th century. These are generally interpreted to have been associated with cooking and date primarily to the Bronze Age (c. 2400 - 500 BC). See also Burnt Mound.
Green Infrastructure	An interconnected network of natural areas and open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife.
Habitat	A place or type of site where an organism or population naturally occurs.
Habitat degradation	The diminishment of habitat quality, which results in a reduced ability to support flora and fauna species. Human activities leading to habitat degradation include polluting activities and the introduction of invasive species. Adverse effects can become immediately noticeable, but can also have a cumulative nature. Biodiversity will eventually be lost if habitats become degraded to an extent that species can no longer survive.

Habitat loss The outcome of a process of land use change in which a 'natural'; habitat-type is removed and replaced by another habitat-type, such as converting natural areas to production sites. In such process, flora and fauna species that previously used the site are displaced or destroyed. Generally this results in a reduction of biodiversity.

Habitats Directive The Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats & of wild fauna & flora, which aims to promote the maintenance of biodiversity in Europe, taking account of economic, social, cultural & regional requirements. The EU Habitats Directive, together with the Birds Directive, forms the cornerstone of Europe's nature conservation policy, and establishes the EU-wide Natura 2000 ecological network of protected areas. Annex I & Annex II list natural habitats & species (both animal & plant) of community interest whose conservation requires the designation of Special Areas of Conservation by Member States. The Habitats Directive is transposed into Irish law under the European Communities (Birds & Natural Habitats) Regulations 2011 (S.I.477 of 2011), as amended, and, as regards forestry developments, by the Forestry Regulations 2017 (S.I.191 of 2017), as amended.

Habitation site A concentration of archaeological features which are indicative of habitation, the remains being insufficient to allow a more specific classification. These may be of any date up to the medieval period (5^{th} - 16^{th} centuries AD).

Hearth A place where a fire is made but where there is insufficient evidence to indicate habitation. These may date to any period from prehistory (c. 8000 BC - AD 400) to the medieval period (5th-16th centuries AD).

IFI Inland Fisheries Ireland - the state agency responsible for the conservation, protection, management, marketing, development and improvement of our inland fisheries and sea angling resources.

L_{den} 24-hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ (plus a 5 dB penalty) and the L_{night} (plus a 10 dB penalty). L_{den} is calculated using the following formula, as defined within the Environmental Noise Regulations (S.I. No. 140/2006).

Where:

$$L_{den} = 10log\left(\frac{1}{24}\right)\left(12 * \left(10^{\frac{Lday}{10}}\right) + 4 * \left(10^{\frac{Levening+5}{10}}\right) + 8 * \left(10^{\frac{Lnight+}{10}}\right.\right.$$

$L_{evening}$ The A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The 4hr evening period is between 19:00hrs and 23:00hrs.

L_{night} The A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The 8hr night-time period is between 23:00hrs and 07:00hrs.

L_{day} The A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the day periods of a year. The 12hr daytime period is between 07:00hrs and 19:00hrs.

Kiln - corn-drying A structure used for drying corn before it is ground. These are also known as cereal-drying kilns. These date from the medieval period (5^{th}-16^{th} centuries AD) onwards.

Local Area Plan (LAP): Local Area Plans are statutory plans covering specifically defined local areas. They must be adhered to in guiding development in the areas to which they refer.

Luvisols These are soils where there has been an accumulation of clay in the lower horizon compared to the upper horizon. This movement of clay has occurred over a long time due to downward percolation of water across the soil profile. Where limed and fertilised these soils are generally productive from an agricultural perspective and suited to grassland and tillage.

Megalithic structure	A construction of large stones of 'megalithic' proportions which, though comparable in certain respects with megalithic tombs, cannot be classified as any other known archaeological monument type on present evidence. These may date from the prehistoric period onwards.
Mound	An artificial elevation of earth or earth and stone of unknown date and function which cannot be classified as any other known archaeological monument type on present evidence.
Mt CO2 eq	Million tonnes of carbon dioxide equivalent.
National Monuments	A national monument, as recorded on the National Monuments in State Care database, receives statutory protection, and is described as the following in Section 2 of the National Monuments Act 1930, as amended: "a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto."
Native species	Flora and fauna species that occur naturally in a given area or region. Also referred to as indigenous species.
NO_2	Nitrogen Dioxide.
NO_x	Nitrogen Oxides.
Noise sensitive location	NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
Non-Native Alien Species or Invasive Species	An introduced species (intentionally or unintentionally) to an ecosystem in which they do not naturally appear and which threaten habitats, ecosystems, or native species. These species become invasive due to their high reproduction rates and by competing with and displacing native species, that naturally appear in that ecosystem. Unintentional introduction can be the result of accidents (e.g. when species escape from a zoo), transport (e.g. in the ballast water of a ship); intentional introduction can be the result of e.g. importing animals or plants or the genetic modification of organisms.
NPWS	National Parks and Wildlife Service at the Department of Housing, Local Government and Heritage. The state agency charged with securing the conservation of wildlife in Ireland and for overseeing management of sites designated for conservation purposes.
Peat soils	Form where there is severely restricted drainage and a wet climate. These are poorly productive from an agricultural point of view.
$PM_{2.5}$	Particulate Matter of less than 2.5 microns in diameter.
PM_{10}	Particulate matter of less than 10 microns in diameter.
Policies and Objectives	Policies emanate from a development plan's core strategy and set out the general direction to be adopted and pursued by the Planning Authority to achieve the proper planning and sustainable development of its area. Objectives, on the other hand, are more specific and refer to actual programmes which will go towards achieving a policy or strategy.
Preservation Orders	Preservation Orders and/or Temporary Preservation Orders can be assigned to a site or sites that are deemed to be in danger of injury or destruction. These are allocated under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Amendment of the National Monuments Act, 1930. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the

	vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister of Culture, Heritage, and the Gaeltacht.
Protected Structures	Structures of architectural, cultural, scientific, historical, or archaeological interest are protected under the Planning and Development Act, 2000 as amended, where the conditions relating to the protection of the architectural heritage are set out in Part IV of this Act. The Planning and Development Act, 2000 as amended defines a protected structure as: "(a) a structure, or (b) a specified part of a structure which is included in a Record of Protected Structures (RPS), and, where that record so indicates, includes any specified feature which is in the attendant grounds of the structure and which would not otherwise be included in this definition. Protection of the structure or part thereof, includes conservation, preservation, and improvement compatible with maintaining its character and interest." Buildings recorded in the RPS can include Recorded Monuments, structures listed in the NIAH or buildings deemed to be of architectural, archaeological, or artistic importance by the Minister of Culture, Heritage, and the Gaeltacht. It is noted that inclusion within the NIAH survey does not afford statutory protection. However, the structure may be added to the RPS by the relevant local authority. As such, these buildings should be considered to be constraints.
Record of Monuments and Places	Section 12 (1) of the National Monuments Act 1930, as amended provides that the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for Culture, Heritage and the Gaeltacht) shall establish and maintain a RMP where it is known that such monuments exist. The record comprises a list of monuments and relevant places and supporting mapping showing each monument and relevant place in respect of each county in the State. Sites recorded on the RMP all receive statutory protection under the National Monuments Act 1930, as amended.
Red List	The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on taxa that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e. are Data Deficient); and on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e. are Near Threatened).
Regional Spatial and Economic Strategy	Strategy governing the planning and development of one of three regions in the country which sets out the regional implementation of national planning policies.
Ribbon Development	The building of houses in a continuous row along a public roadway.
Ring-ditch	A circular or near circular fosse, usually less than 20m in diameter and visible as cropmarks / soilmarks on aerial photographs. The function of these monuments is unknown as ring-ditches may be the remains of ploughed out barrows, round houses or other modern features and, in consequence, may date to any period from prehistory onwards.
Riparian	Something related to, living on, or located at the banks of a watercourse, usually a river or stream
Ritual site - holy well	A well or spring, though in some unusual cases a natural rock basin, which usually bears a saint's name and is often reputed to possess miraculous healing

	properties. These may have their origins in prehistory but are associated with devotions from the medieval period (5th - 16th centuries AD) onwards.
Rock art	Geometric and other motifs mostly pecked out, though some are incised, on earthfast boulders and rock outcrops, and occasionally on cist roofstones and standing stones. These associations suggest a Bronze Age date (c. 2400 - 500 BC), though perhaps with origins in the Neolithic (c. 4000 - 2400 BC). Rock art may be associated with metal deposits, boundaries and routeways
Surface water gleys	Relatively poorly drained soils which develop over time under permanent or intermittent waterlogged conditions caused by high ground water table. The lower soil horizon (layer) has a 'gleyed' appearance i.e. a grey / blue colour caused by the lack of oxygen due to water. These soils are generally suited to grassland enterprises. Where drainage outfalls have been achieved they can be highly productive but may have a shorter grazing season due to the wet nature of the soil.
Waterbody	Mass of water distinct from other masses of water.
Watercourse	Natural or man-made channel through or along which water may flow.

References

Arup, 2021. N4 Carrick-on-Shannon to Dromod Preliminary Sources Study Report: 274219-ARUP-02-OS-RP-CG-000001 (See Appendix A.4.15.1)

Atherton, I., Bosanquet, S. & Lawley, M. 2010. Mosses and Liverworts of Britain and Ireland: A Field Guide. Latimer Trend & Co., Plymouth

Aurora, 2022. Network Maps. Available at: https://www.auroratelecom.ie/network-maps/

Ayres, B. Irish Railways. Available at: https://www.railscot.co.uk/Ireland/Irish_railways.pdf

Bing Aerial Mapping. Available at: https://www.bing.com/maps

Botanical Society of Britain & Ireland (BSBI), 2022. Online maps. Available at: https://bsbi.org/maps

Bus Éireann, 2020. View Timetables. Available at: https://www.buseireann.ie/

CEC (Commission of the European Communities), 2013. Interpretation manual of European Union Habitats EUR28. European Commission, DG Environment. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

Central Statistics Office, 2012. Census of Agriculture 2010 – Final Results. Available at: https://www.cso.ie/en/media/csoie/releasespublications/documents/agriculture/2010/full2010.pdf. Census of Agriculture 2020 – Preliminary Results. Available at: https://www.cso.ie/en/releasesandpublications/ep/p-coa/censusofagriculture2020-preliminaryresults/

Central Statistics Office, 2012. Census 2011 Reports. Available at: https://www.cso.ie/en/census/census2011reports/

Central Statistics Office, 2017. Census 2016 Reports. Available at: https://www.cso.ie/en/census/census2016reports/

Central Statistics Office, 2020. Databases, PxStat (CSO Main Data Dissemination Service), Business Sector, Census of Agriculture

Central Statistics Office, 2020. General Statistics Office-Census of Agriculture Mapviewer. Available at: http://census.cso.ie/agrimap/

Central Statistics Office, 2020. Livestock Survey Final (Table 4). Available at: https://www.cso.ie/en/releasesandpublications/er/clsjf/cropsandlivestocksurveyjunefinal2020/

Central Statistics Office, 2020. Statistics, Agriculture, Census of Agriculture 2010, Agrimap. Available at: http://census.cso.ie/agrimap/

Central Statistics Office, 2020. Statistics, Agriculture, Crops and Livestock June Final Results, Table 4. Available at: https://www.cso.ie/en/releasesandpublications/er/clsjf/cropsandlivestocksurveyjunefinal2018/

Chartered Institute for Ecology and Environmental Management (CIEEM), 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1.pdf

Colt, 2022. Fibre Availability Checker. Available at: https://www.colt.net/colt-network-map/

Department of Agriculture, Food and the Marine (DAFM), 2021. Irish Forestry Viewer. Available at: https://forestry-maps.apps.rhos.agriculture.gov.ie/

Department of Agriculture, Food and the Marine, 2022. Irish Forestry Geo-Portal. Available at: https://data.gov.ie/dataset/suggest/e08f7fc5-6fcb-4301-b996-49bacd0c4409

Department of Culture, Heritage and the Gaeltacht, 2017. National Biodiversity Action Plan 2017 – 2021. Available at: https://www.npws.ie/sites/default/files/publications/pdf/National%20Biodiversity%20Action%20Plan%20English.pdf

Department of Culture, Heritage, and the Gaeltacht, 2017. NIAH Handbook. Available at: https://www.buildingsofireland.ie/app/uploads/2019/10/NIAH-Handbook-Edition-September-2017.pdf

Department of Housing Planning and Local Government, 2018. Project Ireland 2040, National Planning Framework. Available at: https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

Department of Housing, Planning and Local Government, 2018. River Basin Management Plan for Ireland 2018-2021. Available at: https://www.gov.ie/en/publication/429a79-river-basin-management-plan-2018-2021/

Department of House, Planning and Local Government, 2021. National Planning Applications. Available at: https://data.gov.ie/dataset/national-planning-applications

Department of Housing, Local Government and Heritage, 2021. Planning and Development Act 2000. Available at: https://www.gov.ie/en/publication/c0ac2-planning-legislation-primary-legislation/

Department of Public Expenditure and Reform, 2021. National Development Plan 2021-2030, October 2021. Available at: https://www.gov.ie/en/publication/774e2-national-development-plan-2021-2030/

Department of the Environment, Climate and Communications, 2019. Climate Action Plan 2019. Available at: https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/

Department of the Environment, Climate and Communications, 2021. Climate Action Plan 2021. Available at: https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

Department of the Environment, Climate and Communications, 2023. Climate Action Plan 2023. Available at: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Department of the Environment, Climate and Communications, 2021. OPALS Viewer. Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=212642ca425f4739a36e247c64032b73

Department of the Environment, Heritage and Local Government, 2011. Air Quality Standards Regulations 2011. Available at: https://www.irishstatutebook.ie/eli/2011/si/180/made/en/print

Department of the Taoiseach, 2020. Programme for Government: Our Share Future. Available at: https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/

Department of Transport, 2013. National Ports Policy. Available at: https://www.gov.ie/en/publication/4aa3cc-national-ports-policy/

Department of Transport, 2016. Common Appraisal Framework for Transport Projects and Programmes, March 2016 (Updated October 2021). Available at: https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/

Department of Transport, 2019. Sectoral Adaptation Plan for Transport Infrastructure. Available at: https://www.gov.ie/en/publication/a2444e-sectoral-adaptation-plan-for-transport-infrastructure/

Department of Transport, 2021. National Investment Framework for Transport in Ireland, December 2021. Available at: https://www.gov.ie/en/publication/cfae6-national-investment-framework-for-transport-in-ireland-nifti/

Department of Transport, Tourism and Sport, 2019. Common Appraisal Framework for Transport Projects and Programmes, March 2016 Updated October 2019. Available at: https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/

Environmental Protection Agency (EPA), 2002. Environmental Protection Agency Guidelines on the Information to be contained in Environmental Impact Statements, 2002. Available at: http://www.epa.ie/pubs/advice/ea/guidelines/EPA_Guidelines_EIS_2002.pdf

Environmental Protection Agency (EPA), 2002. Guidelines on the Information to be contained in Environmental Impact Statements. Available at https://www.epa.ie/publications/monitoring--assessment/assessment/guidelines-on-information-to-be-contained-in-environmental-impact-statements-ei.php

Environmental Protection Agency (EPA), 2003. Advice Notes on Current Practice in the Preparation of Environmental Impact Statements. Available at: https://www.epa.ie/downloads/advice/ea/guidelines/epa_advice_on_eis_2003.pdf

Environmental Protection Agency (EPA), 2010. EPA Report – Focus on Landfilling in Ireland. Available at: http://www.epa.ie/pubs/reports/waste/stats/EPA_Focus_on_Landfilling_Ireland.pdf

Environmental Protection Agency (EPA), 2015. Draft Advice Notes for Preparing Environmental Impact Statements. Available at: https://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/Draft%20Guidelines%20on%20the%20Information%20to%20be%20contained%20in%20an%20EIS.pdf

Environmental Protection Agency (EPA), 2015. Environmental Protection Agency the Revised Advice Notes for Preparing Environmental Impact Statements (Draft, September 2015). Available at: https://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/Draft%20Advice%20Notes%20for%20preparing%20an%20EIS.pdf

Environmental Protection Agency (EPA), 2015. Extractive Industries Register. Available at: http://www.epa.ie/ei/#/register

Environmental Protection Agency (EPA), 2016. WFD Section 4 Discharges. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2017. Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR). Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/draft-guidelines-on-the-information-to-be-contained-in-environmental-impact-asse.php

Environmental Protection Agency (EPA), 2017. Environmental Protection Agency Revised Guidelines on the information to be contained in Environmental Impact Assessment Reports (Draft, August 2017). Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf

Environmental Protection Agency (EPA), 2017. Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft. Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf

Environmental Protection Agency (EPA), August 2017. Guidelines on the Information to be contained in Environmental Impact Assessment Report. Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf

Environmental Protection Agency (EPA), 2018. Corine Landcover. Available at: https://gis.epa.ie/GetData/Download.

Environmental Protection Agency (EPA), 2019. EPA Contours. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=088740d9f8ad466788fc25e268394656

Environmental Protection Agency (EPA). Air Quality Reports. Available at, http://www.epa.ie/pubs/reports/air/quality/

Environmental Protection Agency (EPA), 2020. Corine Landcover 2018. Available at http://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/e09739bf-abd1-4408-9fa5-510a156673ba

Environmental Protection Agency (EPA), 2020. Data available for download at http://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA). EPA Maps. Available at, https://gis.epa.ie/EPAMaps/

Environmental Protection Agency (EPA), 2020. EPA Webmapping Service Available at: https://gis.epa.ie/EPAMaps/
Environmental Protection Agency (EPA), 2021. GIS Mapping. Available at: https://gis.epa.ie/EPAMaps/
Environmental Protection Agency (EPA), 2020. Historic Landfill Application or Certificate of Authorisation. Available at: http://www.epa.ie/terminalfour/HLF/index.jsp?disclaimer=yes&Submit=Continue

Environmental Protection Agency (EPA), 2020. Historic Landfill-Certificate of Authorisation. Available at: http://www.epa.ie/terminalfour/HLF/HLF-search.jsp?status=Applied&Submit=Search+by+Status

Environmental Protection Agency (EPA), 2020. Historic Mines Project – Site Location. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2020. IE / IPC Register. Available at http://www.epa.ie/terminalfour/ippc/index.jsp?disclaimer=yes&Submit=Continue

Environmental Protection Agency (EPA). IED and IPC Licence Search. Available at https://gis.epa.ie/EPAMaps/

Environmental Protection Agency (EPA), 2020. Industrial Emissions (IE) and Integrated Pollution Control (IPC) Facilities. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2020. Local Authority Waste Facility Register. Available at: http://facilityregister.nwcpo.ie/

Environmental Protection Agency (EPA), 2020. Licensing and Permitting, Waste Licence Search. Available at: http://www.epa.ie/terminalfour/waste/

Environmental Protection Agency (EPA), 2020. Licensed UWWT Plants and 2018 Status. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2020. Licenced Waste Facilities. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2020. National Soils Map. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2020. Waste Licence Search. Available at: http://www.epa.ie/terminalfour/waste/index.jsp?disclaimer=yes&Submit=Continue

Environmental Protection Agency (EPA), 2020. Wastewater Discharge Authorisation Search. Available at: http://www.epa.ie/terminalfour/wwda/wwda-search.jsp?countyName=Leitrim&Submit=Search+by+County

Environmental Protection Agency (EPA), 2020. Water Framework Directive (WFD) river water bodies and lake water bodies datasets. Available at: http://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2020. WFD Article 5 Point Pressures. Available at: https://gis.epa.ie/GetData/Download

Environmental Protection Agency (EPA), 2022. Ireland's Greenhouse Gas Emissions Projections. Available at: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-Ireland's-GHG-Projections-Report-2021-2040v4.pdf

Environmental Resources Management, 2002. Comhairle Chontae Liatroma, Landscape Assessment of County Leitrim Reference 17896

European Commission, 2019. European Green Deal. Available at: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

European Commission, 2021. Fit for 55 Package. Available at https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/

European Union (Planning and Development) (Environmental Impact Assessment) Regulations S.I. No. 296/2018 2018, Dublin, Ireland. Available at: https://www.irishstatutebook.ie/eli/2018/si/296/made/en/print

European Union, 1992. Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

European Union, 2009. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147

European Union, 2014. Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052

European Union, 2014. Directive 2014/52/EU of the European Parliament and of the Council. Official Journal of the European Union

European Union, 2018. (Planning and Development) (Environmental Impact Assessment) Regulations. (SI 296 of 2018). Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print

Fermanagh Tourist Information Centre, 2021. Kingfisher Cycle Trail. Available at: https://kingfishercycletrail.com/

Fossitt, J.A. (2000) A Guide to Habitats in Ireland. Heritage Council, Kilkenny. Available at: https://www.npws.ie/sites/default/files/publications/pdf/A%20Guide%20to%20Habitats%20in%20Ireland%20-%20Fossitt.pdf

Geological Survey Ireland (GSI) Webviewer including: Bedrock Geology 1:100,000, Groundwater Rock Units, Groundwater Aquifers, Groundwater Vulnerability, Groundwater Wells and Springs, Karst Features and Tracer Test. Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=3400f393afa844538e5b81679552205d

Geological Survey Ireland, 2019. APM Pits and Quarries. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a205a046a2474e82944f9823b6568ea0

Geological Survey of Ireland, 2019. APM Crushed Rock Aggregate Final Scores. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=647d87bb85c64c2691f0c1f21cfea273

Geological Survey of Ireland, 2019. APM Granular Aggregate Final Scores. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=8306d891261e44928b240f18edaeb4cc

Geological Survey of Ireland, 2019. Quaternary Geomorphology. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=6ed00a12b7de4a3eb5535bc0875191ee

Geological Survey of Ireland, 2020. Active Quarries and Pits Ireland. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=de18ea08ecd344b88c52b65b55fd9abb

Geological Survey of Ireland, 2020. Bedrock Geology 1:100,000. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a40f6a8ca91f4340a86b12649d831d74

Geological Survey of Ireland, 2020. Boreholes verified by the Geological Survey Ireland. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=4737fa3211c54464b0a1d871f2093121

Geological Survey of Ireland, 2020. Geological Heritage Audited Sites. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=35bb2b4ba2ca479ab7db513b445be7dc

Geological Survey of Ireland, 2020. Geological Heritage Unaudited Sites. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=5203261e602d477da69ef0171f6f403b

Geological Survey of Ireland, 2020. Geotechnical boreholes submitted by industry to GSI. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=a78d571ab90442e2a7ebc6d7d36c9a43

Geological Survey of Ireland, 2020. Geotechnical Site Investigations with Links to Reports

Geological Survey of Ireland, 2020. Groundwater Karst Data. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=aaa493208ff04f059ce5107e96089a71

Geological Survey of Ireland, 2020. Groundwater Vulnerability. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=0a4dfd3097c64aada6eea057b33ba65f

Geological Survey of Ireland, 2020. GSI Bedrock Borehole Locations (Unverified). Available at: https://dcenr.maps.arcgis.com/home/item.html?id=28a500216eba49ce8a32910d2c799620

Geological Survey of Ireland, 2020. Landslide Susceptibility Classification. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=1101f04b18e84ed790fa6e17021f57d8

Geological Survey of Ireland, 2020. Mineral Localities. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=43d66cb2f2f24d81b7e03b8acda00c6a

Geological Survey of Ireland, 2020. National Database of past landslide events in Ireland. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=cc35e0d1462d45698dda2a14d609c4db

Geological Survey of Ireland, 2020. Quaternary Sediments. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=1bbf22e9391c484db4b84e4150313bae

Geological Survey of Ireland, 2020. Teagasc Soils. Available at: https://dcenr.maps.arcgis.com/home/item.html?id=82f09cca5c2c4221aa983d1a6d610c78

Google, 2021. Google Maps. Available at: https://www.google.ie/map

Google Maps, 2022. Online orthophotography. Available at: https://www.google.com/maps and Bing Maps, 2022. Available at: https://www.bing.com/maps

Government of Ireland, 1959. Fisheries (Consolidation) Act, 1959. Available at: http://www.irishstatutebook.ie/eli/1959/act/14/enacted/en/html

Government of Ireland, 1976. Wildlife Act, 1976. Available at: http://www.irishstatutebook.ie/eli/1976/act/39/enacted/en/html

Government of Ireland, 2000. Wildlife (Amendment) Act, 2000. Available at: http://www.irishstatutebook.ie/eli/2000/act/38/enacted/en/html

Government of Ireland, 2010. Wildlife (Amendment) Act 2010. Available at: http://www.irishstatutebook.ie/eli/2010/act/19/enacted/en/html

Government of Ireland, 2011. S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011. Available at: http://www.irishstatutebook.ie/eli/2011/si/477/made/en/print

Government of Ireland 2012. Wildlife (Amendment) Act 2012. Available at: http://www.irishstatutebook.ie/eli/2012/act/29/enacted/en/html

Government of Ireland, 2015. S.I. No. 356/2015 - Flora (Protection) Order, 2015. Available at: http://www.irishstatutebook.ie/eli/2015/si/356/made/en/print

Government of Ireland, 2018. Heritage Act 2018. Available at: http://www.irishstatutebook.ie/eli/2018/act/15/enacted/en/html

Government of Ireland, 2018b. Project Ireland 2040 National Development Plan 2018-2027. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null

Government of Ireland, 2018a. Project Ireland 2040 National Planning Framework. Available at https://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf

Government of Ireland, 2018. S.I. No. 549/2018 – European Communities (Environmental Noise) Regulations 2018. Available at: http://www.irishstatutebook.ie/eli/2018/si/549/made/en/print

Government of Ireland, 2021. Climate Action and Low Carbon Development (Amendment) Act 2021 Available at: https://www.irishstatutebook.ie/eli/2021/act/32/section/15/enacted/en/html

Government of Ireland, 2021. Planning and Development, Heritage and Broadcasting (Amendment) Act 2021. Available at: http://www.irishstatutebook.ie/eli/2021/act/11/enacted/en/html

Government of Ireland. 2022. S. I No. 235/2022 – Flora (Protection) Order, 2022. Available at: irishstatuteboohttps://www.irishstatutebook.ie/eli/2022/si/235/made/en/pdfk.ie

Government of Ireland, Department of Public Expenditure and Reform, 2018. National Development Plan 2018-2027. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null

Government of Ireland, Law Reform Commission, 2016. Roads Act 1993 REVISED Updated to 8 March 2016. Available at: https://www.lawreform.ie/_fileupload/RevisedActs/WithAnnotations/HTML/EN_ACT_1993_0014.htm

Groundwater Flood Data. Available at: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

Haase & Pratschke, 2017. Pobal Indices of Deprivation. Available at: https://data.gov.ie/dataset/pobal-hp-deprivation-index

Highways England, 2021. LA114 Climate, Design Manual for Roads and Bridges. Available at: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0

Highways England, 2020. Design Manual for Roads and Bridges (DMRB)

Iarnród Éireann, 2020. Covid-19 Temporary Timetable. Available at: https://www.irishrail.ie/Admin/IrishRail/media/COVID-19-Timetables/2020-July-Sligo-Temporary-Timetable.pdf.

Iarnród Éireann, 2022. Dublin Sligo Timetable. Available at: https://www.irishrail.ie/Admin/IrishRail/media/Timetable-PDF-s/Connolly-DART-timetables/07_dublin_-sligo.pdf

IGSL, 2001. Carrick-on-Shannon Bypass Ground Investigation Report No. 7435

Inland Fisheries Ireland, 2021. Carrick on Shannon Coarse Angling Centre. Available at: https://fishinginireland.info/coarse/shannon/carrickonshannon/

Irish Forestry Geo-portal. Available at https://www.agriculture.gov.ie/forestservice/forestservicegeneralinformation/foreststatisticsandmapping/forestmapviewer/geoportal/

Irish Heart Foundation, 2022. Walking Routes. Available at: https://irishheart.ie/your-health/our-health-programmes/healthy-communities/slainte/walking-routes/

Irish Lichens Website. Available at: http://www.irishlichens.ie/pages-lichen/l-74.html Accessed on 03rd September 2020

Jacobs, 2004. Understanding Water Levels on the River Shannon; Shannon Catchment-based Flood Risk Assessment and Management (CFRAM) Study. OPW. Available at: http://shannoncframstudy.jacobs.com/docs/Understanding%20water%20levels%20of%20the%20River%20Shannon_120814.pdf

Landscape Institute, 2013. Guidelines for Landscape and Visual Impact Assessment, 3ed. April 2013. Landscape Institute & Institute of Environmental Management and Assessment. London

Leitrim Council, 2010. Carrick-on-Shannon Local Area Plan 2010-2019. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Local-Area-Plan/Amendment-2-Carrick-on-Shannon-2010-2019/

Leitrim Council, 2018. Carrick-on-Shannon Local Area Plan 2010-2019. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Local-Area-Plan/Amendment-2-Carrick-on-Shannon-2010-2019/

Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021 Housing Strategy. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan/County_Development_Plan_2015-2021/Leitrim-Housing-Strategy-2015-2021.pdf

Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan/County_Development_Plan_2015-2021/

Leitrim County Council, 2015. Leitrim County Development Plan 2015-2021. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/County-Development-Plan/County_Development_Plan_2015-2021/

Leitrim County Council, 2018. Noise Action Plan 2018 to 2023. Available at: http://www.leitrimcoco.ie/eng/Services_A-Z/Environment/Noise-Control/Noise-Action-Plan-2018-2023.pdf

Leitrim County Council, 2019. Leitrim County Council Climate Change Adaptation Strategy. Available at: https://leitrimcoco.ie/eng/Services_A-Z/Environment/Climate-Change-Adaptation-Strategy/Leitrim-CCAS-2019-2024-.pdf

Leitrim County Council, 2022. Civic Amenity Sites (Recycling Centres)-Information. Available at: http://leitrimcoco.ie/eng/Services_A-Z/Environment/Recycling_Waste_and_Litter_/Recycling-Centres/Civic-Amenity-Sites-Recycling-Centres-Information.html

Leitrim County Council, 2020. Map Based Planning Enquiry: Available at: https://leitrimcoco.maps.arcgis.com/apps/webappviewer/index.html?id=8645fc340c8d457b99ce71ce20bd79f1

Leitrim County Council, 2022. Draft Leitrim County Development Plan 2023-2029. Available at: https://www.leitrimcoco.ie/eng/Services_A-Z/Planning-and-Development/Development-Plans/Leitrim-County-Development-Plan-2023-%E2%80%93-2029/

Leitrim Tourism, 2021. Walks and Trails. Available at: https://leitrimtourism.com/things-to-do/walks-and-trails/

Mayo County Council, 2015. Connacht - Ulster Region Waste Management Plan 2015 – 2021. Available at: http://www.curwmo.ie/

Met Eireann, 2021. 30-year Climate Averages. Available at: https://www.met.ie/climate/30-year-averages

MosArt Landscape-Architecture-Research, Macroworks, Judy Osborne et. al., 2008. Landscape Character Assessment of County Roscommon. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/Archived-Plans/County_Development_Plan_2008-2014_and_Variations/Landscape_Character_Assessment/

National Biodiversity Data Centre, 2020. Online Database. Available at: https://maps.biodiversityireland.ie/Map

National Inventory of Architectural Heritage (NIAH), 2022. Available at: https://www.buildingsofireland.ie/

National Inventory of Architectural Heritage, 2022. Garden Survey Data Download. Available at: https://www.buildingsofireland.ie/resources/

National Library of Ireland, 2021. Griffith's Valuation. Available at: https://www.askaboutireland.ie/griffith-valuation/index.xml?action=placeSearch

National Monuments Service, 2019. Preservation Orders. Available at https://www.archaeology.ie/sites/default/files/media/publications/po19v1-all-counties.pdf

National Monuments Service, 2021. Historic Environment Viewer. Available at: https://maps.archaeology.ie/HistoricEnvironment/

National Parks & Wildlife Service, 2007. Circular Letter NPWS 2/07 Guidance on compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences. Available at: https://www.npws.ie/sites/default/files/general/circular-npws-2-07-reg-23-compliance.pdf

National Parks & Wildlife Service, 2007. Circular Letter PD 2/07 and NPWS 1/07 Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites. Available at https://www.npws.ie/sites/default/files/general/circular-pd-02-07.pdf

National Parks & Wildlife Service, 2010. Circular NPWS 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Available at https://www.npws.ie/sites/default/files/general/Circular%20NPW1-10%20%26%20PSSP2-10%20Final.pdf

National Parks and Wildlife Service (NPWS), 2012. GIS Dataset for Ancient and Long-Established Woodland. Available at: https://www.npws.ie/maps-and-data/habitat-and-species-data

National Parks and Wildlife Service (NPWS), 2012. GIS Dataset for the National Survey of Native Woodland 2003-2008. Available at: https://www.npws.ie/maps-and-data/habitat-and-species-data

National Parks and Wildlife Service (NPWS), 2019. Article 17 Data for Annex I habitats. Available at: https://www.npws.ie/maps-and-data/habitat-and-species-data/article-17

National Parks and Wildlife Service (NPWS), 2019. The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview. NPWS report. Available at https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol1_Summary_Article17.pdf

National Parks and Wildlife Service (NPWS), 2020. Protected Sites in Ireland. Available at: www.npws.ie/protectedsites/ and http://webgis.npws.ie/npwsviewer/

National Parks & Wildlife Service (NPWS), 2022. Unpublished records and records published on the NPWS Online Map Viewer. Available at: http://webgis.npws.ie/npwsviewer/ . And the Flora Protection Order bryophyte map viewer available at: https://www.npws.ie/maps-and-data/flora-protection-order-map-viewer-bryophytes

National Parks and Wildlife Service. Online Map Viewer. Available at: http://webgis.npws.ie/npwsviewer/. And the Flora Protection Order bryophyte map viewer. Available at: http://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=71f8df33693f48edbb70369d7fb26b7e

National Roads Authority, 2004. Guidelines for the Treatment of Noise and Vibration in National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Treatment_of_Noise_and_Vibration_in_National_Road_Schemes.pdf

National Roads Authority, 2006. Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Best_Practice_Guidelines_for_the_Conservation_of_Bats_in_the_Planning_of_National_Road_Schemes.pdf

National Roads Authority, 2008. Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Ecological-Surveying-Techniques-for-Protected-Flora-and-Fauna-during-the-Planning-of-National-Road-Schemes.pdf

National Roads Authority, 2008. Environmental Impact Assessment of National Road Projects – A Practical Guide. Available at: https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf

National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, Ireland: Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

National Roads Authority, 2008. National Roads Authority Environmental Impact Assessment of National Roads Schemes – A Practical Guide, Revision 1, November 2008. Available at: https://www.tii.ie/technical-services/environment/planning/Environmental-Impact-Assessment-of-National-Road-Schemes-Practical-Guide.pdf

National Roads Authority, 2009. Environmental Impact Assessment of National Road developments – Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Developments. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-

Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

National Roads Authority, 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

National Roads Authority, 2009. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, Ireland: Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

National Roads Authority, 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes. Available at https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

National Roads Authority, 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes

National Waste Collection Permit Office, 2020.Local Authority Waste Facility Register. Available at: http://facilityregister.nwcpo.ie/

Online orthophotography available via Google Maps (https://www.google.com/maps) and Bing Maps (https://www.bing.com/maps) , and Ordnance Survey Ireland orthophotography

Ordnance Survey Discovery Series Map No. 50 Dublin, Kildare, Meath, Wicklow. 2017 (5th Edition) Map Scale 1:50,000

Ordnance Survey Discovery Series Map No. no. 56 Wicklow, Dublin, Kildare. 2018 (4th Edition) Map Scale 1:50,000

Ordnance Survey Ireland (OSi) (Discovery Series) OSi Licence number 2021/OSI_NMA_139 & OSi Licence number 2021/18/CCMA

Ordnance Survey Ireland (OSi), 2020. OSI Rivers and Lakes. Available at: https://gis.epa.ie/GetData/Download

Ordnance Survey Ireland (OSi), 2021. GeoHive Mapping Service. Available at: http://map.geohive.ie/mapviewer.html

Ordnance Survey Ireland (OSi), 2021. OSi 1:50,000 Discovery Series Sheet 33. Available at: https://sites.google.com/site/theirelandwalkingguide/publications/maps/osi-discovery/sheet33

Ordnance Survey Ireland (OSi). Discovery Sheet 1828, 1830, 2028 and 2030, s.l.: s.n.

OSM, 2021. Open Streetmap. Available at: https://www.openstreetmap.org

Parkes, M., Meehan, R. & Preteseille, S., 2012. The Geological Heritage of Roscommon, An audit of County Geological Sites in Roscommon, s.l.: Geological Survey Ireland.

Parnell, J. & Curtis, T. 2012. Webb's An Irish Flora. Eighth Edition

Priority Geotechnical Limited, 2006. N4 Carrick-on-Shannon Bypass Geotechnical Ground Investigation Factual Report No. PC6044

Priority Geotechnical Limited, 2010. N4: Carrick-on-Shannon to Dromod Preliminary Ground Investigation – Contract 1 Factual Report No. PC9081

Property Registration Authority, 2020 & 2021. Available at https://www.landdirect.ie/index

Repak (2020) Recycling Register. Available at: https://repak.ie/

Roscommon County Council, 2005. County Roscommon Hedgerow Survey Report. Available at: http://www.roscommoncoco.ie/en/Download-It/Heritage-Publications/County-Roscommon-s-Hedges.pdf

Roscommon County Council, 2012. Nature and Wildlife in Roscommon, Action for Biodiversity. Available at: https://www.yumpu.com/en/document/read/25848958/nature-and-wildlife-in-roscommon-roscommon-county-council

Roscommon County Council, 2014. Cortober Area Plan 2014-2020. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/2-Cortober-Area-Plan.pdf

Roscommon County Council, 2014. Roscommon County Development Plan 2014-2020. Available at: http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-

Publications/County_Development_Plan_2014_-_2020/County-Development-Plan-2014-2020/

Roscommon County Council, 2017. County Roscommon Heritage Plan 2017 – 2021, Incorporating County Roscommon Biodiversity Plan. Available at: http://www.roscommoncoco.ie/en/Services/Community/Heritage/Heritage/County-Roscommon-Heritage-Plan-2017-2021/

Roscommon County Council, 2018. Noise Action Plan 2018 – 2023. Available at http://www.roscommoncoco.ie/en/Services/Environment/Air-and-Noise-Regulation/Noise/Noise-Action-Plan-2018-2023.pdf

Roscommon County Council, 2019. Roscommon County Council Climate Change Adaptation Strategy. Available at: https://www.roscommoncoco.ie/en/About_Us/Business-Units/Assets-Energy-Management/Climate-Change-Adaptation-Strategy-2019-%E2%80%93-2024/Final-Climate-Change-Adaptation-Strategy-2019-%E2%80%93-2024.pdf

Roscommon County Council, 2022. Civic Amenity Sites. Available at: http://www.roscommoncoco.ie/en/Services/Environment/Waste_Management,_Disposal_and_Recycling/Civic-Amenity-Sites/

Roscommon County Council, 2020. Map Based Planning Enquiry. Available at: https://roscoco.maps.arcgis.com/apps/webappviewer/index.html?id=84b0356c3b45483c9da36ecccbd3aa93

Roscommon County Council, 2021. Draft Roscommon County Development Plan. Available at: https://www.rosdevplan.ie/

Roscommon County Council, 2022. Roscommon County Development Plan 2022-2028. Available at: https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/stage-3-amendments/stage-3-adoption-of-plan

Roughan & O'Donovan Consulting Engineers, 2010. N4 Carrick-on-Shannon to Dromod Road Project - Constraints Study Report. Volume: 1

RPS, 2020. Leitrim Landscape Character Assessment 2019. Leitrim County Council.

SIRO, 2022. SIRO Roll-Out Map. Available at https://siro.ie/roll-out/#Leitrim

Smith, G.F., O'Donoghue, P., O'Hora, K. & Delaney, E., 2011. Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council Church Lane, Kilkenny, Ireland.

Stace, C., 2019. New Flora of the British Isles. 4th Edition. C&M Floristics.

Teagasc, 2019. Irish Soil Information System. Available at http://gis.teagasc.ie/soils/

Teagasc, 2021. Irish Soil Information System. Available at http://gis.teagasc.ie/soils/

Teagasc, Irish Soil Information System. Available at http://gis.teagasc.ie/soils/

TFI Local Link, 2020. Sligo/Leitrim/Roscommon. Available at: https://ua.locallink.ie/en/your-local-link/sligoleitrimroscommon/

The Northern and Western Regional Assembly, 2020. Regional Spatial and Economic Strategy 2020-2032 (RSES). Available at: https://www.nwra.ie/rses/

Transport Infrastructure Ireland (TII), 2005. Guidelines for the Assessment Architectural Heritage Impacts of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Guidelines_for_the_Assessment_of_Architectural_Heritage_Impact_of_National_Road_Schemes.pdf

Transport Infrastructure Ireland (TII), 2009. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Available at: https://www.Transport Infrastructure Ireland.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

Transport Infrastructure Ireland (TII), 2011. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes. Available at https://www.Transport Infrastructure Ireland.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

Transport Infrastructure Ireland (TII), 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes. Available at: https://www.tii.ie/technical-services/environment/planning/Good_Practice_Guidance_for_the_Treatment_of_Noise_during_the_Planning_of_National_Road_Schemes.pdf

Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 3.0 – Project Brief PE-PAG-02012, October 2016. Available at: https://www.Transport Infrastructure Irelandpublications.ie/library/PE-PAG-02012-01.pdf

Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 4.0- Consideration of Alternatives and Options PE-PAG-02013 October 2016. Available at: https://www.tiipublications.ie/library/PE-PAG-02013-01.pdf

Transport Infrastructure Ireland (TII), 2016. Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis. Available at: https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf

Transport Infrastructure Ireland (TII), 2019. Managing Geotechnical Risk DN-ERW-03083. Available at: https://www.tiipublications.ie/library/DN-ERW-03083-01.pdf

Transport Infrastructure Ireland (TII), 2019. Project Management Guidelines PE-PMG-02041. Available at: https://www.tiipublications.ie/library/PE-PMG-02041-02.pdf

Transport Infrastructure Ireland (TII), 2019. Project Manger's Manual for Major National Road Projects PE-PMG-02042 February 2019. Available at: https://www.tiipublications.ie/library/PE-PMG-02042-01.pdf

Transport Infrastructure Ireland (TII), 2020. Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads – Standard December 2020, Transport Infrastructure Ireland

Transport Infrastructure Ireland (TII), 2020. Project Management Guidelines PE-PMG-02041, December 2020. Available at: https://www.Transport Infrastructure Irelandpublications.ie/library/PE-PMG-02041-03.pdf. These guidelines have since been updated in July 2022 and the updates do not affect the content of this report.

Transport Infrastructure Ireland (TII), 2021. Project Appraisal Guidelines for National Roads Unit 13.0 - Appraisal of Active Modes TII PE-PAG-02036. Available at https://www.tiipublications.ie/library/PE-PAG-02036-01.pdf

Transport Infrastructure Ireland (TII). Traffic Counter Data Website. Available at https://www.National Roads Authoritytrafficdata.ie/c2/gmapbasic.asp?sgid=ZvyVmXU8jBt9PJE$c7UXt6

Waterways Ireland, 2021. Blueways. Available at https://www.bluewaysireland.org/

Weekes, L.C. & FitzPatrick, Ú., 2010. The National Vegetation Database: Guidelines and Standards for the Collection and Storage of Vegetation Data in Ireland. Version 1.0. Irish Wildlife Manuals, No. 49. National Parks and

Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Wetland Surveys Ireland, 2021. Map of Irish Wetlands. Available at: http://www.wetlandsurveysireland.com/wetlands/map-of-irish-wetlands--/map-of-irish-wetlands---map/index.html

Westlink Coaches, 2020. Timetables. Available at: http://www.westlinkcoaches.ie/timetables.html.