

Leitrim County Council
**N4 Carrick-on-Shannon to
Dromod Project**
Option Selection Report

274219-ARUP-02-OS-RP-YE-000017

P07 | 14 March 2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 274219

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Job title		N4 Carrick-on-Shannon to Dromod Project		Job number 274219	
Document title		Option Selection Report		File reference	
Document ref		274219-ARUP-02-OS-RP-YE-000017			
Revision	Date	Filename	274219-ARUP-02-OS-RP-YE-000017.docx		
Draft 1	16 Feb 2022	Description	First draft		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
P02	10 March 2022	Filename	274219-ARUP-02-OS-RP-YE-000017.docx		
		Description	Issue back to client with comments addressed		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
P03	11 March 2022	Filename	274219-ARUP-02-OS-RP-YE-000017.docx		
		Description	Final Issue for Peer Review		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
P05	22 July 2022	Filename	274219-ARUP-02-OS-RP-YE-000017.docx		
		Description	Final OSR Draft Tracked Changes		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
P06	10 Aug 2022	Filename	274219-ARUP-02-OS-RP-YE-000017.docx		
		Description	Issue P06		
			Prepared by	Checked by	Approved by

		Name			
		Signature			
P07	14 March 2023	Filename	274219-ARUP-02-OS-RP-YE-000017.docx		
		Description	Final OSR		
			Prepared by	Checked by	Approved by
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Issue Document verification with document					☒

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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 7² 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 forward 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.

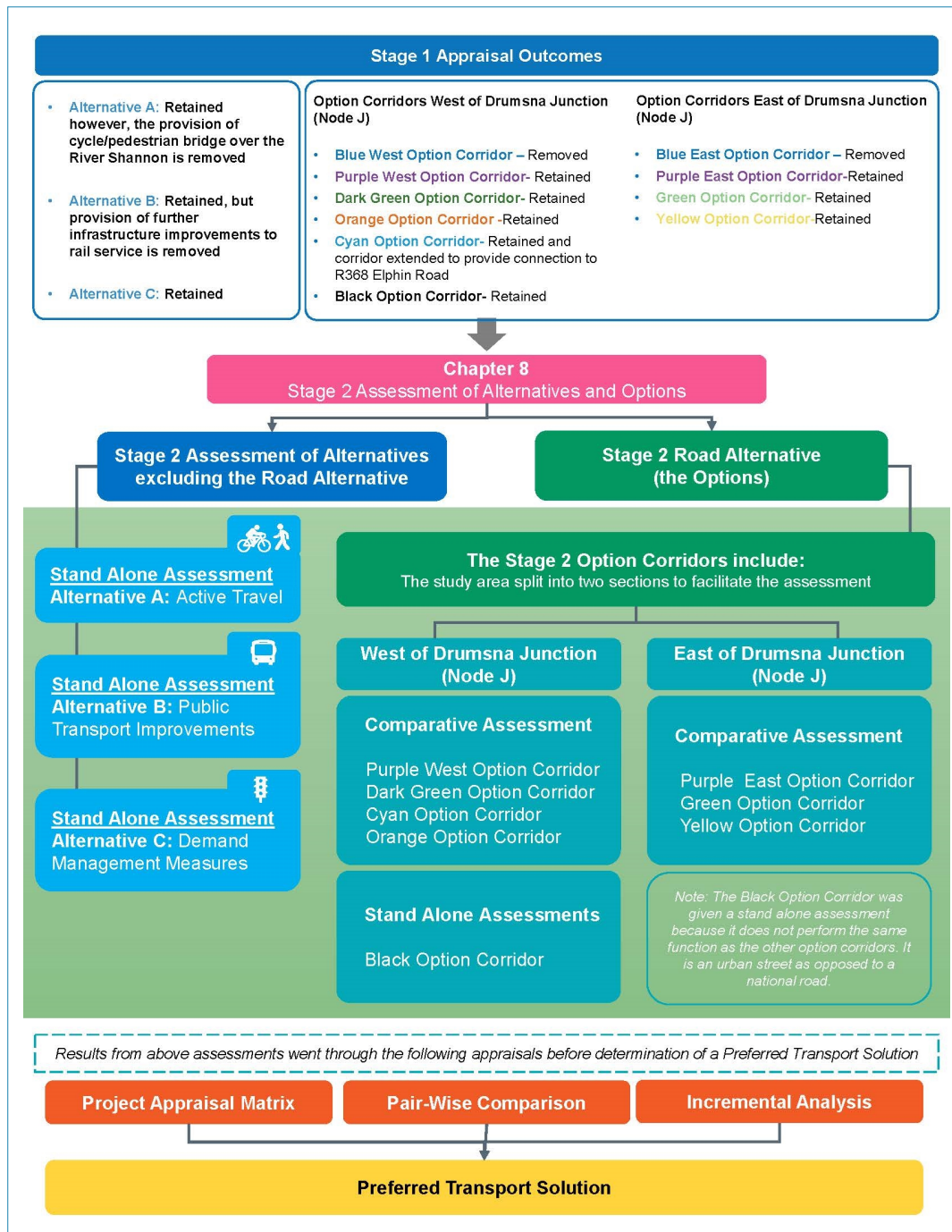


Plate 8.1.1 Stage 2 Assessment Process Flowchart

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 Cloonsheevagh and Hartley. The Stage 2 proposal realigns the horizontal alignment of the Hartley Road to the rear of these properties from Cloonsheebane to Cloonsheevagh, 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.

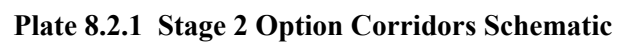


Table 8.2.2 Option Corridors and Design Scenarios West and East of Node J at Drumsna Junction

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
<i>Change in AADT</i>	-0.7%	-0.3%	-10.0%
Do-Minimum 2045	17,515	17,515	17,515
Year 2045	17,380	17,450	15,860
<i>Change in AADT</i>	-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 $\pm 100\text{m}$ of the existing situation was given a score of 4 (Not Significant or Neutral). A trip length between $\pm 100\text{m}$ and $\pm 500\text{m}$ 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 $\pm 500\text{m}$ but less than $\pm 1000\text{m}$ 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 $12,376\text{m}$ west of Node J at Drumsna Junction and $7,876\text{m}$ 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 Neutral	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	
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
<i>At-Grade Assessment Score</i>	4	3	7
# Grade Separated	1	1	2
<i>Grade Separated Assessment Score</i>	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 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 ($\pm 1\%$) is given a score of 4 (neutral). A change in AADT of up to $\pm 20\%$ from this scenario received a score of 3 or 5, where a reduction is deemed positive. A change in AADT between $\pm 20\%$ and $\pm 40\%$ 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 $\pm 40\%$ 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

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.

Summary of assessment West of Drumsna Junction

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)	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 500m of the existing route.
	Not Significant or Neutral (3)	Not Significant or Neutral (4)	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.	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 reduce delay.
	Minor or Slightly Negative (3)	Minor or Slightly Negative (3)	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.	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.
	Minor or Slightly Negative (2)	Minor or Slightly Negative (2)	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 Alternative 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	ALTERNATIVE C REDUCING 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
<i>Transport Efficiency and Effectiveness</i>					
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
<i>Overall ranking for Transport Efficiency and Effectiveness</i>	Preferred (4)	Least Preferred (2)	Intermediate (3)	Intermediate (3)	Not Significant or Neutral (4)
<i>Wider Economic Impacts</i>					
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)
<i>Overall ranking for Wider Economic Impacts</i>	Preferred (5)	Preferred (5)	Preferred (5)	Preferred (5)	Not Significant or Neutral (4)
<i>Funding Impacts</i>					

Assessment Criteria	CYAN OPTION CORRIDOR	ORANGE OPTION CORRIDOR	PURPLE WEST GOPTION CORRIDOR	DARK GREEN OPTION CORRIDOR	BLACK OPTION CORRIDOR
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)
<i>Overall ranking for Funding Impacts</i>	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
<i>Transport Efficiency and Effectiveness</i>			
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)
<i>Overall ranking for Transport Efficiency and Effectiveness</i>	Intermediate (3)	Preferred (3)	Least Preferred (3)
<i>Wider Economic Impacts</i>			
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)
<i>Overall ranking for Wider Economic Impacts</i>	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)	Minor or Slightly Positive (5)
<i>Funding Impacts</i>			
<i>Overall ranking for Funding Impacts</i>	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 repurposed 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 Ireland⁶. 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.

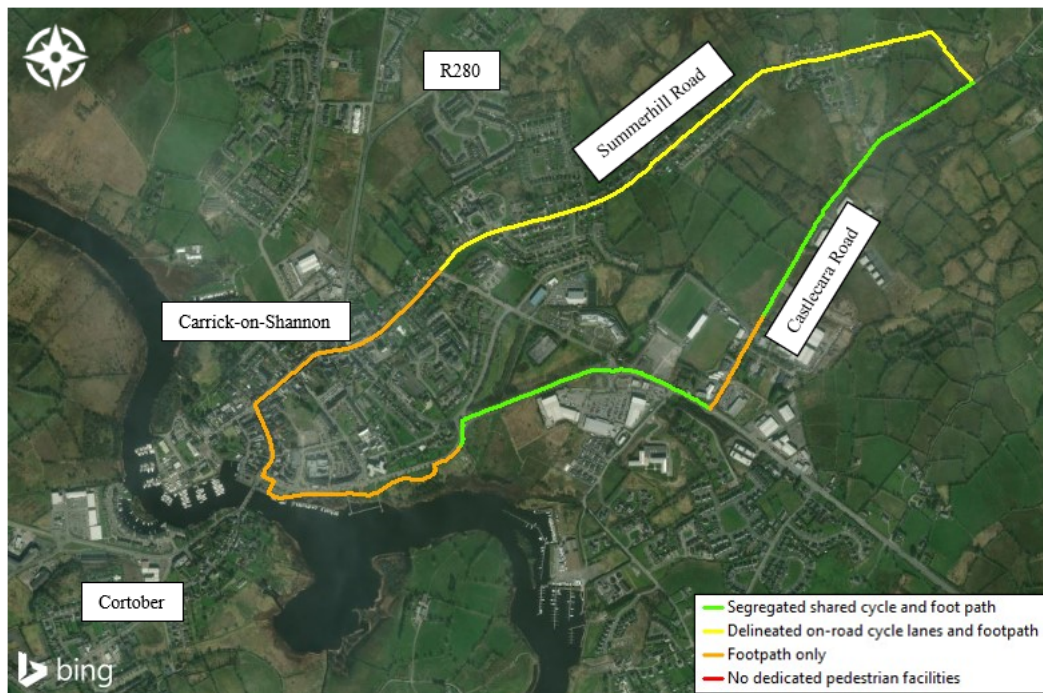


Plate 8.5.1 Irish Heart Foundation Slí na Sláinte Route

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.

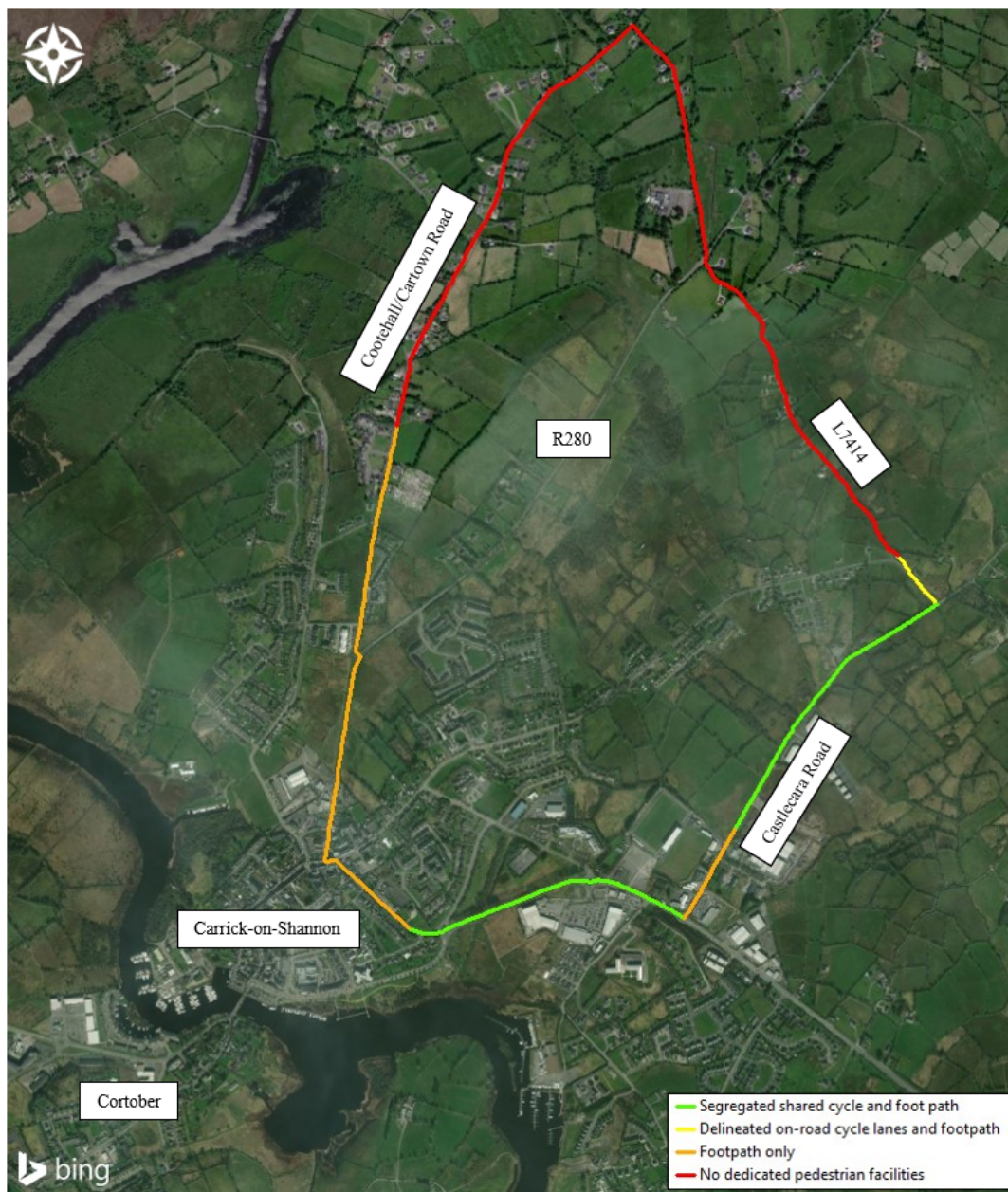


Plate 8.5.3 Popular Walking Route Identified during Public Consultation No. 2

‘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
Qualitative 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* – *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.

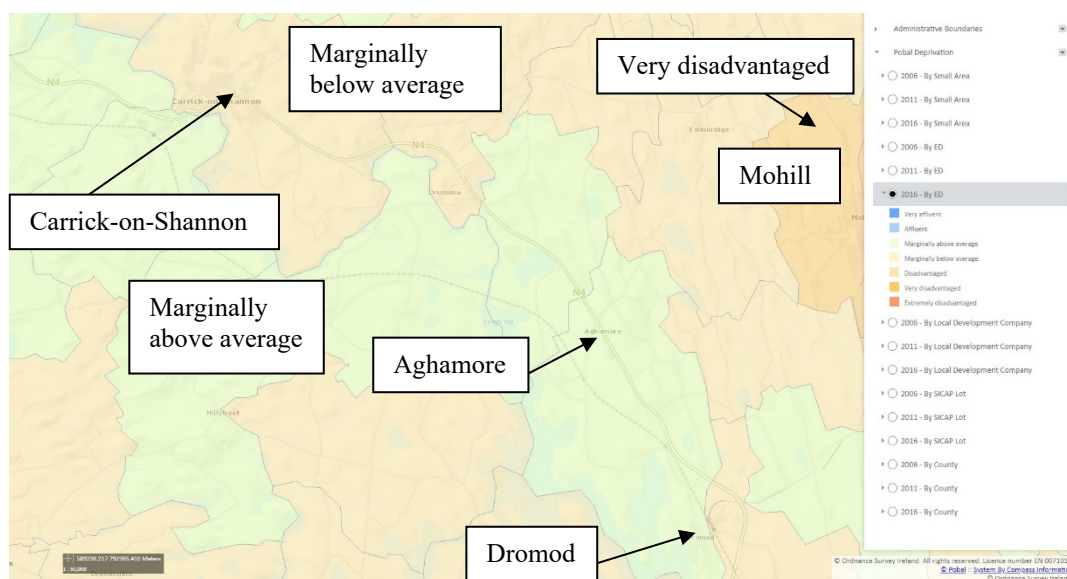


Plate 8.6.1 The 2016 Pobal HP Deprivation Index by Electoral Division

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 minibuss 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 minibuss 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. 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 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-Rosky 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-Rosky 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.	Slightly 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 hydrological 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 opportunities 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 0 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 0.

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 alternative 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 0. 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
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
<i>ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)</i>	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.
<i>ESB High Voltage Underground Lines (HV UG)</i>	2 No. 38kV	2 No. 38kV	0 No.	0 No.	0 No.
<i>ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)</i>	20 No.	21 No.	9 No.	12 No.	2 No.
<i>ESB Substations</i>	None	None	None	None	None
<i>Irish Water watermains with pipe diameter greater than 300mm</i>	0m length	0m length	694m length	536m length	97m length
<i>Irish Water foul or combined sewers with pipe diameters greater than 300mm</i>	0m length	0m length	0m length	0m length	0m length
<i>Water / wastewater treatment plants</i>	None	None	None	None	None
<i>Licenced waste facilities</i>	None	None	None	None	None
<i>Telecoms Antenna</i>	None	None	None	None	None
<i>Eir underground services</i>	5790m length	5696m length	3003m length	1905m length	99.7m length
<i>ENet</i>	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
<i>ESB High Voltage (i.e. 38kV, 110kV and 220kV) Overhead Lines (HV OH)</i>	1 No. 220 kV	1 No. 220 kV	1 No. 220 kV
<i>ESB High Voltage Underground Lines (HV UG)</i>	None	None	None
<i>ESB Medium Voltage (i.e. 10kV, 20kV) Overhead Lines (MV OH)</i>	20	20	22
<i>ESB Substations</i>	None	None	None
<i>Irish Water water mains with pipe diameter greater than 300mm</i>	5023m length	5659m length	3391m length
<i>Irish Water foul or combined sewers with pipe diameters greater than 300mm</i>	None	None	None
<i>Water / wastewater treatment plants</i>	None	None	None
<i>Licensed waste facilities</i>	None	None	None
<i>Telecoms Antenna</i>	None	None	None
<i>Eir underground services</i>	9100m length	10781m length	11061m length
<i>ENet</i>	None	None	None
<i>BT services</i>	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 Guidelines² (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 area⁸). 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 data⁸ 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 landtakes⁹ (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 Guidelines¹¹ 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 Guidelines¹¹ 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 Guidelines¹¹, 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 Guidelines¹¹ 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 applications¹² 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 properties¹² 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-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 CO ₂ eq	1,815	1,963	1,882	1,814	32
Estimated embodied carbon tonnes CO ₂ eq	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 CO ₂ eq	1,136	1,051	1,816
Embodied carbon tonnesCO ₂ eq	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 Schemes¹⁵, Section 2 of the 2014 Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes¹⁶ and in accordance with the requirements of the TII Project Management Guidelines 2020¹⁷, 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)¹⁸.

In terms of operational noise, the NRA 2004 Noise and Vibration Guidelines¹⁵ and the TII Noise Guidelines 2014¹⁶ 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 2004¹⁵ and TII 2014¹⁶ 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

¹⁵National 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 2004¹⁵ 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 2014², 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 Summerhill 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 Castlecara Road	18,300
	N4 – Castlecara 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 2004¹⁵ and TII 2014¹⁶ 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 DMRB¹⁸. 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 guidance¹⁸, 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 2004¹ and TII 2014² 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 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 1 dB is calculated. With reference to the DMRB¹⁸ 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 DMRB¹⁸, 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 DMRB¹⁸, 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 Schemes¹⁹ and Assessment of Architectural Heritage Impacts of National Road Schemes²⁰, 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 Analysis² (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 7.0² 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 'Castlecarrá'. 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 'Castlecarrá'. 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	Cloonteam 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	Cloonteen 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	Cloonteen 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 Drumsna 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 Paire 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	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
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 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 approach² 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 habitat²⁴, non-Annex I semi-natural woodland habitats and watercourses²⁵)
- 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 disappearance²⁸).

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

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

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:
 - 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 <i>Molinia</i> 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 <i>Succisa pratensis</i> and potential for Annex II marsh fritillary <i>Euphydryas aurinia</i> 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 <i>Salmo trutta</i> .	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 Kilmaddoroe 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 orthophotography, 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

Yellow Option Corridor

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).

Green Option Corridor

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 Gortinty 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/Gortinty 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 Drumsna. 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 Gortinty 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 approach², 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.

West of Drumsna

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 Carrickev 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	- EC16 - EC30 - EC32 - EC77	- Lough Eidin pNHA [001643] - River Shannon		- EC27 - EC28 - EC49 - EC87 - EC88 - Lismoyle_26 stream - Kilmaddaroe stream - Killasanowl stream - Kildorragh_26 stream - Aghameeny stream - Unnamed stream - from the Shannon at Annaghbeg to Drumlumman - Unnamed stream - Kilmaddaroe lough to Bran lough to Carrickey lough to the River Shannon
Black Design				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. Gortinty stream
Green Option Corridor	1. EC99 2. EC105			1. EC112 2. Drumsna stream 3. Unnamed stream - border of Annaduff and Gortinty 4. Gortinty 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. Gortinty 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 an 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. 1336km². 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 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).

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 2.13km² and 2.52km² respectively. Trib. Of the Knockanima stream (2.86km²). Knockanima stream (5.43km²). Killukin River and floodplain crossed with catchment area of 35km². The Link Road Crosses a tributary of the Killukin River At 2 locations (small stream 1.2km² in area) Small Stream at Cooreen / Lisseeghan (1.0km²). Kilmuddaroe Stream Lisseeghan (6.7km²). 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 or Slightly 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 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 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 Slightly 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 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. 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 0.47% 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 1336km² 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 3.496km² in area. Knockanima Stream (5.52km²) Killukin River and floodplain crossed with catchment area of 35km². Small Stream at Cooreen / Lisseeghan (1.0km²). Kilmuddaroe Stream Lisseeghan (6.7km²). 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 < 7km²) 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 36km² 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 1290km². 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 3.5km² in area. 1 small spring and drain. 1 small Stream at Lisnagat (<1km²). 1 small stream at Cloonsheeban (1.4km²). 1 small stream (Cloonmulligan) 3.15km². 1 small tributary stream of the Cloonmulligan (c .25km²) 1 medium Stream at Greagh (5.75km²). 1 small trib stream of Greagh at Minkill (1.26km²). 1 small stream at Tully (< 1km²). 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 < 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 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 1290km² 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 3.5km² in area. 1 small spring and drain. 1 small Stream at Lisnagat (<1km²). 1 small stream at Cloonsheeban (1.4km²). 1 small stream (Cloonmulligan) 3.15km². 1 small tributary stream of the Cloonmulligan (c .25km²).	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 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 (1.2km²). 1 small stream the KilMaddaroe Stream (2.75km²) 1 small stream at Drishoge (< 0.5km²) 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	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 or Slightly Negative impact (3) with the main impact of direct loss of
Ecological Sites of Local Higher	The route option encroaches ecological sites EC16, EC30 and EC32 that represent wet	

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 1.3km². 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 (0.9km² in catchment area). 1 small stream (Foxborough) (3.78km²). 1 small Stream at Crickeen (0.5km²). 1 large stream Gortconnellan Lough Stream (17.1km²). Gortinty Stream (5.6km²). 1 small stream at antfield (0.3km²). 1 small tributary stream of the Cloonmulligan (c .25km²). 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 (0.9km² in catchment area) 1 small stream Foxborough (3.78km²). 1 small Stream at Crickeen (0.5km²). 1 large stream Gortconnellan Lough Stream (17.1km²). Gortinty Stream (5.6km²). 1 small stream at Antfield (0.3km²). 1 small tributary stream of the Cloonmulligan (c .25km²). 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 Ecological Sites of Local Higher	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 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	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. 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 (0.9km² in catchment area). 1 small stream Foxborough (3.78km²). 1 small Stream at Crickeen (0.5km²). 1 large stream Gortconnellan Lough Stream (17.1km²). Gortinty Stream (5.6km²). 1 small stream at Antfield (0.3km²). 1 small tributary stream of the Cloonmulligan (c .25km²). 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 Significant 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 Design 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 where 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 'licensed 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 1,000m².
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 (m²)
 - j. Volumes relate to in-situ volumes only, material bulking factors have not been applied
 - k. Volumes have been rounded up to the nearest 1,000m³
 - 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.

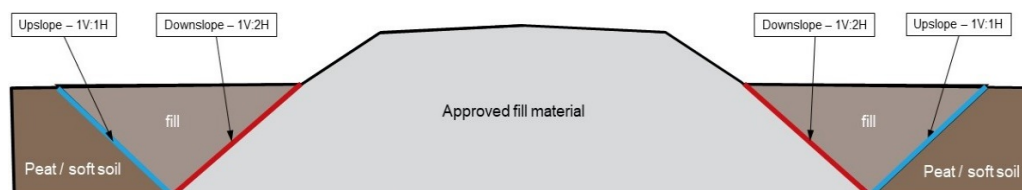


Plate 8.8.12.1 Assumed Soft Soil Excavate and Replace Section

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.

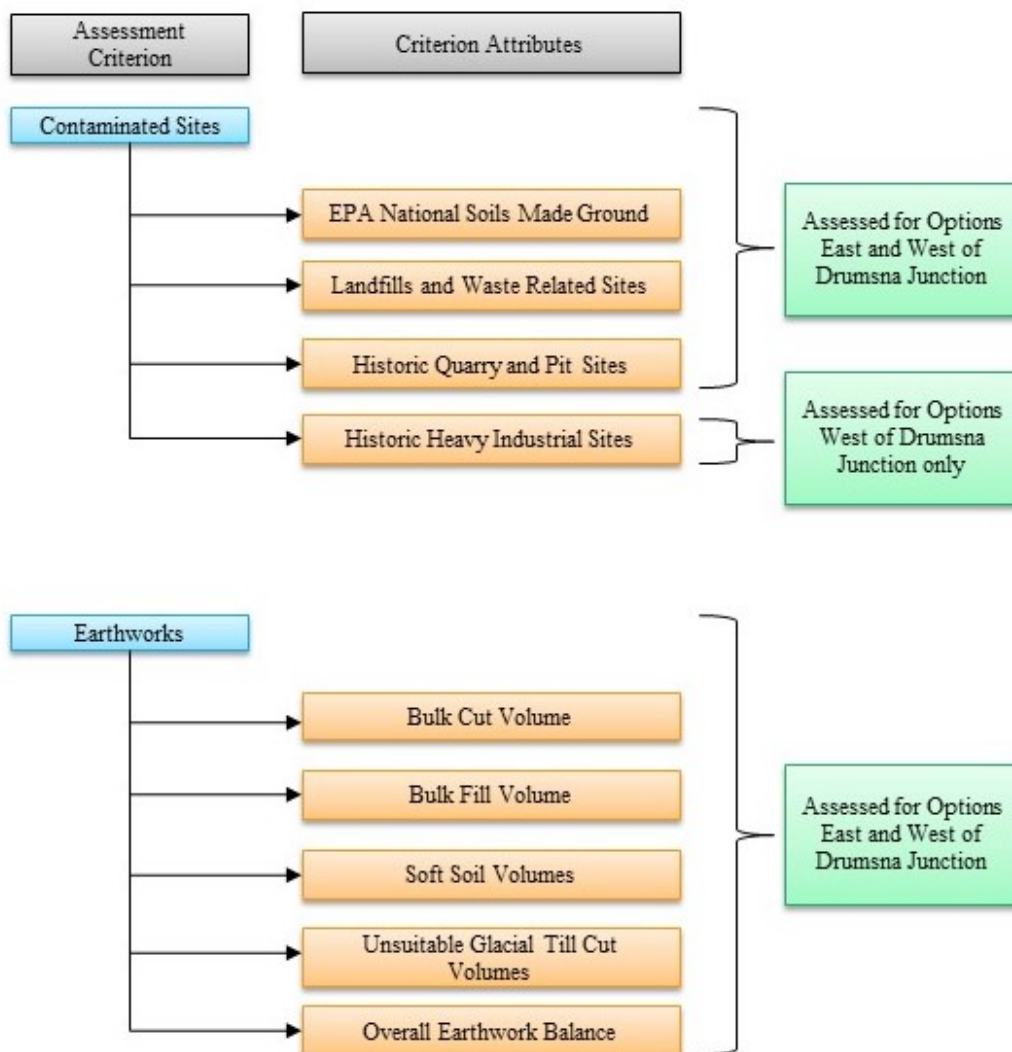


Plate 8.8.12.2 Assessment Criteria and Associated Attributes

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 (m²). The area of made ground intersected by the indicative fencelines options west and east of Drumsna Junction range between 13,000m² and 43,000m² 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 (m²).

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 61,000m² 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 26,690m² 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 within 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 (98,000m³ to 232,000m³) and west (298,000m³ & 308,000m³) 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 (m³)	Importance of Attribute	Magnitude of Impact	Significance of Impact	Overall MCA Score (Description)
Purple East Option Corridor (Purple East Design)	Earthworks	Bulk Earthworks	Cut (m³)	190,000	High	Moderate Adverse	Significant / Moderate	Moderately Negative
			Fill (m³)	145,000		Moderate Adverse	Significant / Moderate	
			Soft Soil (m³)	68,000		Small Adverse	Moderate / Slight	
			Unsuitable Glacial Till Cut Material (m³)	93,000		Small Adverse	Moderate / Slight	
			Overall Deficit (m³)	116,000		Moderate Adverse	Significant / Moderate	
Green Option Corridor (Green Design)	Earthworks	Bulk Earthworks	Cut (m³)	80,000	High	Small Adverse	Moderate / Slight	Minor or Slightly Negative
			Fill (m³)	55,000		Small Adverse	Moderate / Slight	
			Soft Soil (m³)	0		Negligible	Imperceptible	
			Unsuitable Glacial Till Cut Material (m³)	25,000		Small Adverse	Moderate / Slight	
			Overall Deficit (m³)	0		Negligible	Imperceptible	
Yellow Option Corridor (Stage 2 Yellow Design)	Earthworks	Bulk Earthworks	Cut (m³)	174,000	High	Moderate Adverse	Significant / Moderate	Moderately Negative
			Fill (m³)	113,000		Moderate Adverse	Significant / Moderate	
			Soft Soil (m³)	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 = 40,000m³ Bulk Fill Volume = 54,000m³ Soft Soil Volume = 66,000m³ Unsuitable Glacial Till Cut Material = 17,000 m³ Overall Deficit = 66,000m³ 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 Cultycone 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 (992,000m³) 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).	Second largest impact on potential contaminated sites and second largest overall earthwork deficit (829,000m³).	Smallest overall earthwork deficit (546,000m³).	Third largest overall earthwork deficit (729,000m³).	Significant earthwork requirement when considering the short corridor length. (66,000m³).
	Major or Highly Negative	Moderately Negative	Moderately Negative	Moderately Negative	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 combining 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					
<i>Population*</i>	Intermediate (3)	Least Preferred (2)	Preferred (4)	Preferred (4)	Moderately Positive (6)
<i>Human Health*</i>	Preferred (4)	Preferred (4)	Intermediate (4)	Intermediate (4)	Not Significant or Neutral (4)
<i>Material Assets Non-Agriculture*</i>	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
<i>Biodiversity*</i>	Intermediate (1)	Preferred (1)	Least Preferred (1)	Least Preferred (1)	Minor or Slightly Negative (3)
<i>Hydrology*</i>	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)
<i>Soils and Geology*</i>	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			
<i>Population *</i>	Intermediate (4)	Least Preferred (3)	Preferred (6)
<i>Human Health *</i>	Intermediate (4)	Preferred (4)	Preferred (4)
<i>Material Assets Non-Agriculture *</i>	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)
<i>Biodiversity*</i>	Preferred (1)	Preferred (1)	Least Preferred (1)
<i>Hydrology*</i>	Preferred (2)	Preferred (2)	Intermediate (2)
Hydrogeology	Intermediate (3)	Preferred (4)	Intermediate (3)
<i>Soils and Geology*</i>	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 7.0² 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 0, to determine the level of intervention most appropriate for the road alternative to form part of the transport solution to be taken forward 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.

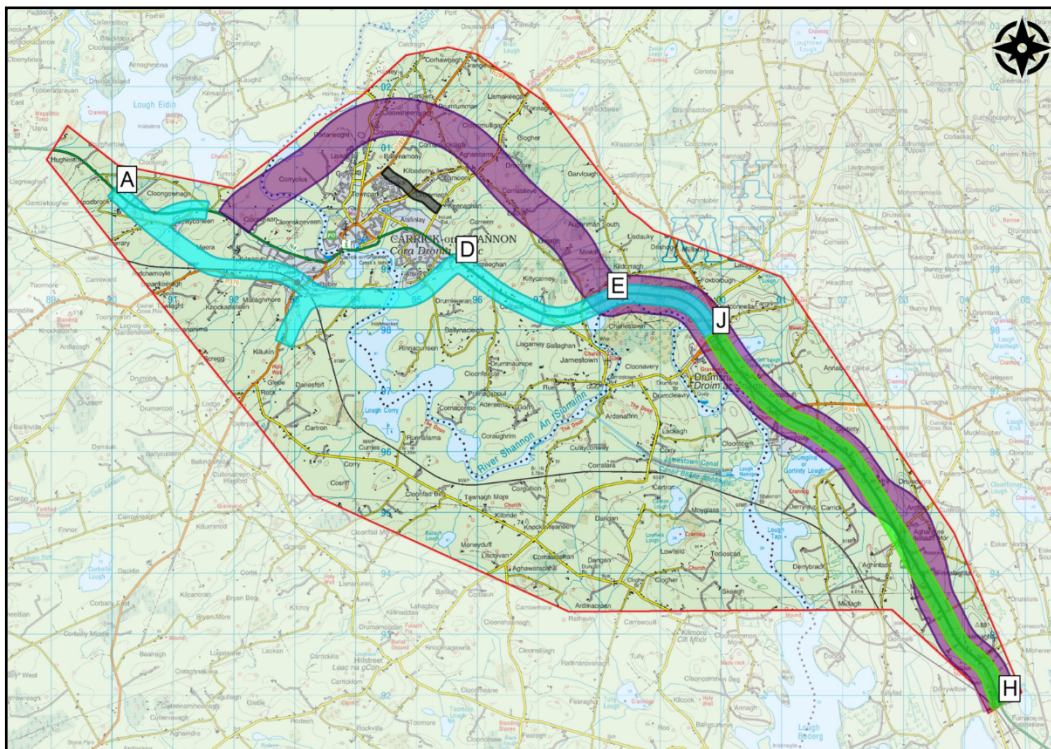


Plate 8.9.1 Preferred Option Corridor West and East of Drumsna Junction versus 2012 Emerging Preferred Route Corridor

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 preferable 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 4³³, 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.

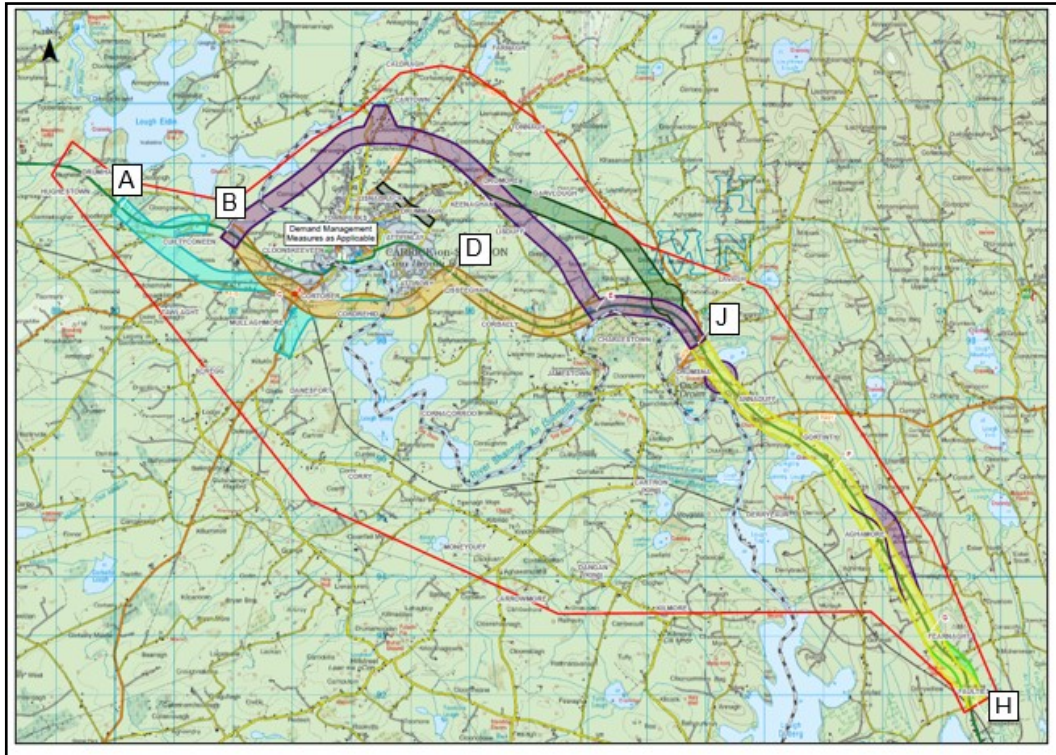


Plate 8.9.2 Stage 2 Option Corridors

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.

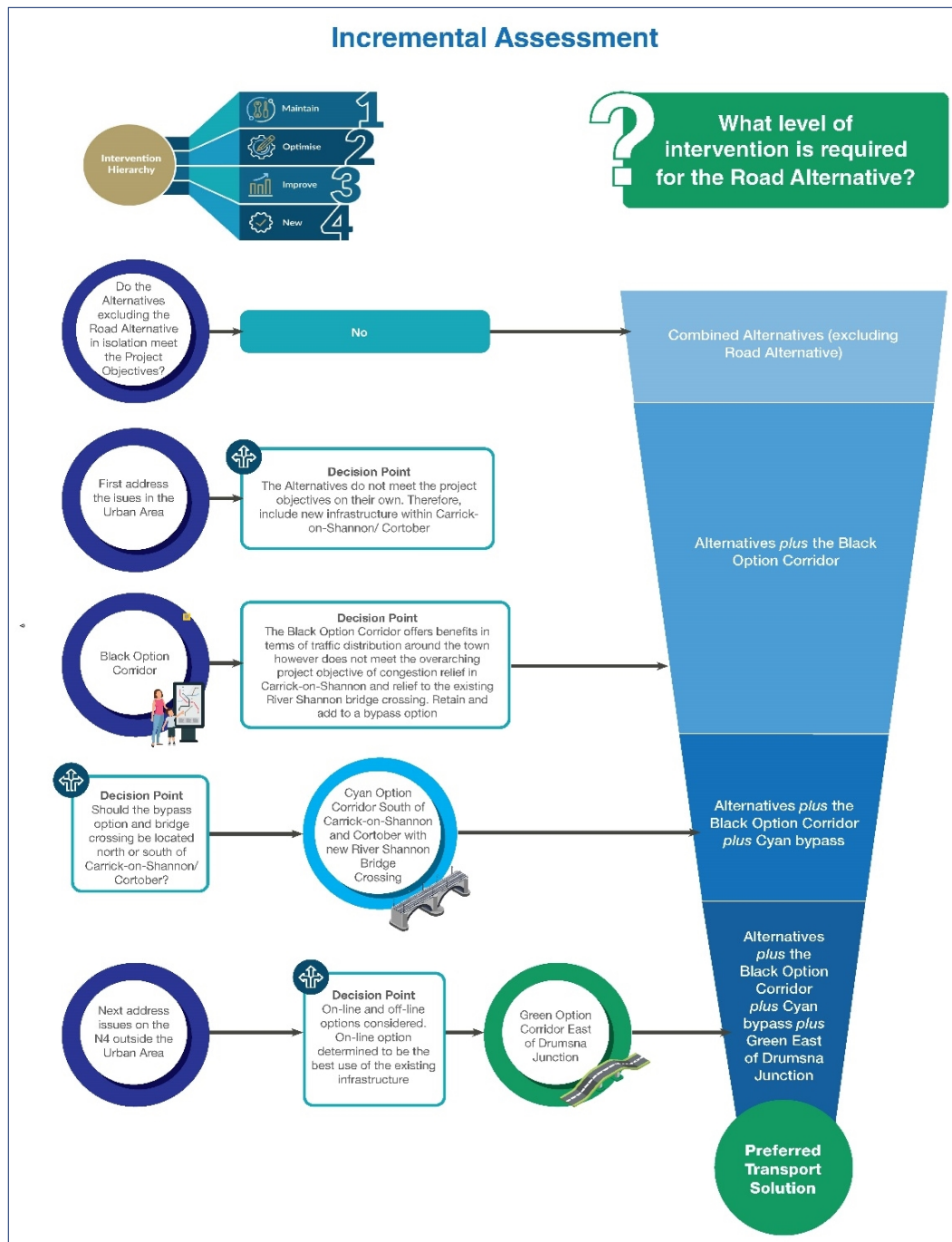


Plate 8.9.3 Incremental Assessment Summary

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 Drumsna 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.