N21 Newcastle West Road Scheme

Option Selection Report

Volume 3 – Stage 2 Environmental Appraisal Report

N21-JAC-GEN-NWP-RP-OS-0003|Rev 1

March 2022

Limerick County Council

L/18/16498

N21 Newcastle West Road Scheme

Project No:	32118000
Document Title:	Stage 2 Environmental Appraisal Report
Document No.:	N21-JAC-GEN-NWP-RP-OS-0003
Revision:	Rev 0
Document Status:	Published Copy
Date:	March 2022
Client Name:	Limerick County Council
Client No:	L/18/16498
Project Manager:	Gerry Healy
Author:	Grainne Quinn
File Name:	N21-JAC-GEN-NWP-RP-OS-0003.docx

Jacobs Engineering Ireland Limited

Merrion House
Merrion Road
Dublin 4, D04 R2C5
Ireland
T +353 (0)1 269 5666
F +353 1 269 5497
www.jacobs.com

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
Rev 0	March 2022	Published Copy	GQ	FL	HOS	GH
Rev 1	March 2022	Published Copy	GQ	FL	HOS	GH

Contents

1. Introduction

1.1 Overview of this Volume

The Option Selection Report (OSR) is completed in Phase 2 of the eight-phase process outlined in the Transport Infrastructure Ireland (TII) Project Management Guidelines. There are five key phases to the Planning and Design process as illustrated in Table 1.1. The report has multiple volumes outlining the constraints in the Study Area and how ultimately the Preferred Route Corridor Option was selected.

Table 1.1: Project Manager's Manual – Planning and Design Project Phases

Project Stage	Scope	Key Outputs
Phase 0: Scope and Pre-Appraisal		Project Appraisal Plan
Phase 1: Concept and Feasibility	Develop and investigate the feasibility of the Project and project management structure.	Project Execution Plan Feasibility Working Costs Project Brief
Phase 2: Option Selection	**Stage 1: Preliminary Options Assessment** Feasible Route Corridor Options identified and assessed to select Route Corridor Options to progress to Stage 2.	Option Selection Report
	Stage 2 – Project Appraisal Matrix Further examination of Route Corridor Options to determine a Preferred Option.	
	Stage 3 – Preferred Option Final detailed appraisal of the Preferred Route Corridor Option emerging from Stage 2.	
Phase 3: Design and Environmental Evaluation	Develop the Project design and complete a full Environmental Impact Assessment (EIA) of the Proposed Route.	Design Report Environmental Impact Assessment Report (EIAR) Appropriate Assessment
Phase 4: Statutory Processes:	Compile documentation and participate in oral hearing(s) as required by the statutory processes to ensure that the proposed Project is developed in accordance with planning and environmental legislation.	An Bord Pleanála (ABP) / Competent Authority Decision

1.2 Phase 2 Stage 2 Assessment

As detailed in Table 1.1, an initial environmental assessment was undertaken during the Phase 2, Stage 1 process, whereby Feasible Route Corridor Options were identified within the Study Area and comparatively assessed to select nine Route Corridor Options to progress to Stage 2 of the Phase 2

process. Details of the Stage 1 assessment process can be found in Chapter 8 of the Main Report (Volume 1).

This document is Volume 3 (Stage 2 Environmental Appraisal Report) and contains the details of the environmental assessment that has been undertaken as part of the Stage 2 assessment which involved a comparative assessment of the nine Route Corridor Options to identify a Preferred Route Corridor. The OSR should be read in its entirety so that a full understanding can be gained on all of the six Main Common Appraisal Framework Criteria used in the Stage 2 Appraisal process. This document presents the Stage 2 Environment Appraisal of the nine Route Corridor Options in relation to a number of environmental topics (listed in Table 1.2); some of the details in this document have been summarised in Volume 1, Chapters 4 and 9 of the OSR.

The assessment of the nine Route Corridor Options is based on the descriptions in Volume 1 (Section 9.2) of this OSR and as shown in Figure 1.3 of Volume 2. Specific assessment guidelines have been applied in each environmental chapter of this Volume 3, to assess the potential effects of the Route Corridor Options. This is set out in the methodology section of each chapter.

Four Route Corridor Options (Option A, E, F and G) also include a potential link road to the R521. A study area for the proposed link road was identified, as shown in Figure 1.3. For the purposes of assessment, the appraisal of the R521 Link Road is based on an indicative 50m alignment within that study area. At the next phase of the project (i.e., Phase 3 Design and Environmental Evaluation), there will be further assessment to inform the proposed alignment of the Preferred Route Corridor and the R521 Link Road. There will also be further surveys, consultation, and design work as the project moves to the next phase of the project. The assessment in this report is based on the corridors and indicative alignment as outlined above. There will be a full assessment of the proposed road layout in the Environmental Impact Assessment Report, which will be published at Phase 3. The assessment presented in this report will be refined as the project design becomes more detailed and will take into account further surveys and consultation, in-line with national guidelines.

The Environment Appraisal Criteria used in this Stage 2 assessment are outlined in detail in the section below against the environmental topics, or 'Sub-Criteria' identified in the TII's PAG Unit 7.0 – Multi-Criteria Analysis PE-PAG-02030. A summary of the Stage 2 Environment Appraisal is provided in Section 9.6 of Volume 1, Chapter 9 (Stage 2 – Project Appraisal Matrix) in the OSR.

1.3 List of Environmental Topics

Environmental Impact Assessment is a process and includes information gathered throughout all planning and design phases of the project. The assessment of alternatives (Phase 2) is a key part of Environmental Impact Assessment. An *Environmental Impact Assessment Report* will be prepared at Phase 3 (Design and Environmental Evaluation) of the project and assessment of alternatives to the Preferred Route Corridor Option will be considered within it. This Option Selection Report and all associated information gathered during Phase 2 of the project will contribute to that. The environmental topics considered in this report are based on the topics that will be considered in the Environmental Impact Assessment.

TII have identified a number of environmental topics (Environmental Criteria) to be assessed as part of the Phase 2 Stage 2 assessment within the PAG Unit 7.0 guidelines. TII have also published specific guidelines for a number of these environmental topics, detailing assessments at various stages of national road schemes. Where available, these guidelines will be used in addition to EIA guidelines and principles to ensure consistency throughout the various stages as far as reasonably practical. In the absence of TII guidelines for a specific topic, EIA guidelines and principles will be used.

There is no single definitive list of environmental topics for inclusion in an Environmental Impact Assessment process. The 2014 Environmental Impact Assessment Directive (2014/52/EU), as transposed into Irish law, outlines factors for inclusion in an Environmental Impact Assessment Report

(which will be completed at Phase 3). These factors have been elaborated on by TII and EPA guidelines, and professional judgement plays a role. In assessing a road scheme, the following are taken into account:

- National Legislation - The European Union (Roads Act 1993) (Environmental Impact Assessment) (Amendment) Regulations 2019[1];
- National Guidelines - Guidelines on The Information to be Contained in Environmental Impact Assessment Reports Draft August 2017[2];
- National Transportation Guidelines - TII Publications PE-PAG-02031 Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis (October 2016)[3]
- National Transportation Planning and Construction Guidelines for Transportation Projects – TII guidelines on environmental topics[4]; and
- National Transportation Guidelines - TII's Project Manager's Manual (PMM) for Major National Road Projects PE-PMG-02042 (February 2019)[5].

Table 1.2 clarifies how the Stage 2 Project Appraisal Matrix environmental criteria identified in Unit 7.0 of the TII PAG have been structured throughout the chapters of this report to allow consistency with the 2014 EIA Directive and national EIA legislation. As well as being addressed in this Option Selection Report, these topics will also be included and addressed in more detail in the Environmental Impact Assessment Report which will be conducted during Phase 3 (Design and Environmental Evaluation) on the Preferred Route Corridor. Please note that there are additional topics that will be assessed at Phase 3 in the Environmental Impact Assessment Report, as required by the 2014 EIA Directive. These include major accidents and disasters, and interactions (including cumulative assessment).

[1] The 2014 EIA Directive has been transposed into national legislation. The 2019 Regulations have amended the 1993 Roads Act and will be the legislative basis of the assessment.
[2] This is a suggested list from the 2017 EPA Guidelines.
[3] Table 7.1.3 (Phase 2 Stage 2), Page 21.
[4] https://www.tii.ie/technical-services/environment/
[5] This division of constraints does not correlate with the legislation and other guidelines and so will not be used in Phase 2.

Table 1.2: Stage 2 Environmental Appraisal - Topics and Chapters

National Legislation: The European Union (Roads Act 1993) (Environmental Impact Assessment) (Amendment) Regulations 2019[6]	**PAG Unit 7.0 Environmental Criteria**	**N21 Option Selection Report Volume 3 Environmental Chapters**
Population & Human Health	Air Quality and Climate Noise Waste Non-agricultural properties Agriculture	Chapter 2 Air Quality and Climate Chapter 3 Noise Chapter 4 Landscape and Visual Chapter 6 Waste Chapter 10 Material Assets (non-agricultural) Chapter 11 Agriculture (Volume 1 Physical Activity)
Biodiversity	Biodiversity – Flora and Fauna	Chapter 5 Biodiversity – Flora & Fauna
Land & Soils	Soils and Geology Hydrogeology Agriculture	Chapter 7 Soils, Geology and Hydrogeology Chapter 11 Agriculture
Water	Hydrogeology Hydrology	Chapter 7 Soils, Geology and Hydrogeology (i.e., groundwater) Chapter 8 Hydrology (i.e., surface water)
Air[7]	Air Quality and Climate	Chapter 2 Air Quality and Climate Chapter 3 Noise
Climate	Air Quality and Climate	Chapter 2 Air Quality and Climate
Material Assets	Non-agricultural properties	Chapter 10 Material Assets (non-agricultural) Chapter 11 Agriculture
Cultural Heritage	Archaeology and Cultural Heritage	Chapter 9 Cultural Heritage
Landscape	Landscape	Chapter 4 Landscape and Visual

[6] The 2014 EIA Directive has been transposed into national legislation. The 2019 Regulations have amended the 1993 Roads Act and will be the legislative basis of the assessment.

[7] Noise is not specifically identified in the EIA Directive or national legalisation but as noise is transmitted through air, it is taken to be included here.

Each assessment chapter outlines the methodology that was completed, the relevant constraints and the findings of the Option Selection process that was followed. The findings within each assessment chapter are relevant to that chapter and form one part of the overall Option Selection process that was used to select the Preferred Route Corridor. Details on the overall Option Selection process are presented in Volume 1 of the OSR.

Some chapters reference figures (e.g., Figure 5.1) and these are presented in Volume 2 of the OSR. Any appendices referred to within the chapter (e.g., Appendix 11.1) are presented at the end of this document.

1.4 Specialists and Sub-Consultants

Jacobs is the lead consultant throughout this process; however, a number of sub-consultants have been commissioned to undertake the assessment for some environmental topics. The sub-consultant responsible for each assessment is detailed at the beginning of the relevant chapter and is detailed in Table 1.3.

Table 1.3: Responsible Consultants by Environmental Topic

Chapter	Responsible Consultant
Chapter 2 Air Quality and Climate	AONA Environmental Consulting Limited
Chapter 3 Noise	AONA Environmental Consulting Limited
Chapter 4 Landscape and Visual	Macro Works Limited
Chapter 5 Biodiversity – Flora & Fauna	EirEco Limited
Chapter 6 Waste	Jacobs
Chapter 7 Soils, Geology and Hydrogeology	Jacobs
Chapter 8 Hydrology	Jacobs
Chapter 9 Cultural Heritage	Archaeological Management Solutions Ltd (AMS)
Chapter 10 Material Assets (non-agricultural)	Jacobs
Chapter 11 Agriculture	Curtin Agricultural Consultants Ltd

2. Air Quality and Climate

2.1 Introduction

AONA Environmental Consulting Ltd. has been commissioned to conduct an air quality assessment for the Route Corridor Options proposed for the N21 Newcastle West Road Scheme. This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

2.2 Methodology

2.2.1 Assessment Criteria

This assessment has been completed in accordance with the following relevant guidance notes:

- NRA (now TII) Guidelines for the Treatment of Air Quality in National Road Schemes during the Planning and Construction of National Road Schemes (Revised May 2011).

2.2.1.1 Air Quality

In accordance with the NRA (now TII) Guidelines for the Treatment of Air Quality in National Road Schemes during the Planning and Construction of National Road Schemes (2011), the following are considered as part of a Stage 2 assessment:

- Changes to baseline air quality conditions noted in the Stage 1 assessment;
- Calculation of the index of overall change in exposure for the existing route and each Route Corridor Option in the opening year;
- Calculation of local-scale pollutant concentrations; and
- Impacts on sensitive ecosystems.

2.2.1.2 Climate Change

Climate Change considerations have been built into Phase 2 and are documented within this section of the Option Selection Report and through use of the TII Carbon Assessment Tool, which is summarised in this section. The air quality elements of this section consider the emissions which primarily impact air quality and human health, but these emissions also have consequences for global warming and climate change and have informed the Option Selection Process.

An assessment of the impact on climate change (including greenhouse gas (GHG) emissions) from the construction phase and operational phase for the proposed Route Corridor Options has been undertaken using the TII calculation tool for assessing lifecycle carbon emissions for national road and light rail infrastructure projects in Ireland (the Carbon Assessment Tool) The purpose of the tool is to assist TII to comply with the requirements of the revised EIA Directive 2014/52/EU, which requires European Union (EU) Member States to assess the impact of projects on climate change (including GHG emissions) as part of the EIA process. A full option selection air quality and climate analysis (in accordance with the TII guidelines) of the feasible Route Corridor Options for the N21 Newcastle West Road Scheme is presented in this chapter.

The Carbon Assessment Tool can also be employed to compare carbon emissions from a number of options at Phase 2 Option Selection. However, it should be noted that there is a limited level of design detail on each Route Corridor Option at this stage and a number of assumptions have had to be made to complete the Tool. Therefore, the outputs of the Carbon Assessment Tool have not fed into the

scoring of Route Corridor Options as part of this Option Selection Report. The outputs of the Carbon Assessment Tool have been used purely as a guide and a base for the Climate assessment to be completed within the Phase 3 (Design and Environmental Evaluation). The inputs and outputs of the Carbon Assessment Tool are summarised in Section 2.4.1.4

The assessment of Route Corridor Options was assisted by scoring of impacts to sensitive air quality receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 - Multi Criteria Analysis[8]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the scores detailed within the PAG Unit 7.0, as shown in Table 2.1 and a number was assigned according to the level of significance of the effect.

Table 2.1: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

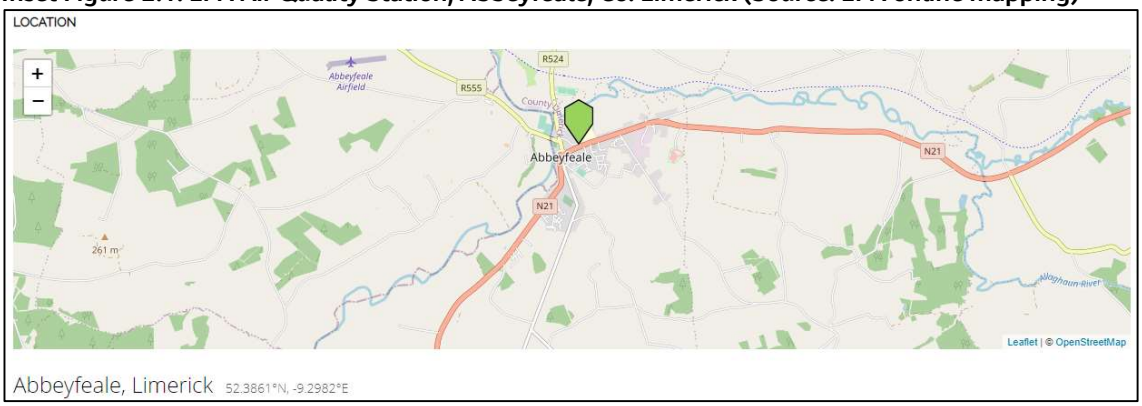
2.3 Existing Environment

2.3.1 Air Quality

Since the Stage 1 assessment there have been no changes to baseline air quality conditions. An EPA air quality station was commissioned in Abbeyfeale, Co. Limerick in December 2020 which monitors particulate matter (PM_{10} and $PM_{2.5}$). The monitoring location is located approximately 20km from Newcastle West and is shown in Inset Figure 2.1. This monitoring location measures the existing air quality in close proximity to the N21 national route and therefore, is indicative of roadside air pollutant concentrations from the N21 in Newcastle West.

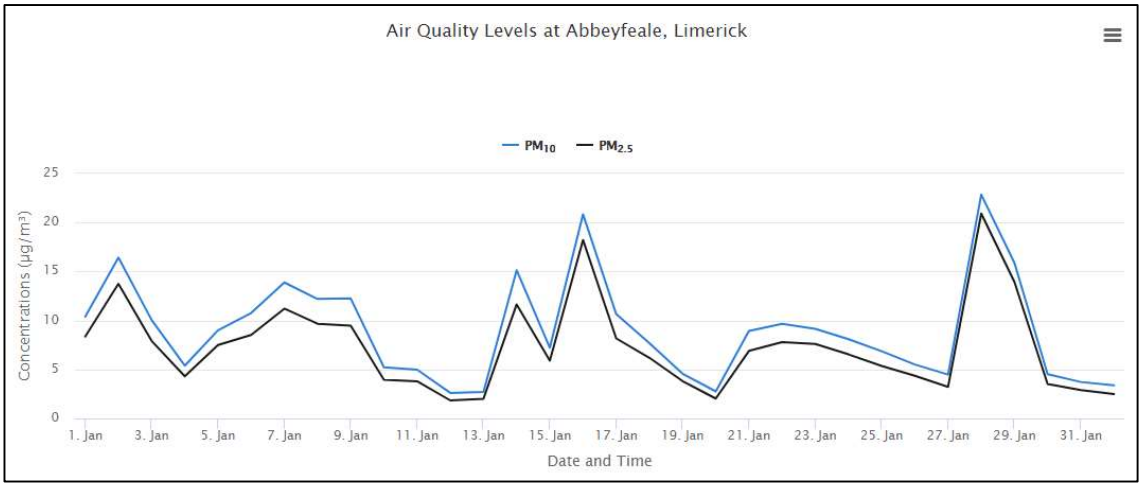
[8] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

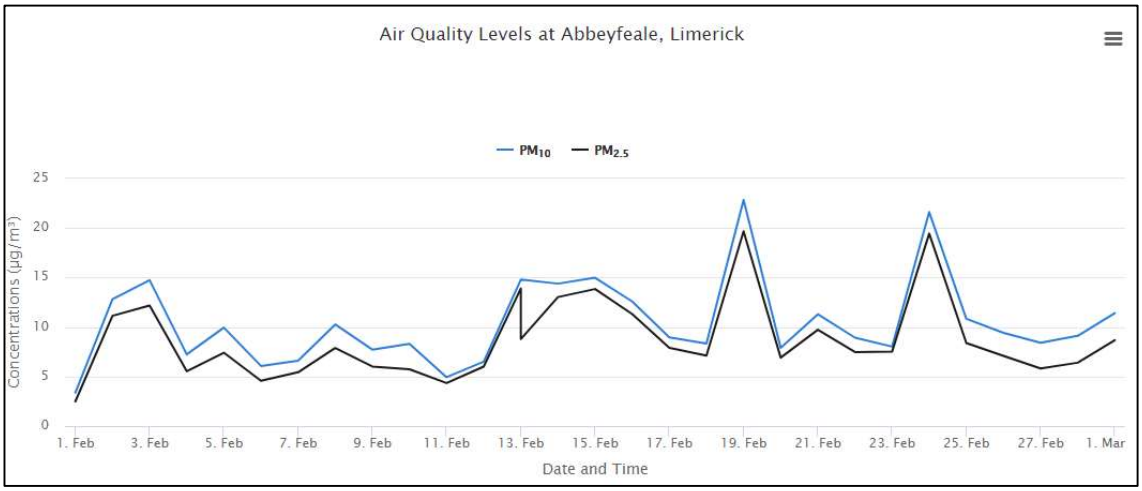
Inset Figure 2.1: EPA Air Quality Station, Abbeyfeale, Co. Limerick (Source: EPA online mapping)

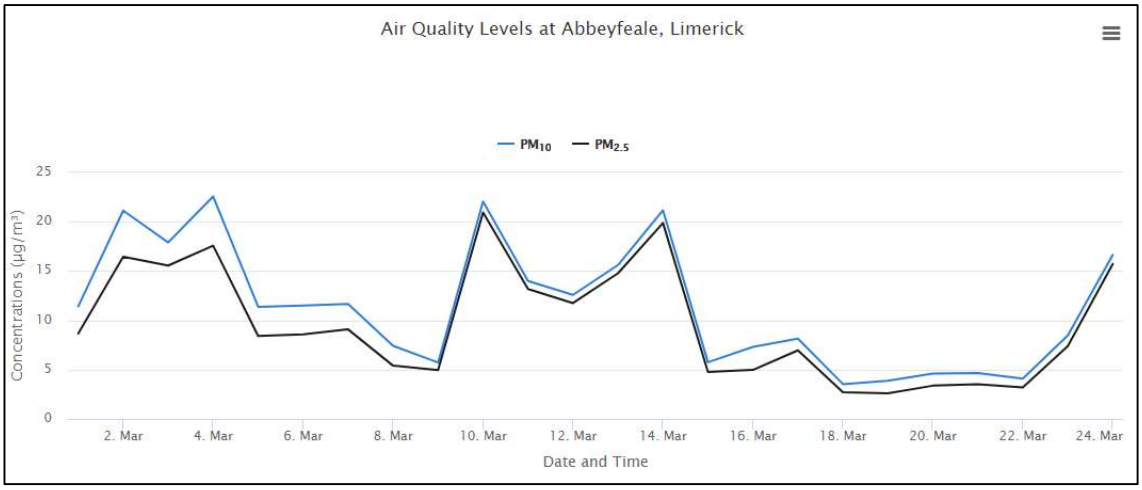


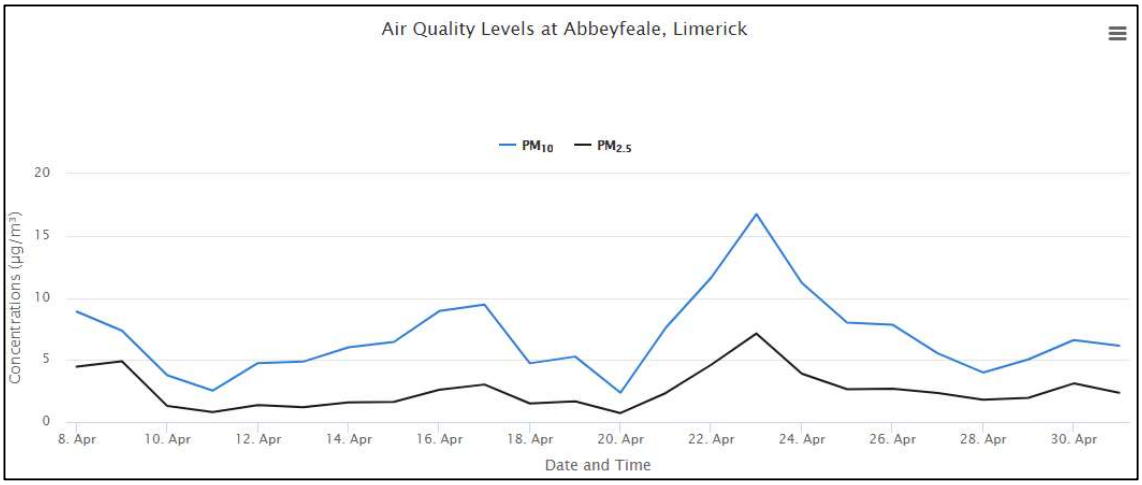
Graph 2.1 and Table 2.2 show the average values for Particulate Matter (PM_{10} and $PM_{2.5}$) levels for each month, January to June 2021. The EPA Particulate Matter monitor at this location has been undergoing calibration since July 2021, hence no data exists since this date.

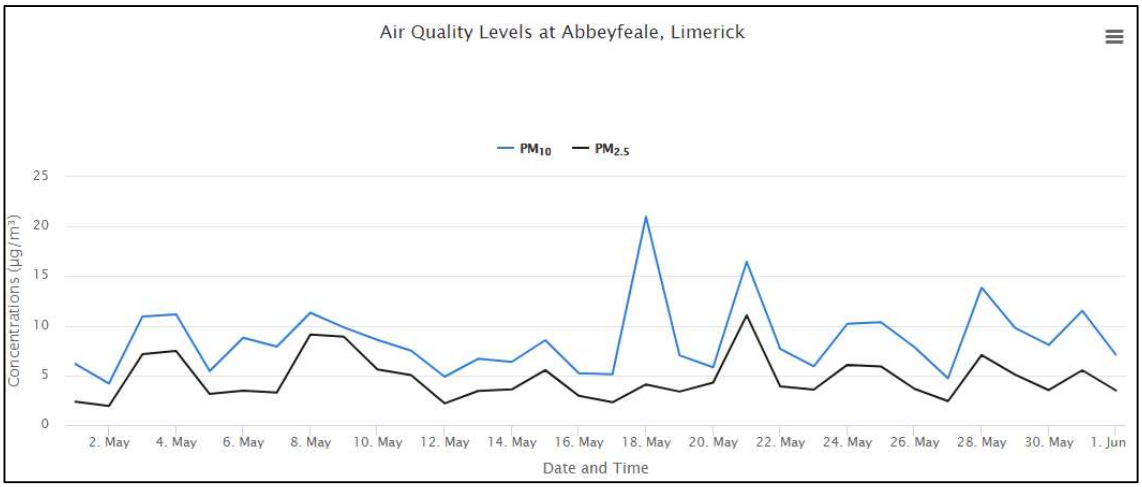
Graph 2.1: Air Quality Levels at Abbeyfeale, Co. Limerick (January - June 2021)






Air Quality Levels at Abbeyfeale, Limerick
PM10
PM2.5
Concentrations (µg/m³)
25
20
15
10
5
0
2. Mar
4. Mar
6. Mar
8. Mar
10. Mar
12. Mar
14. Mar
16. Mar
18. Mar
20. Mar
22. Mar
24. Mar
Date and Time


Air Quality Levels at Abbeyfeale, Limerick
PM10
PM2.5
Concentrations (µg/m³)
20
15
10
5
0
8. Apr
10. Apr
12. Apr
14. Apr
16. Apr
18. Apr
20. Apr
22. Apr
24. Apr
26. Apr
28. Apr
30. Apr
Date and Time


Air Quality Levels at Abbeyfeale, Limerick
PM10
PM2.5
Concentrations (µg/m³)
25
20
15
10
5
0
2. May
4. May
6. May
8. May
10. May
12. May
14. May
16. May
18. May
20. May
22. May
24. May
26. May
28. May
30. May
1. Jun
Date and Time

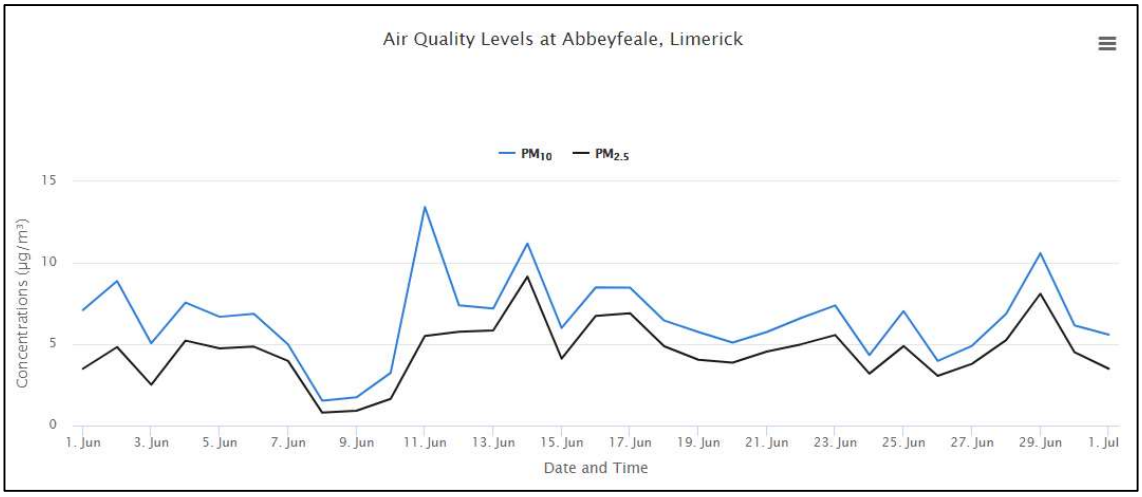


Table 2.2: Air Quality Levels at Abbeyfeale, Co. Limerick (January - June 2021)

Month	PM_{10} µg/m³	$PM_{2.5}$ µg/m³
January	9.17	7.46
February	10.16	8.35
March	11.38	9.60
April	6.94	2.57
May	8.67	4.74
June	6.52	4.55
July (18th July)	5.81	4.06
Annual Mean Limit	40 µg/m³	20 µg/m³

Table 2.2 shows that the limit value for Particulate Matter (PM_{10} and $PM_{2.5}$) has not been exceeded in Abbeyfeale from January to June 2021. The fact that the Particulate Matter (PM_{10} and $PM_{2.5}$) concentrations are so low relative to the national Air Quality Standards annual mean limit value indicates good air quality in the area.

2.3.2 Nitrogen Sensitive Habitats

One ecologically designated area is located in proximity to the Study Area, namely the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Areas (NPWS site code ref: 004161).

2.4 Assessment of Route Corridor Options

2.4.1 Assessment of Potential Impacts

2.4.1.1 Calculation of the index for overall change in exposure

The Calculation of the Index of Overall Change in Exposure allows a comparison of the overall impact on people of each Route Corridor Option to be carried out. The Index is based on taking the number of sensitive receptor locations within 50m of the carriageway of all road links that would experience a significant change in traffic for each of the Route Corridor Options. Fifty metres represents the distance within which detectable impacts of a road might be found, while a significant change can be considered to be an increase or decrease in traffic emissions of 10% or more. The number of properties is then multiplied by the predicted change in the emission rate along that link, and then summed across all links for the Route Corridor Options. The changes in emissions will be influenced by changes in traffic flow, composition and speed.

The assessment of the calculation of the index for overall change in exposure is completed using the UK DMRB assessment for regional assessment. The index of overall change in exposure is calculated for NO_2 and PM_{10} for the different Route Corridor Options. A negative index score indicates that there would be an overall reduction in exposure to pollution, i.e., a benefit. A positive index score indicates an increase in exposure to pollution, i.e., negative impact. The nitrogen oxides (NO_x) and particulate matter (PM_{10}) indices for each Route Corridor Option are presented in Tables 2.3 & 2.4.

Table 2.3: Route Corridor Options NOx index

Option	Properties within 50m	Route Corridor Option Length (m)	Do Minimum Emissions (Kg/yr)	Do Something Emissions (Kg/yr)	Change in Emissions (Kg/yr)	Change in NOx Emission rate (Kg/Km/r)	NOx Index
Route Corridor Option A	1	7,724	0	23,789	23,789	3.1	3.1
Route Corridor Option B	2	8,724	0	21,377	21,377	2.5	4.9
Route Corridor Option C	2	8,224	0	18,353	18,353	2.2	4.5
Route Corridor Option D	2	5,164	0	13,689	13,689	2.7	5.3
Route Corridor Option E	2	8,214	0	25,101	25,101	3.1	6.1
Route Corridor Option F	1	7,346	0	21,983	21,983	3.0	3.0
Route Corridor Option G	2	7,805	0	23,495	23,495	3.0	6.0
Route Corridor Option H	1	6,907	0	18,330	18,330	2.7	2.7
Route Corridor Option I	3	6,549	0	14,807	14,807	2.3	6.8

Table 2.4: Route Corridor Options PM_{10} index

Option	Properties within 50m	Option Length (m)	Do Minimum Emissions (Kg/yr)	Do Something Emissions (Kg/yr)	Change in Emissions (Kg/yr)	Change in PM_{10} Emission rate (Kg/Km/yr)	PM_{10} Index
Route Corridor Option A	1	7,724	0	785	785	0.1	0.1
Route Corridor Option B	2	8,724	0	728	728	0.1	0.2
Route Corridor Option C	2	8,224	0	719	719	0.1	0.2
Route Corridor Option D	2	5,164	0	558	558	0.1	0.2
Route Corridor Option E	2	8,214	0	826	826	0.1	0.2
Route Corridor Option F	1	7,346	0	728	728	0.1	0.1
Route Corridor Option G	2	7,805	0	771	771	0.1	0.2
Route Corridor Option H	1	6,907	0	747	747	0.1	0.1
Route Corridor Option I	3	6,549	0	585	585	0.1	0.3

A summary of the results of the index of overall change in NO_x and PM_{10} exposure for each Route Corridor Option is provided in Table 2.5.

All Route Corridor Options result in increased Overall NO_x and PM_{10} Exposure, however there are minor differentiations between Route Corridor Options. Route Corridor Options F and H have the lowest change in exposure for both NO_x and PM_{10}. In terms of the Index of Overall NO_x and PM_{10} Exposure, Route Corridor Option I has the highest change in overall exposure.

Table 2.5: Summary of Index of Overall NOx and PM_{10} Exposure for each Route Corridor Option

NB This assessment of Better or Worse is a comparison of the Route Corridor Option against its location where there is not currently a road. The Route Corridor Options are not being compared against the existing N21 – that will be done in the next phase of the project. It is important to consider that the existing air quality in the area is of very good quality and no Route Corridor Option will result in an exceedance of the air quality standards or pollutant concentrations that will be close to exceeding the air quality standard limit values.

Route Corridor Option	NO_x Exposure Index	Better or Worse	PM_{10} Exposure Index	Better or Worse
Route Corridor Option A	3.1	Worse	0.1	Worse
Route Corridor Option B	4.9	Worse	0.2	Worse
Route Corridor Option C	4.5	Worse	0.2	Worse
Route Corridor Option D	5.3	Worse	0.2	Worse
Route Corridor Option E	6.1	Worse	0.2	Worse
Route Corridor Option F	3	Worse	0.1	Worse
Route Corridor Option G	6	Worse	0.2	Worse
Route Corridor Option H	2.7	Worse	0.1	Worse
Route Corridor Option I	6.8	Worse	0.3	Worse

2.4.1.2 Calculation of the local scale pollutant concentrations

The TII guidelines states that if there are sensitive receptors within close proximity to one or more Route Corridor Options, i.e., within 10m of the edge of the road, it is necessary to predict pollutant concentrations at Stage 2. The guidance advises that it would be appropriate in these circumstances to calculate concentrations of both NO_2 and PM_{10} at a small number of 'worst-case' receptors for the year of opening. However, no residential properties will be within 10m of any of the proposed Route Corridor Option alignments.

2.4.1.3 Impacts on sensitive ecosystems

The TII guidelines states that consideration should be given to all designated sensitive sites that are within 200m of any road that could be affected by the Project, both during operation and construction. For the purpose of this Option Assessment, it should only be necessary to consider roads where there would be a 5% change or greater in traffic flows. For each affected Route Corridor Option nitrogen oxide concentrations and nitrogen deposition rates are calculated within the designated site, in a transect up to 200m away from the road carriageway using the DMRB screening model. The results are then compared with the standard for the protection of vegetation of 30 $\mu g/m^3$.

One ecologically designated area is located in proximity to the Study Area, the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Areas (NPWS site code ref: 004161). However, none of the Route Corridor Options are within 200m of this SPA, therefore there will be no significant impact from the development on designated sites.

2.4.1.4 Carbon Assessment Tool

Although the results of the Carbon Assessment Tool will not feed into the option scoring and Preferred Option selection directly, much of the information which has been used to populate the Tool has been gathered from various sources from the Option Selection Report. Therefore, these carbon considerations are embedded into the Phase 2 decision making process.

Information feeding into the Carbon Assessment Tool included:

- Material usage (Waste section) and embodied carbon;
- Carbon Dioxide emissions from vehicles (Transport Users Benefit Appraisal (TUBA));
- Loss of habitats which are valuable for carbon sequestration (Ecology / Agriculture); and
- Addition of carbon sequestration habitat such as landscaping and planting.

The limitations and assumptions used to complete the Carbon Assessment Tool include:

- Fuel and water use during construction is not known;
- Construction worker travel is not known;
- Project duration is assumed at this stage;
- Excavation volumes and areas to be cleared are approximate and not finalised;
- Materials used and exported off-site is approximated;
- Landscape planting at construction phase is assumed;
- Operational traffic volumes and consequential emissions are estimated from TUBA data; and
- Operational and decommissioning waste and resource use cannot be calculated.

The carbon emissions calculated for each Route Corridor Option from the Carbon Assessment Tool are detailed in Table 2.6 below. Options A, E, F and G have potential to be carbon negative due to a number of factors. These Route Corridor Options are the shortest (as measured from consistent end points either side of Newcastle West), and thus have the shortest travel time and lower emissions. Consistent with the Cost Benefit Analysis, these Route Corridor Options have a negative indirect tax benefit as vehicles use less fuel on these routes.

The caveats to these carbon calculations, discussed above, should be considered when reading this table, and as a consequence these results have not fed into the scoring of Route Corridor Options.

Table 2.6 – Carbon Tool Outputs[9]

	Before Use (kgCO2e)				Use (kgCO2e)	
Option	**Pre-Construction**	**Embodied Carbon**	**Construction Activities**	**Construction Waste**	**Vehicles using the Infrastructure**	**Totals**
Option A	19,337	13,109,128	486,407	125,922	-25,396,940	-11,656,144
Option B	74,004	14,460,964	527,531	976,354	7,668,000	23,706,854.
Option C	252,866	14,976,590	524,560	1,080,768	3,050,000	19,884,785
Option D	11,862	10,907,304	450,409	86,166	2,215,000	13,670,743
Option E	17,685	13,423,745	496,159	139,526	-36,693,000	-22,615,883
Option F	16,918	12,907,066	501,469	167,131	-15,450,000	-1,857,414
Option G	16,806	13,102,121	502,805	166,111	-25,983,000	-12,195,154
Option H	247,260	13,272,803	467,790	100,906	966,000	15,054,761
Option I	14,498	11,848,065	518,312	1,332,596	1,616,000	15,329,473

2.4.2 Assessment of Effects of Route Corridor Options

The elements of Route Corridor Selection outlined in the Guidelines for the Treatment of Air Quality in National Road Schemes during the Planning and Construction of National Road Schemes (Revised May 2011), has allowed for minor differentiations between Route Corridor Options for the Newcastle West N21 Road Scheme. In terms of the Index of Overall NO_x and PM_{10} Exposure, Route Corridor Options F and H had the lowest Index of Exposure and Route Corridor Option I had the highest Index of Exposure.

However, it is important to consider that the existing air quality in the area is of very good quality and no Route Corridor Option will result in an exceedance of the air quality standards or pollutant concentrations that will be close to exceeding the air quality standard limit values. Therefore, based on the elements of Route Corridor Selection outlined in Guidelines for the Treatment of Air Quality in National Road Schemes during the Planning and Construction of National Road Schemes (Revised May 2011), in terms of the Index of Overall NO_x and PM_{10} Exposure, as quoted in Tables 2.5, all Route Corridor Options will result in Minor negative impact on Air Quality as illustrated in Table 2.6.

Table 2.7: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Route Corridor Option A	Minor negative	3
Route Corridor Option B	Minor negative	3

[9] Decommissioning has not been included in the carbon tool assessment. There are no plans for decommissioning this project in the foreseeable future. The carbon cost of decommissioning would likely be similar to the construction phase but it has not been estimated at this Stage of the project.

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Route Corridor Option C	Minor negative	3
Route Corridor Option D	Minor negative	3
Route Corridor Option E	Minor negative	3
Route Corridor Option F	Minor negative	3
Route Corridor Option G	Minor negative	3
Route Corridor Option H	Minor negative	3
Route Corridor Option I	Minor negative	3

2.5 Conclusion

Based on the elements of Route Corridor Selection outlined in Guidelines for the Treatment of Air Quality in National Road Schemes during the Planning and Construction of National Road Schemes (Revised May 2011), in terms of the Index of Overall NO_x and PM_{10} Exposure, all Route Corridor Options will result in Minor negative impact on Air Quality as illustrated in Table 2.6.

However, it is important to consider that the existing air quality in the area is of very good quality and no Route Corridor Option will result in an exceedance of the air quality standards or pollutant concentrations that will be close to exceeding the air quality standard limit values.

3. Noise

3.1 Introduction

AONA Environmental Consulting Ltd. have been commissioned to undertake the Stage 2 Route Corridor Option assessment relating to noise for the proposed N21 Newcastle West Road Scheme. This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

This assessment evaluates the noise and vibration impacts which would have the potential to constrain the location of any proposed Route Corridor Option for the N21 Newcastle West Road Scheme and tries to reach a conclusion on the most acceptable option in terms of noise and vibration.

This assessment has been completed in accordance with the following relevant guidance notes:

- TII Guidelines for the Treatment of Noise & Vibration in National Road Schemes (October 2004);
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014).

3.2 Methodology

3.2.1 Assessment Criteria

The TII Guidelines for the Treatment of Noise & Vibration in National Road Schemes (2004) state that "the work undertaken as part of the Constraints Study is used by the project engineers responsible to refine the broad corridor into a small number of Route Corridor Options".

The Guidelines state that there are three elements to the Route Corridor Selection. These elements consist of the following;

- an assessment of potential impact based upon property counts,
- a consideration of likely changes in traffic flow, and
- a review of the need for, and difficulties associated with, noise mitigation measures.

Once these three elements have received detailed consideration, Route Corridor Options should be awarded a PAG score with respect to noise.

A review of the Guidelines for the Treatment of Noise & Vibration in National Road Schemes (2004) has been undertaken. This review was based on the experiences acquired from the implementation of the original draft guidelines, on a validation study that was undertaken to assess the applicability of the specified design criteria and the functionality of the various Transport Research Laboratory (TRL) conversion methodologies for Irish road conditions. This review provides guidance on the revised design criteria and the application of validated approaches to deriving the L_{den} values as well as an overview of the baseline monitoring and model validation procedure. The new Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes is based on the lessons learned from post EIA noise evaluation studies and research undertaken on the design of noise barriers. It provides advice and information for use by acousticians, and it is also relevant for traffic, motorway and pavement engineers. The advice amplifies and supplements the original noise guidelines, and it should be read in conjunction with that document. The Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014) references the approach to preferred Route Corridor Option selection as was outlined in the 2004 Guidelines. A full Option Selection analysis (in accordance with the TII guidelines) of the feasible Route Corridor Options for the N21 Newcastle West Road Scheme is presented in this chapter.

The assessment of Route Corridor Options was assisted by scoring of impacts to noise sensitive receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines (PAG) for National Roads Unit 7.0 - Multi Criteria Analysis[10]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the scores detailed within the PAG Unit 7.0, shown in Table 3.1, and a number was assigned according to the level of significance of effect.

Table 3.1: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

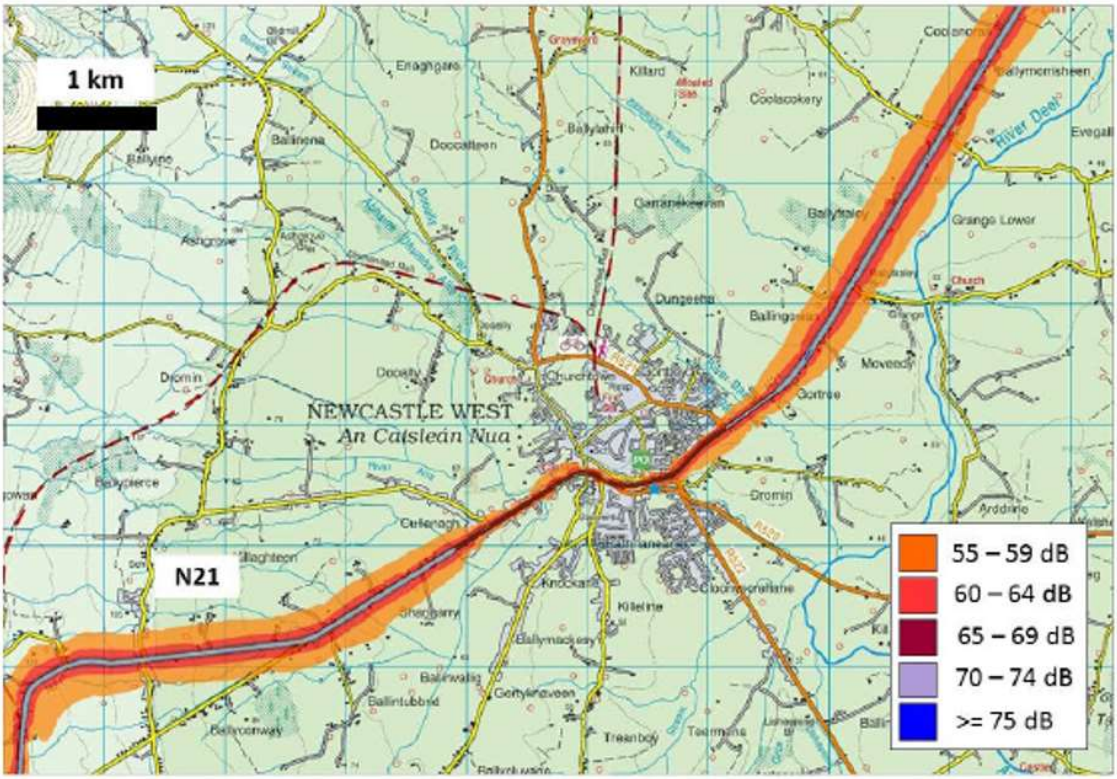
3.3 Existing Environment

Newcastle West is located approximately 40 kilometres south-west of Limerick City. Newcastle West is on the existing N21 from Limerick to Tralee, between Rathkeale and Abbeyfeale. Newcastle West is a busy town and the main road in the area of the town is the existing N21. The existing N21 is heavily trafficked and traffic noise is audible and significant at many residential properties in the area.

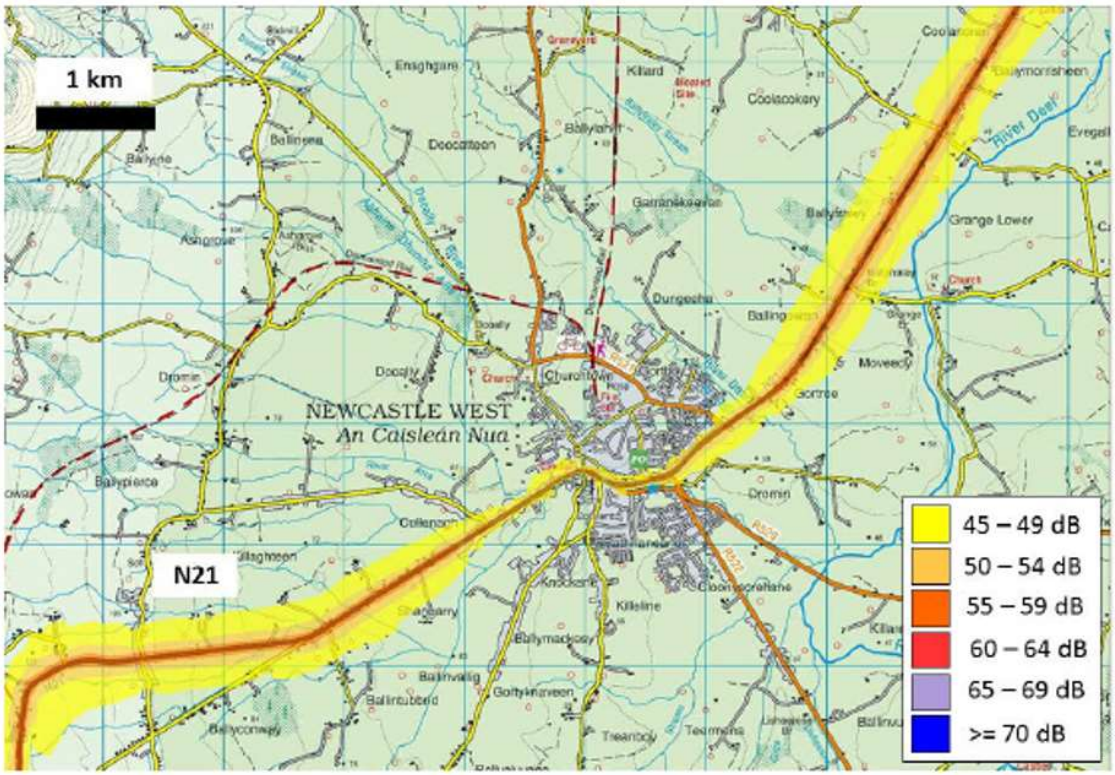
Limerick County Council has prepared a Noise Action Plan for Major Roads in the County 2018 - 2023. This Noise Action Plan has been prepared in accordance with EU Directive 2002/49/EC commonly referred to as the 'END' Directive and S.I. 140 of 2006 commonly referred to as the Environmental Noise Regulations. For the third round of noise mapping in 2017, the strategic noise mapping was undertaken for "major roads", i.e., sections of road with a flow threshold of 3,000,000 vehicle passages per year (or 8,220 AADT). This was included for the N21 in proximity to Newcastle West.

Inset Figures 3.1 and 3.2 illustrate the noise contour mapping showing the 'Average Sound Levels from Roads' presented as dB(A) L_{den} and dB(A) $L_{night.}$ The area through which the Route Corridor Options pass in proximity to Newcastle West is primarily rural countryside away from the existing arterial road network. Therefore, the residential properties in this area are not exposed to a significant traffic noise level.

[10] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.



Inset Figure 3.1: Lden (dB) – N21, Newcastle West



Inset Figure 3.2: Lnight (dB) – N21, Newcastle West

3.4 Assessment of Route Corridor Options

3.4.1 Assessment of Potential Impacts

3.4.1.1 Potential Impact Rating Calculations

This aspect of the option selection process has involved identification of all sensitive receivers within 300m of each Route Corridor Option and assigning into one of four "bands". These bands are defined by their distance either side of the centre line of each Route Corridor Option. Band 1 is from 0 to 50m of the centre line, Band 2 is from 50 to 100m, Band 3 is from 100 to 200m and Band 4 is from 200 to 300m. The TII Guidelines for the Treatment of Noise & Vibration in National Road Schemes states that a receiver is defined as being any dwelling house, hotel, hostel, health building, educational establishment, place of worship, entertainment venue or any other facility or area of high amenity which benefits from, or requires the absence of, high noise levels. Noise sensitive receiver band count numbers based on identification of all dwelling houses within 300m of each option have been determined based on mapping provided by the design team. There are three B&Bs in the Study Area, with Shanagarry B&B and The Orchard B&B in proximity to Route Corridor Options D & H, and Ballingowan House B&B in proximity to Route Corridor Options C & I. Further assessment of the proposed R521 Link Road will be carried out at the next stage of the project.

The total number of receivers in each band has been multiplied by a rating factor. The rating factor is 4 for Band 1, 3 for Band 2, 2 for Band 3 and 1 for Band 4. The resultant values have been summed to give a single number for each Route Corridor Option, termed the Potential Impact Rating (PIR). The PIR values have been used to assess the potential impact of each Route Corridor Option, the larger the PIR the greater the potential impact.

PIRs of the Route Corridor Options for the N21 Newcastle West Road Scheme have been provided. The PIR figures outlined in Table 3.2 are based on Band Property Count Numbers for each of the Route Corridor Options.

Table 3.2: Number of properties within 0-50m, 50m-100m, 100–200m and 200–300m bands of the Corridor Options for the N21 Newcastle West Road Scheme

Route Corridor Options	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Property counts within 0 to 50m from the centreline	0	1	3	2	1	1	2	1	4
Property counts within 50 to 100m from the centreline	7	2	4	6	7	5	4	7	3
Property counts within 100 to 200m from the centreline	22	20	17	40	23	14	16	41	16
Property counts within 200 to 300m from the centreline	28	25	36	64	33	28	32	77	25

Table 3.3: Overall Potential Impact Rating of the Corridor Options for the N21 Newcastle West Road Scheme

Route Corridor Options	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
PIR 0-50m	0	4	12	8	4	4	8	4	16
PIR 50-100m	21	6	12	18	21	15	12	21	9
PIR 100-200m	44	40	34	80	46	28	32	82	32
PIR 200-300m	28	25	36	64	33	28	32	77	25
PIR Sum	**93**	**75**	**94**	**170**	**104**	**75**	**84**	**184**	**82**
PIR Rank 0-50m	1	2	8	6	2	2	6	2	9
PIR Rank Total	**5**	**1**	**6**	**8**	**7**	**1**	**4**	**9**	**3**

3.4.1.2 Discussion of Potential Impact Rating

Based on PIR values of the Route Corridor Options for the N21 Newcastle West Road Scheme, as quoted in Table 3.3, the following determination can be provided:

- Route Corridor Options B and F have the lowest PIR Sums;
- Route Corridor Option I has the highest number of properties within 50m of the indicative alignment; and
- Route Corridor Options D and H have the highest PIR Sums compared to other Route Corridor Options.

In terms of the number of properties in close proximity to the Route Corridor Options, Option A has no properties within 50m of the centreline of the corridor option. Route Corridor Options B, E, F and H have just one property within 50m of the centreline of the corridor. Route Corridor Options D and G have just two properties within 50m of the centreline of the corridor. Route Corridor Option C has three properties within 50m of the centreline of the corridor. Route Corridor Option G has four properties within 50m of the centreline of the corridor. It is these properties that are most likely to experience a significant noise impact and therefore, have the potential to require noise mitigation measure design.

Route Corridor Options B and F have a total PIR of 75 within 0-300m of the centreline of the corridor. Route Corridor Options G & I have a total PIR of 84 and 82, respectively, within 0-300m of the centreline of the corridor. Route Corridor Options A and C have a total PIR of 93 and 94 respectively, within 0-300m of the centreline of the corridor. Route Corridor Options D and H have a total PIR of 170 and 184 respectively within 0-300m of the centreline of the corridor.

In order to accurately assess the likely impact of each Route Corridor Option, other factors such as earthworks and the vertical alignment ("cut and fill"), traffic flow and mitigation measures should be considered. This will be considered at Phase 3 of the project (Design and Environmental Evaluation).

3.4.1.3 Assessment of Changes in Traffic Flow

Outlined below is an assessment of the potential changes in traffic flow data provided at this stage of the scheme appraisal, based on the traffic data provided. The TII Guidelines for the Treatment of Noise & Vibration in National Road Schemes, states that an estimate should be made of the number of receivers where traffic flows are likely to increase or decrease by 25% or more.

The traffic flow data for the Future Year 2042 indicates that there will be a reduction in the AADT volumes on the existing N21 alignment, with the proposed Route Corridor Options taking a significant percentage of the traffic flows from the existing N21 alignment when in operation.

To put changes in site traffic noise levels into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows will result in a just perceptible change of 3 dB(A), while an increase or decrease of more than 25%, in traffic flow represents a change of 1 dB(A) in traffic noise levels (assuming no significant alteration in the mix of traffic or speed). In terms of changes in traffic flow data, there will be a potential beneficial noise impact at noise sensitive receivers located in proximity to the existing N21 alignment, where the N21 Newcastle West Road Scheme is realigned away from the existing N21 alignment and the more densely populated areas around Newcastle West town. The proposed Route Corridor Options will result in traffic flows being further removed away from these properties, with a significant percentage of the AADT traffic flows on the existing N21 moving on to the Route Corridor Option. The predicted reductions in AADT traffic flows along the existing N21 will potentially result in a perceptible reduction in traffic noise level at up to approximately 940 residential locations within 300m of the N21 alignment through Newcastle West.

Table 3.4: Predicted Traffic Flow Data for the Year of Opening (2027) and the Design Year (2042).

Route Corridor Option	2027		2042	
	max AADT	%HGV	max AADT	%HGV
Option A	17,820	10.3%	20,903	12.3%
Option B	14,731	9.3%	17,761	11.9%
Option C	15,824	5.4%	19,285	5.7%
Option D	19,704	4.4%	24,835	12.5%
Option E	17,615	10.4%	20,726	12.5%
Option F	17,380	10.2%	20,648	12.1%
Option G	17,287	10.5%	20,356	12.1%
Option H	19,726	4.4%	24,897	12.5%
Option I	16,181	5.2%	19,161	5.7%

Note: These are the maximum flows for each option; the flows are 40% higher than the flows presented in the Traffic Modelling Report (Volume 4) to represent a conservative worst case scenario in terms of adverse environmental impact.

All of the proposed Route Corridor Options will result in relatively similar traffic flows along the alternative N21 route option alignments, and hence a similar reduction in traffic levels along the existing N21 alignment.

In terms of predicted noise levels, there is a relatively insignificant difference between the highest and lowest predicted future AADT volumes due to any of the Route Corridor Options in terms of future noise levels at nearby receivers. While all properties in proximity to any of the proposed alignments will experience a potential noise impact, there are approximately 940 properties within 300m of the existing N21 alignment through Newcastle West which will experience a significant traffic noise level reduction of at least 3 dB(A) with any of the proposed Route Corridor Options in operation. This will result in a perceptible noise level reduction.

3.4.1.4 Assessment of Likely Need for Mitigation Measures

A prediction of the likely noise levels at receivers in proximity to the proposed Route Corridor Options based on the Design Year 2042 AADT volumes was carried out using the *Calculation for Road Traffic Noise* (CRTN) calculation methodology and CadnaA noise modelling software.

The noise level prediction parameter is the L_{den} noise indicator as specified in the TII document "Guidelines for the Treatment of Noise and Vibration in National Road Schemes". This is a composite of L_{Aeq} values for L_{Day}, $L_{Evening}$ and L_{Night}. The design goal set out in the TII document is to achieve 60dB L_{den} (free field residential façade criterion) or less at each receptor. The TII document states that mitigation measures are only deemed necessary when the following three conditions are satisfied at designated sensitive receptors:

- the combined expected maximum traffic noise level, i.e., the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal - 60dB L_{den}.
- the relevant noise level is at least 1dB more than the expected traffic noise level without the proposed road scheme in place.
- the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1dB.

The assessment of the potential noise impacts of the Route Corridor Options has been completed using a worst-case assessment based on the maximum AADT and percentage HGV, as shown in Table 3.5. By using this method, the noise assessment is robust and does not underestimate the potential noise effects from the Route Corridor Options. Further detailed assessment will be required at the next Phase of the project.

Table 3.5: Predicted number of properties with a noise level potentially greater than 60 dB L_{den} & potentially requiring Mitigation.

Route Corridor Option	AADT & %age HGV (2042 Design Year)	Maximum number of properties potentially within 60 dB L_{den} contour
Option A	20,903, 12.3%	198
Option B	17,761, 11.9%	191
Option C	19,285, 5.7%	209
Option D	24,835, 12.5%	618
Option E	20,726, 12.5%	193
Option F	20,648, 12.1%	178
Option G	20,356, 12.1%	168
Option H	24,897, 12.5%	608
Option I	19,161, 5.7%	187

The worst-case predicted noise levels at receivers in proximity to the proposed Route Corridor Options indicate that noise mitigation measures will potentially be necessary in order to achieve the design goal of 60dB L_{den} at certain existing properties. This will depend on proximity to the Preferred Route Corridor Option alignment, the proximity to the existing road network, the proposed vertical alignment relative to existing topography and the existing and proposed traffic volumes in proximity to the property. The predicted future noise level as well as the difference between the existing noise level and the predicted future noise level will determine if noise mitigation measures will be required.

3.4.1.5 Construction Noise

As stated in the TII Guidelines, "there is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities, where appropriate, should control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion". The Authority considers that the noise levels in Table 3.6 are typically deemed acceptable [Note: that these values are indicative only; it may be appropriate to apply

more stringent limits in areas where pre-existing noise levels are low]. These construction noise limits would be applied to all Route Corridor Options.

Table 3.6: Maximum permissible noise levels at the façade of dwellings during construction

Days & Times	$L_{Aeq\ (1\ hour)}$ dB	$L_{pA(max)slow}$ dB
Monday to Friday - 07.00 to 19.00	70	80[1]
Monday to Friday - 19.00 to 07.00	60[1]	65[1]
Saturday - 08.00 to 16.30	65	75
Sundays & Bank Holidays - 08.00 to 16.30	60[1]	65[1]

NB Construction activities at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant local authority.

3.4.2 Assessment of Effects of Route Corridor Options

The prevailing noise climate in the Study Area of the Route Corridor Options varies from rural areas with low background noise levels to residential estate development, properties in closer proximity to Newcastle West, and the existing N21 which experience an elevated noise level due to traffic flows on the existing N21.

Table 3.7 outlines a summary of the assessment of the nine Route Corridor Options based on the three elements of Route Corridor Selection outlined in "The TII Guidelines for the Treatment of Noise & Vibration in National Road Schemes", including an assessment of potential impact rating (PIR) based upon property counts, a consideration of likely changes in traffic flow, and a review of the need for and difficulties associated with noise mitigation measures.

Table 3.7: Route Corridor Option Comparison

Route Corridor Option	PIR 0-50m	PIR 50-100m	PIR 100-200m	PIR 200-300m	PIR Sub-Total	AADT & %age HGV (2042 Design Year)	Maximum number of properties potentially within 60 dB L_{den} contour
Option A	0	21	44	28	93	20,903, 12.30%	198
Option B	4	6	40	25	75	17,761, 11.90%	191
Option C	12	12	34	36	94	19,285, 5.70%	209
Option D	8	18	80	64	170	24,835, 12.50%	618
Option E	4	21	46	33	104	20,726, 12.50%	193
Option F	4	15	28	28	75	20,648, 12.10%	178
Option G	8	12	32	32	84	20,356, 12.10%	168
Option H	4	21	82	77	184	24,897, 12.50%	608
Option I	0	21	44	28	93	19,161, 5.70%	187

An assessment has been conducted based on the three elements of Route Corridor Selection outlined in "The TII Guidelines for the Treatment of Noise & Vibration in National Road Schemes", including an assessment of Potential Impact Rating (PIR) based upon property counts, a consideration of likely changes in traffic flow and a review of the need for and difficulties associated with noise mitigation measures. The assessment has been summarised in Table 3.8 below. The majority of Route Corridor Options have received an Impact score of Moderate negative as illustrated in Table 3.8 and summarised in Table 3.9. However some Route Corridor Options (D, H and I) have scored Major negative due to their proximity to Newcastle West and therefore potential to impact a larger number of properties.

Although many Route Corridor Options have scored the same, there are minor differentiations between Route Corridor Options as outlined in Table 3.8 and summarised in Table 3.9.

Table 3.8: Stage 2 Route Corridor Option Assessment Matrix

Route Corridor Option	Assessment Summary	Impact Score
Option A	Option A is located to the north of Newcastle West and passes through a relatively rural area and agricultural lands with sporadic housing and linear development along rural roads. This option has a relatively low PIR value with no properties within 50m of the alignment. Therefore, there will be a relatively low level of mitigation required.	2
Option B	Option B is the option located furthest to the north of Newcastle West and passes through a relatively rural area and agricultural lands with sporadic housing and linear development along rural roads. This option has a relatively low PIR value with a relatively low number of properties within 50m of the alignment. There will be a relatively low level of mitigation required. This is the joint Preferred Option in terms of noise.	2
Option C	Option C is the option located furthest to the south of the outskirts of Newcastle West and passes through a relatively rural area and agricultural lands with sporadic housing and linear development along rural roads. This option has a relatively low PIR value but a relatively high number of properties within 50m of the alignment. There will be a relatively low level of mitigation required. This is one of the least Preferred options in terms of noise.	2
Option D	Option D is located in closest proximity to the south of the outskirts of Newcastle West. This option has a relatively high PIR value with a medium range number of properties within 50m of the alignment. There will potentially be a relatively high level of mitigation required. This Route Corridor Option will likely have one of the greatest noise impacts.	1
Option E	Option E is located to the north of Newcastle West and passes through a relatively rural area and agricultural lands with sporadic housing and linear development along rural roads. This option has a medium range PIR value but with a relatively high number of properties within 50m of the alignment. There will be a relatively low level of mitigation required.	2
Option F	Option F is located to the north of Newcastle West and passes through a relatively rural area and agricultural lands with sporadic housing and linear development along rural roads. This option has a relatively low PIR value with a relatively low number of properties within 50m of the alignment. There will be a relatively low level of mitigation required. This is the joint Preferred Option in terms of noise.	2

Route Corridor Option	Assessment Summary	Impact Score
Option G	Option G is located to the north of Newcastle West and passes through a relatively rural area and agricultural lands with sporadic housing and linear development along rural roads. This option has a relatively low PIR value with a medium range of properties within 50m of the alignment. There will be a relatively low level of mitigation required.	2
Option H	Option H is located in close proximity to the south of the outskirts of Newcastle West. This option has the highest PIR value with a low number of properties within 50m of the alignment.	1
Option I	Option I is located further to the south of the outskirts of Newcastle West. This option has a relatively low PIR value but with the highest number of properties within 50m of the alignment. There will potentially be a relatively high level of mitigation required.	1

Table 3.9: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Moderate negative	2
Option B	Moderate negative	2
Option C	Moderate negative	2
Option D	Major negative	1
Option E	Moderate negative	2
Option F	Moderate negative	2
Option G	Moderate negative	2
Option H	Major negative	1
Option I	Major negative	1

3.5 Conclusion

Based on the elements of Route Corridor Selection outlined in Guidelines for the Transport Infrastructure Ireland Guidelines, the Treatment of Noise and Vibration in National Road Schemes (TII 2004) and Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII 2014). Route Corridor Options B and F will likely have the lowest impact on noise. Route Corridor Options C, D and I will likely have the highest impact in relation to noise.

4. Landscape & Visual

4.1 Introduction

Macro Works Limited was commissioned to conduct the Landscape and Visual assessment for the Route Corridor Options proposed for the N21 Newcastle West Road Scheme. This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

This chapter assesses the various Route Corridor Options in-line with:

- Environmental Protection Agency (EPA), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft 2017.[11]
- Landscape Institute and the Institute of Environmental Management and Assessment (eds.) (2013) Guidelines for Landscape and Visual Impact Assessment. Routledge, Oxon.[12]
- Transport Infrastructure Ireland Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects - Overarching Technical Document PE-ENV-01101, 2020.[13]
- Transport Infrastructure Ireland Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads - Standard PE-ENV-01102, 2020.[14]
- Transport Infrastructure Ireland Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis PE-PAG-02031, 2016. [15]

The landscape is the visible environment in its entirety, comprised of both natural and built elements including topography, water bodies, vegetation, wildlife habitats, open spaces, buildings and structures. Landscape and visual sensitivities considered include statutory and non-statutory landscape designations, natural features, landscape character areas, notable deciduous trees of woodland, amenities and historic landscapes.

Landscape and visual constraints are examined as two discrete topics:

- **Landscape** - is concerned with alteration to the physical landscape and elements which contribute to its character; and
- **Visual** - is concerned with changes that may arise in the overall visual amenity enjoyed by people.

4.2 Methodology

The landscape and visual assessment are derived from the methods described in the Design Manual for Roads and Bridges (UK)[16], Guidelines for Landscape and Visual Impact Assessment (UK) (GLVIA) [17] and was undertaken in accordance with the new Transport Infrastructure Ireland guidelines published in December 2020. The 'Landscape and Visual Baseline and Sensitivity Rating Criteria' contained in the Transport Infrastructure Ireland (TII) Project Appraisal Guidelines document 'Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis'[18] were referred to when establishing the landscape and visual receptor sensitivity categories. The Environmental

[11] Environmental Protection Agency (Draft 2017), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available from: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed: 08 January 2021]
[12] Landscape Institute and the Institute of Environmental Management and Assessment (eds.) (2013) Guidelines for Landscape and Visual Impact Assessment. Routledge, Oxon.
[13] TII. 2016. Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects - Overarching Technical Document PE-ENV-01101, 2020. Available from: https://www.tiipublications.ie/library/PE-ENV-01101-01.pdf [Accessed 04 January 2021]
[14] TII. 2016. Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads - Standard PE-ENV-01102, 2020. Available from: https://www.tiipublications.ie/library/PE-ENV-01102-01.pdf [Accessed 04 January 2021]
[15] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031. Available from: https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf [Accessed 08 January 2021]
[16] Design Manual for Roads and Bridges Volume 11, Section 3 for Stage Two Assessment (UK DMRB, 1994)
[17] Landscape Institute and the Institute of Environmental Management and Assessment (eds.) (2013) Guidelines for Landscape and Visual Impact Assessment. Routledge, Oxon.
[18] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports were also referred to when undertaking this assessment[19].

The assessment of landscape and visual impacts is generally separated into three phases: construction, operation and decommissioning. It also considers proposed mitigation measures and any likely cumulative impacts. However, an assessment of impacts during decommissioning is not relevant to road schemes. For the purposes of this assessment, the operational stage impacts of each Route Corridor Option are the primary consideration. Other aspects like construction, cumulative and residual impacts were not considered to be a differentiating factor in terms of option selection. The other aspects will be examined in greater detail in relation to the Preferred Route Corridor as part of the TII Phase 3 assessment.

4.2.1 Desk Study

The methodology for Landscape and Visual assessment involved a desk study of the relevant County Development Plans to ascertain the most valuable and sensitive landscapes, along with a variety of other information sources listed in the bullet points below, to identify sensitive receptors that may be impacted by the proposed development. This desk study was based on a review of the following sources:

- Limerick County Development Plan 2010 - 2016[20];
- National Parks and Wildlife Service[21];
- The Heritage Council – HeritageMaps.ie[22];
- Ordnance Survey maps[23];
- Coillte Recreation[24];
- Fáilte Ireland's Discover Ireland – DiscoverIreland.ie[25];
- Sport Ireland Trails[26];
- CORRINE land cover mapping[27]; and
- Google Maps[28].

4.2.2 Fieldwork

Site visits were undertaken in May 2021 to establish an understanding of the landscape and visual context of the proposed Route Corridor Options and to validate the County Landscape Character Assessments. Fieldwork was undertaken from publicly accessible roads/land. Photography was captured and notes taken at intersection points and close parallel sections of the existing road network to all of the Route Corridor Options.

4.2.3 Assessment Criteria

4.2.3.1 Landscape

When assessing the potential impacts on the landscape, the following criteria are considered:

- Landscape character, value and sensitivity;
- Magnitude of likely impacts; and
- Significance of landscape impacts.

[19] Environmental Protection Agency (Draft 2017), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available from: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed: 08 January 2021]
[20] Limerick County Council (2010) Limerick County Development Plan 2010-2016. Available from: https://www.limerick.ie/council/services/planning-and-property/development-plans/county-development-plan [Accessed: 28 January 2021]
[21] National Parks and Wildlife Service (2021) Map viewer. Available from: http://webgis.npws.ie/npwsviewer/ [Accessed: 16 March 2021]
[22] The Heritage Council (2021) Map Viewer. Available from http://www.heritagemaps.ie/ [Accessed: 16 March 2021]
[23] The Heritage Council (2021) Map Viewer. Available from http://www.heritagemaps.ie/ [Accessed: 16 March 2021]
[24] Coillte (2021) Map Viewer. Available from https://www.coillte.ie/our-forests/recreation-map/ [Accessed: 16 March 2021]
[25] Fáilte Ireland (2021). Available from: https://www.discoverireland.ie/ [Accessed: 16 March 2021]
[26] Sport Ireland (2021) Sport Ireland Trails. Available from: :www.irishtrails.ie [Accessed: 16 March 2021]
[27] The Heritage Council (2021) Map Viewer. Available from http://www.heritagemaps.ie/ [Accessed: 16 March 2021]
[28] Google Maps (2021) Map view and aerial view. Available from: www.google.ie/maps [Accessed: 16 March 2021]

4.2.3.1.1 Landscape Sensitivity

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area or landscape element) can accommodate changes or new elements without unacceptable detrimental effects to its essential characteristics. At a high level, landscape Sensitivity is based on the criteria set out in Table 4.1. However, it should also be noted that the final judgement of sensitivity is dependent on the form of development being assessed and is ultimately a professional judgement.

Table 4.1: Landscape Sensitivity

Landscape Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered for conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes, which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically, this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

4.2.3.1.2 Magnitude of Landscape Impacts

The magnitude of predicted landscape impacts is a product of the scale, extent or degree of change that is likely to be experienced as a result of the likely impacts. The magnitude takes into account whether there is a direct impact resulting from the loss of landscape elements and/or a change that extends beyond the immediate extents of a development that may have an effect on the landscape character of the area. This is shown in Table 4.2.

Table 4.2: Magnitude of Landscape Impact

Magnitude of Landscape Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.

Magnitude of Landscape Impact	Description
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

4.2.3.2 Visual

As with landscape impacts, the visual impacts of a development are assessed as a function of sensitivity versus magnitude. In this instance the sensitivity of the visual receptor, weighed against the magnitude of the visual impact.

4.2.3.2.1 Visual Sensitivity

Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric basis in that it is considered from a viewer's context. It considers factors such as:

- the perceived quality and values associated with the view;
- the landscape context of the viewer;
- the likely activity they are engaged in; and
- whether this heightens their awareness of the surrounding landscape.

A variety of factors are outlined in the GLVIA and were considered by the assessor when estimating the level of sensitivity for a particular visual receptor.

4.2.3.2.2 Magnitude of Visual Impacts

The magnitude of visual impact is determined on the basis of two factors; the visual presence (relative visual prominence within the scene) of a development and its effect on visual amenity (nature of change to the visual qualities of the scene). The magnitude of visual impact is classified in Table 4.3.

Table 4.3: Magnitude of Visual Impact

Magnitude of Visual Impact	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual disorder or disharmony is also generated, strongly reducing the visual amenity of the scene.

High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual disorder or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene.
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual disorder or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity.
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene.
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene.

4.2.3.3 Significance of Impacts

The significance of an impact is based on a balance between the sensitivity of the receptor and the magnitude of the impact as illustrated in Table 4.4 below. This applies to both landscape receptors and visual receptors alike.

Table 4.4: Key for Determining Significance of Impacts

Magnitude of Impact	**Sensitivity of Receptor**				
	Very High	**High**	**Medium**	**Low**	**Negligible**
Very High	Profound	Profound-substantial	Substantial	Moderate	Slight
High	Profound-substantial	Substantial	Substantial - moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial - moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible
*The significance matrix provides an indicative framework from which the significance of impact is derived. The significance judgement is ultimately determined by the assessor using professional judgement. Due to nuances within the constituent sensitivity and magnitude judgements, this may be up to one category higher or lower than indicated by the matrix.					

The relative importance of the receptor is also considered in order to further differentiate the significance of impacts. The likely 'importance' of any potential significant impacts is judged depending on a scale from, 'Local', 'Regional', 'National' or 'International' outlined as:

- Local - likely significant effect impact on receptors where there is evidence of appreciation and value locally and / or where ramifications are unlikely to extend beyond a localised context;
- Regional - likely significant effect impact where a county designation applies and / or where effects could potentially extend beyond a localised context;

- National - likely significant impact where a national designation applies and / or where effects could potentially extend beyond a regional context; and
- International - likely significant impact where an international designation applies and / or where effects could potentially extend beyond a national context.

4.2.3.4 Quality of Impacts

In addition to assessing the significance of landscape effects and visual effects, EPA Guidance for EIAs requires that the quality of the effects is also determined. This could be negative, neutral, or positive.

The introduction of new built elements into countryside areas most often results in negative landscape and visual effects. However, in some instances, such as when a busy section of road is moved further away from a receptor or is downgraded in terms of its hierarchy due to a new and more distant section of road, effects may be positive.

4.2.3.5 Determining Overall Effects

The assessment of Route Corridor Options was assisted by scoring of impacts to sensitive receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis[29]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the Scores detailed within the PAG Unit 7.0, as shown in Table 4.5 and a number was assigned according to the level of significance of the effect.

Table 4.5: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

As part of this assessment, it is assumed that general landscape mitigation measures such as screening and landscape planting will be implemented to all Route Corridor Options.

4.3 Existing Environment

The constraints identified in Volume 1, Chapter 4 form the basis of the receptors assessed herein. The constraints in the Study Area have been mapped and are presented in Volume 2 (Figures 4.1 – 4.2) of this Option Selection Report.

Volume 1, Chapter 4 highlighted the presence of potential sensitive receptors within the Study Area. There is no potential for material landscape or visual impacts to arise at many of these receptors due to considerable distances and/or screening. As such, only receptors with potential to be materially impacted have been selected for further assessment.

[29] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

4.3.1 Landscape

4.3.1.1 Landscape Character

The Limerick County Development Plan (CDP) 2010-2016 (as varied) (Limerick County Council) incorporates a Landscape Character Assessment, which divides the county into ten Landscape Character Areas (LCAs). These LCAs are identified on Map 7.4 of the CDP. The majority of the Study Area is located within the 'Agricultural Lowlands' LCA and a small proportion is located within the 'Western Uplands' LCA, however, none of the Route Corridor Options pass through the 'Western Uplands' LCA and thus, negative impacts are highly unlikely to occur in respect of landscape character within the 'Western Uplands' LCA, therefore, it will not be included for any further assessment. The 'Agricultural Lowlands' are described in the Limerick County Development Plan as:

> '*This is the largest of the Landscape Character Areas in the County and comprises almost the entire central plain. This landscape is a farming landscape and is defined by a series of regular field boundaries, often allowed to grow to maturity. This well-developed hedgerow system is one of its main characteristics. In terms of topography the landscape is generally rather flat with some locally prominent hills and ridges. The pastoral nature of the landscape is reinforced by the presence of farmyards.*'

The Limerick CDP contains several objectives relating to this LCA, but none are relevant to the Project. There is one policy relating to landscape character in Limerick which is:

> *'Policy EH P2: It is the policy of the Council to promote the distinctiveness and where necessary safeguard the sensitivity of Limerick's landscape types through the landscape characterisation process and also where possible to develop the means to successfully integrate differing kinds of development within them.'*

4.3.1.2 Landscape Elements

Churchtown House demesne is a landscape element within the Study Area with the potential to be impacted as a result of some of the Route Corridor Options. Castle Desmond is another historic designed landscape within the Study Area that contributes to the character of the surrounding landscape, but it has no potential to be directly impacted by any of the Route Corridor Options, thus significant effects are not anticipated.

The Local Area Plan for the settlement of Newcastle West identifies 'GZT G5: Open Space & Recreation' and 'GZT G3: Semi Natural Open Space' as areas zoned locally for protection. None of the Route Corridor Options directly impact any areas zoned as 'GZT G3: Semi Natural Open Space'. There is the potential for impacts on two areas zoned as 'GZT G5: Open Space & Recreation'. One forms part of a former golf course to the south of the settlement and the other is an area near a stream to the southeast of the settlement that is currently managed for agricultural purposes.

4.3.1.3 Landscape Sensitivity Assessment

Table 4.6: Schedule of landscape receptors, description and assessment of likely sensitivity – landscape

Landscape	Description and assessment of likely sensitivity	Sensitivity rating
Agricultural Lowlands LCA	This LCA is composed of a large area that is bounded to the west by the uplands near Knockanimpaha Mountain and by the county border with Tipperary in the east. The portion of this LCA that is located within the Study Area is a low-lying plain with strong rural characteristics. The topography ranges from approximately 50m OD in the southern portions of the Study Areas to approximately 111m OD in the northwest and approximately 114m OD at Knockaderry in the east. The most notable watercourse is the River Deel, which flows through the eastern half of the Study Area from the south, in a northerly direction, towards the River Shannon. There are several woodland blocks located in the western and northern portions of the Study Area, but the land cover is predominantly agricultural, apart from the built-up areas of Newcastle West. The N21 national primary road is the most significant piece of transport infrastructure within the Study Area, passing	Medium-Low

Landscape	Description and assessment of likely sensitivity	Sensitivity rating
	through in a northeast-southwest orientation. The R520 and R522 regional roads converge on Newcastle West. Outside of the settlements of Ardagh in the north and Mahoonagh in the south, there is a rural population dispersed along the local road network.	
Churchtown House demesne	The historic designed landscape setting of Churchtown House containing a small mature woodland adjoining the house, several fields bounded by mature, wide hedgerows. Presently the fields are under agricultural management, but several mature parkland trees remain.	Medium
GZT G3: Semi Natural Open Space – former golf course	The area subject to this local zoning includes the northern portion of the former golf course. The proximity of this area to the local population makes it a potentially valuable resource for outdoor recreation. This area would be sensitive to both direct impacts and to changes to the surrounding landscape setting.	Medium
GZT G3: Semi Natural Open Space – currently managed for agriculture	The area subject to this local zoning lies to the southeast of the settlement, on the eastern side of the R520 regional road. The River Arra meanders through this area from northwest to southeast. Lands in this area are currently managed for agriculture. The proximity of this area to the local population makes it a potentially valuable resource for outdoor recreation. This area would be sensitive to both direct impacts and to changes to the surrounding landscape setting.	Medium

4.3.2 Visual

All residential settings are considered to be sensitive receptors, however, the main focus at this Option Selection Report is population intensity. The visual impact of the Preferred Route Corridor Option on individual residential settings will be considered in future phases of the assessment process. The settlements of Ardagh and Mahoonagh are located in the northern and southern portions of the Study Areas, respectively, but significant visual impacts are not anticipated. The highest population density is within the town of Newcastle West which is located in the centre of the Study Area.

The Great Southern Trail[30] is a walking/cycle route along the alignment of the now dismantled railway line and several Route Corridor Options intersect with this trail.

There is a designated scenic view/prospect associated with the 'Barna Gap & NCW Scenic Drive' located in the uplands to the west of the Study Area. In this area, there is also an elevated lookout point marked on OS maps at a lay-by on the N21 national primary road. Views of the Project are likely to be afforded but significant visual impacts are not anticipated due to:

(i) the distance from the Route Corridor Options,

(ii) the elevated and expansive nature of the available views; and

(iii) the settled lowland character of the receiving landscape of the Route Corridor Options.

Castle Desmond and the Newcastle West Slí na Slainte route are located within the town of Newcastle West and consequently are highly visually enclosed, therefore significant visual impacts are not likely as a result of any of the Route Corridor Options.

[30] This has been recently renamed the Limerick Greenway.

4.3.2.1 Visual Sensitivity Assessment

Table 4.7: Schedule of visual receptors and assessment of likely sensitivity - visual

Visual receptor	Assessment of likely sensitivity - visual	Sensitivity rating
Settlement: Newcastle West	Represents a higher concentration of residential visual receptors.	Medium
Limerick Greenway	This long-distance trail is a tourist attraction for cyclists and walkers who are afforded sequential views of the surrounding lowland landscape. This trail frequently intersects roads as it passes through the Study Area.	Medium

4.4 Assessment of Route Corridor Options

4.4.1 Assessment of Potential Impacts

All nine Route Corridor Options will be assessed from west to east. Route Corridor Options A, B, E, F and G pass the settlement of Newcastle West to the north, while Route Corridor Options C, D, H and I pass to the south.

The tables below detail the likely significant effects on each landscape and visual receptor as a result of each Route Corridor Option. The significance is generated automatically through the combination of the 'sensitivity rating' and the 'likely magnitude of effect' as illustrated in Table 4.8.

4.4.1.1 Route Corridor Option A:

Table 4.8: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option encompasses the historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The removal of this vegetation would have a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.	Medium	Yes, local
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.9: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option bypasses the settlement. In this low-land landscape, views towards this Route Corridor Option will be heavily screened by intervening buildings and vegetation. Route Corridor Option will be located at distances greater than 1km from the centre of the settlement. As a result of the screening and the intervening distances most dwellings will not be adversely affected thus overall magnitude of visual effect is deemed to be Negligible which, in conjunction with the Medium sensitivity rating, the visual effect is unlikely to be significant.	Negligible	No
Limerick Greenway	Medium	Route Corridor Option intersects with the Limerick Greenway in a settled lowland landscape. Views of works from trail will be intermittent, highly localised and brief in the context of the journey along the trail. However, there is the potential for considerable, but localised, visual change in the immediate context of the trail. As a result, the magnitude of effect is likely to be Medium-Low which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	Medium-Low	Yes, local

4.4.1.2 Route Corridor Option B:

Table 4.10: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option encompasses the historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The removal of this vegetation would have a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.	Medium	Yes, local
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.11: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option bypasses the settlement. In this low-land landscape, views towards this Route Corridor Option will be heavily screened by intervening buildings and vegetation. Route Corridor Option will be located at distances greater than 1km from the centre of the settlement. As a result of the screening and the intervening distances most dwellings will not be adversely affected thus overall magnitude of visual effect is deemed to be Negligible which, in conjunction with the Medium sensitivity rating, the visual effect is unlikely to be significant.	Negligible	No
Limerick Greenway	Medium	Route Corridor Option intersects with the Limerick Greenway in a settled lowland landscape. Views of works from trail will be intermittent, highly localised and brief in the context of the journey along the trail. However, there is the potential for considerable, but localised, visual change in the immediate context of the trail. As a result, the magnitude of effect is likely to be Medium-Low which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	Medium-Low	Yes, local

4.4.1.3 Route Corridor Option C:

Table 4.12: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.13: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	No direct impacts thus the magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
Limerick Greenway	Medium-Low	No direct impacts thus the magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

4.4.1.4 Route Corridor Option D:

Table 4.14: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option includes a large portion of this area. This area is conveniently located close to the population of Newcastle West, but this Route Corridor Option could result in a permanent alteration the landcover in this Semi Natural Open Space and could potentially indirectly reduce the tranquillity of the Semi Natural Open Space as a whole. These effects could negate the value of this area as a potential future amenity. Therefore, the magnitude of effect is likely to be High, which in conjunction with the Medium sensitivity rating of this landscape element, is likely to result in a locally significant effect.	High	Yes, local
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option clips this southern end of this area. This area is conveniently located close to the population of Newcastle West, but this Route Corridor Option could result in a permanent alteration the landcover in this Semi Natural Open Space and could potentially indirectly reduce the tranquillity of the Semi Natural Open Space as a whole. These effects could negate the value of this area as a potential future amenity. Therefore, the magnitude of effect is likely to be High, which in conjunction with the Medium sensitivity rating of this landscape element, is likely to result in a locally significant effect.	Medium	Yes, local

Table 4.15: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option encompasses the Woodfield Grove residential area. Multiple houses could have close-up views of new road infrastructure.	High-Medium	Yes, local
Limerick Greenway	Medium-Low	No direct impacts thus the magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

4.4.1.5 Route Corridor Option E:

Table 4.16: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option encompasses the historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The removal of this vegetation would have a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.	Medium	Yes, local
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.17: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option bypasses the settlement. In this low-land landscape, views towards this Route Corridor Option will be heavily screened by intervening buildings and vegetation.	Negligible	No
Limerick Greenway	Medium	Route Corridor Option intersects with the Limerick Greenway in a settled lowland landscape. Views of works from trail will be intermittent, highly localised and brief in the context of the journey along the trail. However, there is the potential for considerable, but localised, visual change in the immediate context of the trail. As a result, the magnitude of effect is likely to be Medium-Low which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	Medium-Low	Yes, local

4.4.1.6 Route Corridor Option F:

Table 4.18: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option encompasses the historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The removal of this vegetation would have a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.	Medium	Yes, local
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.19: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option bypasses the settlement. In this low-land landscape, views towards this Route Corridor Option will be heavily screened by intervening buildings and vegetation. Route Corridor Option will be located at distances greater than 1km from the centre of the settlement. As a result of the screening and the intervening distances most dwellings will not be adversely affected thus overall magnitude of visual effect is deemed to be Negligible which, in conjunction with the Medium sensitivity rating, the visual effect is unlikely to be significant.	Negligible	No
Limerick Greenway	Medium	Route Corridor Option intersects with the Limerick Greenway in a settled lowland landscape. Views of works from trail will be intermittent, highly localised and brief in the context of the journey along the trail. However, there is the potential for considerable, but localised, visual change in the immediate context of the trail. As a result, the magnitude of effect is likely to be Medium-Low which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	Medium-Low	Yes, local

4.4.1.7 Route Corridor Option G:

Table 4.20: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option encompasses the historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The removal of this vegetation would have a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.	Medium	Yes, local
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.21: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option bypasses the settlement. In this low-land landscape, views towards this Route Corridor Option will be heavily screened by intervening buildings and vegetation. Route Corridor Option will be located at distances greater than 1km from the centre of the settlement. As a result of the screening and the intervening distances most dwellings will not be adversely affected thus overall magnitude of visual effect is deemed to be Negligible which, in conjunction with the Medium sensitivity rating, the visual effect is unlikely to be significant.	Negligible	No
Limerick Greenway	Medium	Route Corridor Option intersects with the Limerick Greenway in a settled lowland landscape. Views of works from trail will be intermittent, highly localised and brief in the context of the journey along the trail. However, there is the potential for considerable, but localised, visual change in the immediate context of the trail. As a result the magnitude of effect is likely to be Medium-Low which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	Medium-Low	Yes, local

4.4.1.8 Route Corridor Option H:

Table 4.22: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option includes a large portion of this area. This area is conveniently located close to the population of Newcastle West, but this Route Corridor Option could result in a permanent alteration the landcover in this Semi Natural Open Space and could potentially indirectly reduce the tranquillity of the Semi Natural Open Space as a whole. These effects could negate the value of this area as a potential future amenity. Therefore, the magnitude of effect is likely to be High, which in conjunction with the Medium sensitivity rating of this landscape element, is likely to result in a locally significant effect.	High	Yes, local
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option clips this southern end of this area. This area is conveniently located close to the population of Newcastle West, but this Route Corridor Option could result in a permanent alteration the landcover in this Semi Natural Open Space and could potentially indirectly reduce the tranquillity of the Semi Natural Open Space as a whole. These effects could negate the value of this area as a potential future amenity. Therefore, the magnitude of effect is likely to be High, which in conjunction with the Medium sensitivity rating of this landscape element, is likely to result in a locally significant effect.	Medium	Yes, local

Table 4.23: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Route Corridor Option encompasses the Woodfield Grove residential area. Multiple houses could have close-up views of new road infrastructure. As a result, the magnitude of effect is likely to be High-Medium which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	High-Medium	Yes, local
Limerick Greenway	Medium-Low	No direct impacts thus the magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

4.4.1.9 Route Corridor Option I:

Table 4.24: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Route Corridor Option is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Route Corridor Option. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – former golf course	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Route Corridor Option does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.25: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	No direct impacts thus the magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
Limerick Greenway	Medium-Low	No direct impacts thus the magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

4.4.1.10 Indicative R521 Link Road:

Table 4.26: Assessment of potential significant effects - landscape

Landscape	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Agricultural Lowlands LCA	Medium-Low	Direct impact on the physical landscape but Indicative R521 Link Road is relatively short and would not be an uncharacteristic feature in this LCA. There will be permanent changes to landcover and localised earthworks within this Indicative R521 Link Road. Overall, the magnitude of effect is likely to be Medium-Low, which in conjunction with the Medium-Low sensitivity rating of this LCA, is unlikely to result in a significant effect.	Medium-Low	No
Churchtown House demesne	Medium	The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – former golf course	Medium	Indicative R521 Link Road does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No
GZT G3: Semi Natural Open Space – currently managed for agriculture	Medium	Indicative R521 Link Road does not pass within this landscape element thus no direct impacts will occur. The magnitude of effect is likely to be Negligible, which, by default, is not considered to be significant.	Negligible	No

Table 4.27: Assessment of potential significant effects - visual

Visual	Sensitivity rating	Assessment of likely magnitude of effect	Likely magnitude of effect	Likely significant
Settlement: Newcastle West	Medium	Indicative R521 Link Road bypasses the settlement. In this low-land landscape, views towards this Indicative R521 Link Road will be heavily screened by intervening buildings and vegetation. The Indicative R521 Link Road will be located at distances greater than 1km from the centre of the settlement. As a result of the screening and the intervening distances most dwellings will not be adversely affected thus overall magnitude of visual effect is deemed to be Negligible which, in conjunction with the Medium sensitivity rating, the visual effect is unlikely to be significant.	Negligible	No
Limerick Greenway	Medium	Indicative R521 Link Road intersects with the Limerick Greenway in a settled lowland landscape. Views of works from the greenway will be intermittent, highly localised and brief in the context of the journey along the trail. However, there is the potential for considerable, but localised, visual change in the immediate context of the trail. As a result, the magnitude of effect is likely to be Medium-Low which, in conjunction with the Medium sensitivity rating, the visual effect is likely to be locally significant.	Medium-Low	Yes, local

4.4.2 Assessment of Effects of Route Corridor Options

As outlined in Section 1.2, the assessment of Route Option Corridors A, E, F, and G include the additional impacts of the indicative layout of the R521 Link road as presented in Table 4.26 and 4.27. Further surveys, consultation, design, and assessment will amend the design of the road layout further, which is typical for road schemes and is in-line with national guidelines. The assessment of the corridors and link road is based on the current indicative layout and the assessment presented in this report will be refined as the project design becomes more detailed and will take into account further surveys and consultation, in-line with national guidelines.

4.4.2.1 Route Corridor Option A

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have a negative effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

This Route Corridor Option encompasses an historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The potential removal of this vegetation would be a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects are anticipated to occur due to a Medium-Low magnitude of effect at intersections with the Limerick Greenway which has a Medium sensitivity rating.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

4.4.2.2 Route Corridor Option B

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects are anticipated to occur due to a Medium-Low magnitude of effect at intersections with the Limerick Greenway which has a Medium sensitivity rating.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

Route Corridor Option B avoids the historic demesne at Churchtown House and involves one less intersection with the Limerick Greenway thus is preferable to the other Route Corridor Options that bypass Newcastle West to the north.

4.4.2.3 Route Corridor Option C

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents.

Therefore, this Route Corridor Option is anticipated to result in Minor Negative effect on Landscape and Visual.

This Route Corridor Option avoids both GZT G3: Semi-Natural Open Spaces and the Woodfield Grove residential housing estate thus is preferable to the other Route Corridor Options that pass Newcastle West to the south which have the potential to significantly impact these receptors.

4.4.2.4 Route Corridor Option D

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

This Route Corridor Option includes a large portion of GZT G3: Semi Natural Open Space (former golf course) and clips the southern end of GZT G3: Semi Natural Open Space (currently managed for agriculture.) These areas are conveniently located close to the population of Newcastle West, but this Route Corridor Option could result in a permanent alteration the landcover in these Semi Natural Open Spaces and could potentially indirectly reduce the tranquillity of these Semi Natural Open Spaces as a whole. These effects could negate the value of these areas as a potential future amenity. Therefore, the magnitude of effect is likely to be High, which in conjunction with the Medium sensitivity rating of these landscape elements, are likely to result in locally significant effects.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects could potentially occur at a relatively high number of residents within this Route Corridor Option at Woodfield Grove housing estate.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

4.4.2.5 Route Corridor Option E

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

This Route Corridor Option encompasses an historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The potential removal of this vegetation would be a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects are anticipated to occur due to a Medium-Low magnitude of effect at intersections with the Limerick Greenway which has a Medium sensitivity rating.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

4.4.2.6 Route Corridor Option F

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

This Route Corridor Option encompasses an historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The potential removal of this vegetation would be a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects are anticipated to occur due to a Medium-Low magnitude of effect at intersections with the Limerick Greenway which has a Medium sensitivity rating.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

4.4.2.7 Route Corridor Option G

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

This Route Corridor Option encompasses an historic demesne and traverses a section of Churchtown Road which is enclosed by roadside vegetation that is potentially 'long-established'. The potential removal of this vegetation would be a negative effect and would also contribute the degradation of the integrity of the demesne. As a result, the magnitude of effect is likely to be Medium which, in conjunction with the Medium sensitivity rating, the effect on this landscape element is likely to be locally significant.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects are anticipated to occur due to a Medium-Low magnitude of effect at intersections with the Limerick Greenway which has a Medium sensitivity rating.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

4.4.2.8 Route Corridor Option H

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

This Route Corridor Option includes a large portion of GZT G3: Semi Natural Open Space (former golf course) and clips the southern end of GZT G3: Semi Natural Open Space (currently managed for agriculture.) These areas are conveniently located close to the population of Newcastle West, but this Route Corridor Option could result in a permanent alteration the landcover in these Semi Natural Open Spaces and could potentially indirectly reduce the tranquillity of these Semi Natural Open Spaces as a whole. These effects could negate the value of these areas as a potential future amenity. Therefore, the magnitude of effect is likely to be High, which in conjunction with the Medium sensitivity rating of these landscape elements, are likely to result in locally significant effects.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents. Localised significant visual effects could potentially occur at a relatively high number of residents within this Route Corridor Option at Woodfield Grove housing estate.

Therefore, this Route Corridor Option is anticipated to result in Moderate Negative effect on Landscape and Visual.

4.4.2.9 Route Corridor Option I

This Route Corridor Option results in a direct impact on the physical landscape as it passes through the Agricultural Lowlands LCA and will have an adverse effect on the landscape character in the vicinity of the Route Corridor Option. However, it is unlikely to be a significant impact as the magnitude of effect is likely to be Medium-Low, and the sensitivity rating of this LCA is deemed to be Medium-Low.

From a visual perspective, there is potential for locally significant negative visual impacts on multiple rural residents.

Therefore, this Route Corridor Option is anticipated to result in Minor Negative effect on Landscape and Visual.

This Route Corridor Option avoids both GZT G3: Semi-Natural Open Spaces and the Woodfield Grove residential housing estate thus is preferable to the other Route Corridor Options that bypass Newcastle West to the south which have the potential to significantly impact these receptors.

Table 4.28: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Moderate Negative	2
Option B	Moderate Negative	2
Option C	Minor Negative	3
Option D	Moderate Negative	2
Option E	Moderate Negative	2
Option F	Moderate Negative	2
Option G	Moderate Negative	2
Option H	Moderate Negative	2
Option I	Minor Negative	3

4.5 Conclusion

All Route Corridor Options will result in impacts directly on the physical landscape and have the potential for locally significant negative visual impacts on multiple rural residents.

Route Corridor Options C, D, H and I pass Newcastle West to the South. Route Corridor Options D and H have the potential for significant negative visual impacts on a relatively high proportion of residential dwellings in the Woodfield Grove housing estate and are likely to result in direct landscape impacts on the areas zoned as GZT G3: Semi-Natural Open Space. For these reasons, they are scored Moderate Negative. However, it should be noted that the extent of these impacts could be reduced through careful design of the final road alignment and specific mitigation measures, such as fencing and/or hedgerow planting, to screen views of the road. Route Corridor Option C and Route Corridor Option I avoid direct impacts at the Woodfield Grove housing estate and the areas zoned as GZT G3: Semi-Natural Open Space, thus scored Minor Negative but impacts on the landscape setting of the areas zoned as GZT G3: Semi-Natural Open Space is possible.

Route Corridor Options A, B, E, F and G pass Newcastle West to the north. Route Corridor Options A, E, F and G have the potential for significant negative visual impacts on users of the Limerick Greenway and negative landscape impacts at Churchtown House demesne. For these reasons, they are scored Moderate Negative. Route Corridor Option B is also scored Moderate Negative, but it should be noted that it avoids impacts at Churchtown House demesne and involves one less intersection with the Limerick Greenway than Route Corridor Options A, E, F and G.

5. Biodiversity - Flora & Fauna

5.1 Introduction

EirEco Environmental Consultants was commissioned to conduct the biodiversity assessment for the Route Corridor Options proposed for the N21 Newcastle West Road Scheme.

This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four main Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

5.2 Methodology

5.2.1 Assessment Criteria

An assessment was undertaken of the likely impacts of each of the Route Corridor Options on the following ecological parameters:

1. Designated conservation areas (including European Sites and sites protected under National legislation).
2. General Ecology (habitats of high value identified in the constraints study).
3. Watercourse crossings including fisheries, aquatic fauna and riparian habitats).
4. Bats (including roosting, foraging and commuting habitats).

Each parameter is assessed in relation to a potential zone of influence, which may extend well beyond the actual footprint of the road. The assessment therefore considers the significance of the potential impact and the geographical level. The key ecological receptors identified along the various Route Corridor Options have been identified from desktop studies of existing databases covering designated conservation areas, identified habitats of biodiversity value (native woodlands, known bat roosts, important bird areas, etc.), sites identified from a review of aerial imagery, and water course crossings. Bat surveys from publicly accessible lands were also conducted in May 2021. Ecological sites within the Study Area have been evaluated and the scale of impact determined based on the criteria presented in Table 5.1 (adapted from NRA, 2009).

The assessment of Route Corridor Options was assisted by scoring of impacts to sensitive receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis[31]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the scores detailed within the PAG Unit 7.0, as shown in Table 5.2 and a number was assigned according to the level of significance of the effect. The scoring reflects the number and significance of ecological receptors impacted by each Route Corridor Option.

Table 5.3 lists the sub-criterion elements used to assess each Route Corridor Option in relation to potential impacts on local bat populations. The total score provides an indication of the potential impact of each of the Route Corridor Options.

[31] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

Table 5.1. Ecological Valuation Criteria (adapted from NRA 2009)

Importance	Ecological Valuation
International Importance A	• 'European Site' including Special Area of Conservation (cSAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. • Features essential to maintaining the coherence of the Natura 2000 Network. • Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. • Resident or regularly occurring populations (assessed to be important at the national level) of species of animal and plants listed in Annex II and/or IV of the Habitats Directive. • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988). • Major salmon river fisheries.
National Importance B	• Site designated or proposed as a Natural Heritage Area (NHA)) or proposed National Heritage Area (pNHA). • Statutory Nature Reserve. • Refuge for Fauna and Flora protected under the Wildlife Acts 1976 to 2012. • National Park. • Resident or regularly occurring populations (assessed to be important at the national level) of species protected under the Wildlife Acts 1976 to 2012; and/or; species listed on the relevant Red Data list. • Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive. • Major trout river fisheries. • Commercially important coarse fisheries. • Waterbodies with high amenity value.

County Importance
C
	• Area of Special Amenity.
	• Area of High Amenity, or equivalent, designated under a County Development Plan.
	• Resident or regularly occurring populations (assessed to be important at the County level) of:
	  ○ species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
	  ○ species protected under the Wildlife Acts 1976 to 2012; and/or, species listed on the relevant Red Data list.
	• Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.

Importance	Ecological Valuation
Local Importance (Higher Value) D	• Locally important populations of priority species or habitats or natural heritage features identified in the Local Biodiversity Action Plan (BAP), if this has been prepared. • Resident or regularly occurring populations (assessed to be important at the Local level) of: o species of animal and plants listed in Annex II and/or IV of the Habitats Directive. o species protected under the Wildlife Acts 1976 to 2012; and/or, o species listed on the relevant Red Data list. • Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality. • Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value. • Sites of 'High' water quality status (Q4-5, Q5). • Waterbodies with some fisheries value and potential salmonid habitat.
Local Importance (Lower Value) E	• Sites containing small areas of semi-natural habitat that are of some local importance for wildlife. • Sites or features containing non-native species that are of some importance in maintaining habitat links. • Waterbodies with no fisheries value and poor fisheries habitat.

Table 5.2: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

Table 5.3. Sub-criterion used to assess impact of Route Corridor Options on Bats

Sub-criterion	Details	Impact Level	Score
Bat roost (1km)	<1km from LHB roost <2.5 km from LHB roost >2.5km from LHB roost	1 2 3	Major negative Moderate negative Minor or slightly negative
Bat record (5km)	<1km from 400m corridor buffer >1km from 400m corridor buffer	2 3	Moderate negative Minor or slightly negative
Waterbody (400m)	10 or greater water courses 8-9 water courses <8 watercourses	1 2 3	Major negative Moderate negative Minor or slightly negative
Bat habitat (400m)	Woodland, watercourses, linear habitat and scrub. 3 or less of the habitats listed	2 3	Moderate negative Minor or slightly negative
Bat Landscape Model	High favourability squares Medium or Low favourability squares	2 3	Moderate negative Minor or slightly negative
400m buffer corridor area	>350hectares 300-350 hectares <300 hectares	1 2 3	Major negative Moderate negative Minor or slightly negative
Route Option Length	>7.5km <7.5km	2 3	Moderate negative Minor or slightly negative
Buildings (digitised)	>10 clusters <10 clusters	2 3	Moderate negative Minor or slightly negative
Bat Activity (Driving Transect)	Bat Activity present along >50% of route option Bat Activity present along <50% of route option	2 3	Moderate negative Minor or slightly negative
Railway Line	Crossings – YES Crossings - NO	2 4	Moderate negative Neutral

5.3 Existing Environment

This section of the report documents the key ecological constraints for the N21 Newcastle West Road Scheme. The assessment involved identification of constraints using a combination of a desktop assessment of available data sources combined with surveys from publicly accessible lands conducted in May 2021.

This assessment has been conducted in line with the following guidelines:

- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009);

- Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019).

Data and information collected as part of the desk study was sourced from the following locations:

- Online data as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie;
- Online data available on protected habitats and species as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie;
- Online data available on protected species as held by the National Biodiversity Data Centre (NBDC) from www.biodiversityireland.ie;
- Online data available on geology, soils and hydrogeology as provided by Geological Survey of Ireland (GSI) www.gsi.ie;
- Online data available on water bodies, water quality and salmonid rivers (Salmonid Regulations S.I. 293) as provided by Environmental Protection Agency (EPA) www.epa.ie;
- Ordnance Survey of Ireland mapping and aerial photography available from www.osi.ie and www.geohive.ie;
- Records of rare and protected flora listed on the Flora Protection Order collected and provided by Botanical Society of Britain and Ireland (BSBI) vice-county recorders;
- Online data available on wintering birds from Irish Wetland Bird Survey (I-WeBS);
- Aerial imagery and surveys from publicly accessible land.

The assessment involved the identification of constraints within the following ecological parameters:

- Designated conservation areas (including European Sites and sites protected under National legislation).
- General Ecology (habitats of high value identified in the constraints study).
- Watercourse crossings including fisheries, aquatic fauna and riparian habitats).
- Bats (including roosting, foraging and commuting habitats).

5.3.1 Designated Conservation Areas

There are no designated conservation areas within the Study Area. The nearest designated conservation area to the Study Area is the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Area (site code 004161) which extends along the low hilly ground to the west and north of Newcastle West.

The entire Study Area is within the River Deel Catchment, which flows into the Lower River Shannon Special Area of Conservation (SAC), approximately 25km downstream of the Study Area at Askeaton. There are no Natural Heritage Areas or proposed Natural Heritage Areas within the Study Area, and all Route Corridor Options are effectively equidistant from the nearest sites.

5.3.2 Overview of land use and ecological value

The underlying geology of the Study Area ranges from Waulsortian limestone in the east to Shale, sandstone, siltstone and coals in the higher ground to the west. The topography of the Study Area is mainly low-lying and gently undulating with a gentle rise on the west towards the elevated lands around Sugar Hill. There are numerous watercourses draining from these elevated lands in a generally eastwards direction towards the Deel River, which flows in a northerly direction in the eastern half of the Study Area. All watercourses have the potential to support salmonids along with other aquatic ecological sensitivities including brook lamprey, otter and kingfisher (all annex listed species).

The Study Area is characterised by agricultural grasslands with hedgerow and treelines, and semi-natural habitats are confined primarily to linear corridors along the network of watercourses. The network of treelines and hedgerows are of considerable ecological importance in the overall landscape as they provide one of the principal biodiversity features in the landscape. A few small pockets of woodland occur, the largest of these being at Castle Demesne on the west of the urban fringe of Newcastle West. There are occasional conifer plantations in the west

of the Study Area also, though these generally do not form significant ecological constraints. All ecological sites within the Study Area are rated of Local Importance (Higher Value).

In view of the extent of Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Area in the vicinity of the Study Area, which extends along the low hilly ground to the west and north of Newcastle West, it is probable that periodic foraging by Hen Harrier, the principal conservation interest for the SPA, will occur over potentially suitable habitat (rough grassland, young forestry, river corridors, etc.) throughout the Study Area. The Study Area is also within the core range for Barn Owl in Ireland, though there are no recorded breeding sites from the area.

5.3.3 Bats

The NPWS Lesser Horseshoe Bat Database reports three roost records for this species within the 10km search area, one north of Newcastle West and the two south of Newcastle West. All three roosts are sites for a small number of lesser horseshoe bats (4 or less individuals).

The Bat Conservation Ireland Landscape Model divides the island into 5km squares and models the favourability of each 5km square for Irish bat species (based on Bat Conservation Ireland database). The 5km square, in which Newcastle West is located, is a square deemed highly favourable for seven species of bat.

A data request to the NPWS Lesser Horseshoe Bat Database was made to access their data (Irish Grid Reference R2828333522). Records from the Bat Conservation Ireland Database for a 10km radius around Newcastle West yielded 225 records for six bat species including Leisler's bat, common pipistrelle, soprano pipistrelle, brown long-eared bat, Natterer's bat and Daubenton's bat with additional records assigned to *Pipistrellus* species and *Myotis* species. Common pipistrelle was the most frequently encountered bat species (n=85 records) followed by soprano pipistrelle (n=54 records). Nineteen roost records are also reported for the following bat species: brown long-eared bat, Daubenton's bat, Natterer's bat and Pipistrellus species. All Route Corridor Options (400m buffer) are located 2.3km or more away from the known bat roosts. The majority of these records are located to the north and north-east of Newcastle West.

5.4 Assessment of Route Corridor Options

5.4.1 Assessment of Potential Impacts

A description of the potential impacts of the various Route Corridor Options is presented below. This assesses the impacts on designated conservation areas, sites of potential ecological value identified in the constraints study, watercourse crossings and impacts on known or potential habitats of importance for bats. In relation to designated conservation areas, the Study Area is fringed to the west by the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Area (site code 004161). In view of the extent of the SPA, it is probable that periodic foraging by Hen Harrier, the principal conservation interest for the SPA, will occur over potentially suitable habitat (rough grassland, young forestry, river corridors, etc.) in the western side of the Study Area.

Table 5.4 presents a summary of the impacts of the various Route Corridor Options on these ecological parameters.

Table 5.4. Summary Ecology Performance Matrix

	Number of Impacts on Ecologically Sensitive Sites / Habitats					
Route Corridor Option	**SAC/SPA**	**Other Ecologically Sensitive Sites**	**Watercourses (Crossings)**	**Bat Habitats (Score based on Table 5.3)**	**400m corridor area (ha.)**	**Score**
Option A	0	3	10	25	318.76	2
Option B	0	3	10	22	361.21	1
Option C	0	3	8	24	339.70	2
Option D	0	2	4	27	217.69	3
Option E	0	3	10	22	343.69	2
Option F	0	3	8	25	301.79	2
Option G	0	3	9	25	326.34	2
Option H	0	2	7	27	286.78	2
Option I	0	3	5	26	270.61	2

5.4.1.1 Route Corridor Option A

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the north of Newcastle West, impacts on three ecologically sensitive sites, (as illustrated in Volume 2, Figure 5.2.) leading to a loss of habitat and fragmentation of the sites. The Route Corridor Option crosses the Limerick Greenway (Site 3) to the west and further east the Route Corridor Option crosses another section of the Limerick Greenway at Site 1 which also contains a section of mature treeline. The Route Corridor Option crosses Site 2 at Churchtown House which consists of a network of mature treelines and hedgerows with unimproved grasslands. The indicative R521 link road also crosses these same sites in addition to a crossing of the River Daar (WFD Name: Deel (Newcastle West) _090) which has a well-developed fringe of riparian woodland.

Outside of the identified ecologically sensitive sites there will be a habitat loss and fragmentation effect on treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option will cross a total of ten separate watercourses resulting in a localized loss of aquatic and riparian habitat and will also lead to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.2 Route Corridor Option B

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the north of Newcastle West, has the greatest total length and impacts on three

ecologically sensitive sites as illustrated in Volume 2, Figure 5.2. The Route Corridor Option crosses the Limerick Greenway (Site 3) and a young mixed woodland plantation at Doocatteen (Site 8). The Route Corridor Option also impacts on a well-developed network of hedgerows and treelines around a derelict farm building at Coolacockery (Site 9) which has potential to support breeding barn owl. There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of ten separate watercourses with a resultant localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.3 Route Corridor Option C

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the south of Newcastle West, impacts on three ecologically sensitive sites as illustrated in Volume 2, Figure 5.2.

The Route Corridor Option crosses through lands around Killeline House (Site 4) which has well-developed treelines and parkland and may support unimproved grasslands. A short distance to the east, the Route Corridor Option impacts on belt of deciduous woodland at Cloonyscrehane House (Site 5). The Route Corridor Option also crosses the confluence of the Rivers Arra, Ehernagh, and Daar with the River Deel (Site 6).

There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of eight separate watercourses. All watercourse crossings will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation. The Route Corridor Option does not cross the River Deel but runs close to over a length of approximately 600m in the townland of Kilaready.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.4 Route Corridor Option D

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the south of Newcastle West, but closer to the south of the town and is shortest in total length. The Route Corridor Option impacts on two ecologically sensitive sites as illustrated in Volume 2, Figure 5.2.

The Route Corridor Option crosses through lands around Killeline House (Site 4) which has well-developed treelines and parkland and may support unimproved grasslands. A short distance to the east, the Route Corridor Option impacts on belt of deciduous woodland at Cloonyscrehane House (Site 5). There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of four separate watercourses. All watercourse crossings will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.5 Route Corridor Option E

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the north of Newcastle West, and impacts on three ecologically sensitive sites as illustrated in Volume 2, Figure 5.2.

The Route Corridor Option crosses the Limerick Greenway (Site 3) to the west and further east the Route Corridor Option crosses another section of the Limerick Greenway at Site 1. The Route Corridor Option also crosses Site 2 which consists of a network of mature treelines and hedgerows with unimproved grasslands at Churchtown House. The indicative R521 link road impacts all three of these sites in addition to a crossing of the River Daar (WFD Name: Deel (Newcastle West) _090) which has a well-developed fringe of riparian woodland.

There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of ten separate watercourses. It crosses diagonally on the River Daar (Deel (Newcastle West) _090) which has a well-developed fringe of riparian woodland. All watercourse crossings will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and

- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.6 Route Corridor Option F

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option also runs to the north of Newcastle West, and impacts on three ecologically sensitive sites as illustrated in Volume 2, Figure 5.2.

The Route Corridor Option crosses the Limerick Greenway (Site 3) to the west, and further east the Route Corridor Option crosses another section of the Limerick Greenway at Site 1. The Route Corridor Option crosses Site 2 which consists of a network of mature treelines and hedgerows with unimproved grasslands at Churchtown House. The indicative R521 link road impacts all three of these sites in addition to a crossing of the River Daar (WFD Name: Deel (Newcastle West) _090) which has a well-developed fringe of riparian woodland.

There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of eight separate watercourses. It crosses diagonally on the River Daar (WFD Name: Deel (Newcastle West_090) which has a well-developed fringe of riparian woodland. All watercourse crossings will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.7 Route Corridor Option G

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option also runs to the north of Newcastle West, and impacts on three ecologically sensitive sites as illustrated in Volume 2, Figure 5.2.

The Route Corridor Option crosses the Limerick Greenway (Site 3) to the west, and further east the Route Corridor Option crosses another section of the Limerick Greenway at Site 1. The Route Corridor Option crosses Site 2 which consists of a network of mature treelines and hedgerows with unimproved grasslands at Churchtown House . The indicative R521 link road impacts all three of these sites in addition to a crossing of the River Daar (WFD Name: Deel (Newcastle West) _090) which has a well-developed fringe of riparian woodland.

There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of nine separate watercourses. It crosses diagonally on the River Daar (Deel (Newcastle West_090) which has a well-developed fringe of riparian woodland. All watercourse crossings

will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.8 Route Corridor Option H

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the south of Newcastle West. The Route Corridor Option impacts on two ecologically sensitive sites as illustrated in Volume 2, Figure 5.2. The Route Corridor Option crosses through lands around Killeline House (Site 4) which has well-developed treelines and parkland and may support unimproved grasslands. A short distance to the east, the Route Corridor Option impacts on belt of deciduous woodland at Cloonyscrehane House (Site 5). There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option crosses a total of seven separate watercourses. All watercourse crossings will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.1.9 Route Corridor Option I

This Route Corridor Option does not have any direct impact on any designated conservation areas. The Route Corridor Option runs to the south of Newcastle West, and impacts on three ecologically sensitive sites identified in the constraints study and crosses a total of five separate watercourses. The Route Corridor Option crosses through lands around Killeline House (Site 4) which has well-developed treelines and parkland and may support unimproved grasslands. A short distance to the east, the Route Corridor Option impacts on belt of deciduous woodland at Cloonyscrehane House (Site 5). There will be a direct loss of habitat at these sites as well as fragmentation effects, which will also be experienced at treelines and hedgerows along the length of the Route Corridor Option.

The Route Corridor Option also crosses the confluence of the Rivers Ehernagh, Doolally and Daar with the River Deel (Site 6). The Route Corridor Option does not cross the River Deel but runs close to over a length of approximately 600m in the townland of Kilaready. All watercourse crossings will result in a localized loss of aquatic and riparian habitat, in addition to potential fragmentation along the watercourse without appropriate design and mitigation. The degree of impact will vary according to the particular ecological sensitivities at the crossing location, in addition to downstream impacts on water quality during construction and operation.

The potential impacts of the Route Corridor Option on local bat populations are as follows:

- Loss of roosts in buildings, structures and trees;
- Loss of foraging habitats;
- Loss of commuting habitats; and
- Reduction in landscape connectivity.

In relation to watercourses, works in the vicinity of watercourses is likely to reduce tall vegetation. Depending on the type of tall vegetation present, trees with Potential Roost Features (PRFs) such as tree holes and dead wood can provide roosting sites for bats. The loss of such may result in the loss of bat roosts. The clearing of tall vegetation may also reduce foraging resource for local bat populations and reduce commuting habitats for local bat populations.

5.4.2 Assessment of Effects of Route Corridor Options

An assessment of the effects of each of the Route Corridor Options is presented below with a summary of their overall impact on biodiversity using the significance rating and scoring detailed in Table 5.2 above.

For biodiversity, based on available desktop information, it is difficult to separate most Route Corridor Options from each other as the Route Corridor Options all cross mainly open agricultural grasslands with numerous watercourse crossings. There are no designated conservation sites within the Study Area and all Route Corridor Options are equally distant from the nearest designated sites.

There are no apparent ground water dependent terrestrial ecosystems or surface water dependant habitats identified within the zone of influence of any Route Corridor Option. There are a high number of watercourse crossings on most Route Corridor Options, and these present one of the few semi-natural habitats within the Study Area.

For bats, Route Corridor Options E and B are deemed to have a potentially higher impact than all other Route Corridor Options, with Option C closely behind. The remaining Route Corridor Options would be expected to have less of an impact. However, there is very little to differentiate the various Route Corridor Options and all Route Corridor Options are considered to have a Moderate Negative impact.

The key differentiations between scoring illustrated in Table 5.4 were for the following reasons:

- Option D is considered to have the least impact on account of its shorter length, and the few watercourse crossings, therefore is deemed to be of Minor Negative impact.
- Conversely, Option B is considered to have the highest potential impact on account of its length, the number of watercourse crossings and the potential impact on barn owl nesting site and is therefore considered to have Major Negative impacts.

5.4.2.1 Route Corridor Option A

This Route Corridor Option is assessed as having a Moderate Negative impact on ecology overall. It does not have any direct impact on any designated conservation areas. It impacts on three ecologically sensitive sites identified in the constraints study and crosses a total of ten separate watercourses, all of which have the potential to support salmonids along with other aquatic ecological sensitivities. Route Corridor Option A is rated as having a Minor negative impact on local bat populations.

5.4.2.2 Route Corridor Option B

This Route Corridor Option is assessed as having a Major Negative impact as it has the greatest total length and impacts on three ecologically sensitive sites and crosses a total of ten separate watercourses. Route Corridor Option Bis rated as having a Moderate negative impact on local bat populations.

5.4.2.3 Route Corridor Option C

This Route Corridor Option is assessed as having a Moderate Negative impact. It impacts on three ecologically sensitive sites identified in the constraints study and cross a total of eight separate watercourses. The Route Corridor Option does not cross the River Deel but runs close to over a length of approximately 600m in the townland of Kilaready which presents a risk of both direct and indirect impacts during construction. Route Corridor Option C is rated as having a Moderate negative impact on local bat populations.

5.4.2.4 Route Corridor Option D

This Route Corridor Option is assessed as having a Minor Negative impact as it is the shortest in total length, crosses two ecologically sensitive sites identified in the constraints study and crosses a total of four separate watercourses. Route Corridor Option D is rated as having a Minor-Moderate negative impact on local bat populations.

5.4.2.5 Route Corridor Option E

This Route Corridor Option is assessed as having a Moderate Negative impact. It impacts on three ecologically sensitive sites identified in the constraints study and cross a total of ten separate watercourses. Route Corridor Option E is rated as having a Moderate negative impact on local bat populations.

5.4.2.6 Route Corridor Option F

This Route Corridor Option is assessed as having a Moderate Negative impact. It impacts on three ecologically sensitive sites identified in the constraints study and crosses a total of eight separate watercourses. Route Corridor Option F is rated as having a Minor-Moderate negative impact on local bat populations.

5.4.2.7 Route Corridor Option G

This Route Corridor Option is assessed as having a Moderate Negative impact. It impacts on three ecologically sensitive sites identified in the constraints study and crosses a total of nine separate watercourses. Route Corridor Option G is rated as having a Minor-Moderate negative impact on local bat populations.

5.4.2.8 Route Corridor Option H

This Route Corridor Option is assessed as having a Moderate Negative impact. The Route Corridor Option impacts on two ecologically sensitive sites identified in the constraints study and crosses a total of seven separate watercourses. Route Corridor Option H is rated as having a Minor-Moderate negative impact on local bat populations.

5.4.2.9 Route Corridor Option I

This Route Corridor Option is assessed as having a Moderate Negative impact. The corridor impacts on three ecologically sensitive sites identified in the constraints study and crosses a total of five separate watercourses. The Route Corridor Option does not cross the River Deel but runs close toit for over a length of approximately 600m in the townland of Kilaready. Route Corridor Option I is rated as having a Minor-Moderate negative impact on local bat populations.

A summary of the significance effects of the Route Corridor Options is presented in Table 5.5 below.

Table 5.5: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Moderate negative	2

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option B	Major negative	1
Option C	Moderate negative	2
Option D	Minor negative	3
Option E	Moderate negative	2
Option F	Moderate negative	2
Option G	Moderate negative	2
Option H	Moderate negative	2
Option I	Moderate negative	2

5.5 Conclusion

Route Corridor Option D is considered to have the least impact on account of its shorter length, and the least number of watercourse crossings (four) and is therefore rated as a Minor Negative impact. Conversely, Route Corridor Option B is considered to have the highest potential impact, Major Negative, on account of its length, the number of watercourse crossings (ten), moderate impact on bat populations and the potential impact on barn owl nesting site. All other Route Corridor Options have been assessed as having a Moderate Negative impact.

6. Waste

6.1 Introduction

This chapter identifies and assesses the potential for generation of waste material and the subsequent effects for each of the Route Corridor Options proposed for the N21 Newcastle West Road Scheme and has been completed by Jacobs. This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

A range of materials will be used in the construction of a new road and most have the potential to create waste arisings; however, the largest volume of material which may become waste relates to the earthworks required to construct the Project. Specifically, how much soil (including topsoil and sub-soil), stone and gravel need to be removed or 'cut' to facilitate the road, and how much similar material or 'fill' is required to construct the road. The relationship between these two quantities, the 'cut and fill', and any subsequent waste as a result of excess and / or unacceptable (for reuse in construction) excavated materials, forms the basis of the majority of the assessment in this chapter. The various Route Corridor Options are assessed in-line with TII *Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis* October 2016 which highlights the following:

> *Road schemes have the potential to produce significant amounts of waste where a cut/fill balance cannot be achieved. Disposal of this material can have adverse effects on the environment in terms of transport of material to/from site causing increased vehicle trip with increased air pollution, noise levels along existing roads and also issues with regard to disposal to licensed sites.*

6.2 Methodology

6.2.1 Assessment Criteria

6.2.2 Legislation, Policy & Guidance Overview

The methodology used to identify and assess the impacts associated with the generation of waste had appropriate regard to relevant guidance including, but not limited to:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency (EPA) August 2017 Draft);
- Guidelines for the Management of Waste from National Road Construction Projects Revision 1 (Transport Infrastructure Ireland (TII) 2014);
- Guidelines on Soil and Stone By-products in the context of Article 27 of the European Communities (Waste Directive) Regulations 2011 (EPA 2019);
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects (Department of Environment Heritage and Local Government1 July 2006);
- Construction Industry Research and Information Association (CIRIA) document 133 Waste Minimisation in Construction (CIRIA 1997);
- Design Manual for Roads and Bridges (DMRB) LA110 Material assets and waste Revision 0 (Highways England August 2019);
- Specification for Road Works Series 900 – Road Pavements – Bituminous Materials;
- Construction and Demolition Waste Statistics for Ireland (EPA October 2019);
- A Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020-2025;
- Management of Materials Arising from Roadworks, County and City Management Association 2020; and
- Design Out Waste factsheet (EPA 2013).

As part of the compilation of this chapter the following EU, national, regional and local policy documents were reviewed with respect to waste management policies:

- EU Construction & Demolition Waste Management Protocol (EC 2016);
- A Resource Opportunity – Waste Management Policy in Ireland (DoCELG 2012);
- Construction & Demolition Waste: Soil and Stone Recovery / Disposal Capacity (RPS on behalf of Regional Waste Management Planning Offices, Update Report 2020);
- Southern Region Waste Management Plan 2015-2021;
- Limerick County Development Plan 2010-2016; and
- Mid-West Area Strategic Plan 2012-2030.

In addition to the above, the following documents and legislation have been reviewed:

- The EU Waste Framework Directive (2008/98/EC);
- The Waste Management Act 1996 (as amended);
- The European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011); and
- Waste Classification – List of Waste and Determining if Waste is Hazardous or Non-Hazardous (EPA 2015).

6.2.2.1 Legislative Exemptions

The European Union (Waste Directive) regulations 2011 set out the exclusions from the scope of the Directive which includes the following under Article 3(1)(c):

> *"uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated."*

Article 27 of the European Communities (Waste Directive) Regulations 2011 allows an economic operator to demonstrate, under certain circumstances, that material is a by-product and not a waste. The following conditions must be met in this case:

- Further use of the substance or object is certain;
- The substance or object can be used directly without any further processing other than normal industrial practice;
- The substance or object is produced as an integral part of a production; and
- Further use is lawful in that the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

In addition, Article 28 of the European Communities (Waste Directive) Regulations 2011 sets out the grounds for an economic operator to determine the point waste, which has undergone a recycling or other recovery operation, is considered to have ceased to be waste. The following conditions must be met in this case:

- the substance or object is to be used for specific purposes;
- a market or demand exists for such a substance or object;
- the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- the use of the substance or object will not lead to overall adverse environmental or human health impacts.

Classification of material as a by-product or determining that 'waste' has been recycled / recovered (and is longer considered waste) means that the material is of a type that is not regulated by waste management legislation, and therefore is not required to be managed under that legislation. For such construction projects, excavated soil and stone can be categorised under these exemptions provided the materials adhere to the conditions stipulated under Articles 27 or 28 as applicable. The economic operator and destination for the material must adhere to all applicable requirements for these exemptions to be permitted.

Excavated materials from each Route Corridor Option which fall within these provisions are therefore not subject to the requirements of EU and National Waste Legislation.

Article 31(2)(b) of the regulations sets out a target of 70% reuse of non-hazardous Construction and Demolition (C&D) waste by 2020.

6.2.2.2 European Union 7th Environment Action Programme to 2020

Turning waste into a resource is key to a circular economy. The objectives and targets set in European legislation have been key drivers to improve waste management, stimulate innovation in recycling, limit the use of landfilling, and create incentives to change consumer behaviour. If countries engage in re-manufacturing, reusing and recycling, and if one industry's waste becomes another's raw material, it is possible to move to a more circular economy where waste is eliminated, and resources are used in an efficient and sustainable way.

The EU's 7th Environment Action Programme sets out environmental policy for the EU to 2020 and a vision to 2050. It identifies three key objectives:

- "To protect, conserve and enhance the Union's natural capital;
- To turn the Union into a resource-efficient, green, and competitive low-carbon economy; and
- To safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing."

In line with this programme and its policy objectives, waste policy for the EU identifies the following priority objectives:

- "To reduce the amount of waste generated;
- To maximise recycling and re-use;
- To limit incineration to non-recyclable materials;
- To phase out landfilling to non-recyclable and non-recoverable waste; and
- To ensure full implementation of the waste policy targets in all Member States."

Preliminary consideration of how excavated material could be re-used on each of the Route Corridor Options has been included in this assessment.

6.2.2.3 Regional and County Waste Policies

Any waste arisings are also governed by the requirements as set out in the Southern Region Waste Management Plan 2015-2021 which includes the following relevant statement: "other treatment capacity appears to be in plentiful supply (e.g., land improvement recovery of C&D wastes)".

One of the objectives in the Limerick County Development Plan 2010-2016 Section 8.4.1 is:

"It is the objective of the Council to ensure that all significant construction/demolition projects include construction and demolition waste management plans. These plans should seek to focus on waste minimisation in general and optimise waste prevention, re-use and recycling opportunities."

6.2.2.4 Data Collection Methods

Online data sources used in the collation of data were:

- Southern region annual statistics; and
- www.ec.europa.eu/Eurostat.com European Union statistics on resource productivity.

6.2.3 Assessment Criteria

6.2.3.1 Significance of Impact Method

The assessment of Route Corridor Options was assisted by scoring of impacts to sensitive receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi

Criteria Analysis[32]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the scores detailed within the PAG Unit 7.0, as shown in Table 6.1 and a number was assigned according to the level of significance of the effect.

Table 6.1: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

The assessment of the potential effects of each Route Corridor Option has been undertaken having regard to the guidelines as set out in the draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017) (the draft Guidelines). The characteristics of an effect in terms of waste relates to the quality, significance and duration of the effect. The definition of these effect characteristics in accordance with the draft Guidelines is provided in Table 6.2.

In some cases, there may be very little difference in potential impacts between Route Corridor Options and the impact scores may be the same. Where possible, expert judgement has been used to compare Route Corridor Options, taking into account the quantitative and qualitative assessments.

Table 6.2: EPA impact Assessment Criteria

Quality of Effects	
It is important to inform the non-specialist reader whether the effect is positive, negative, or neutral.	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities)
	Neutral Effects A change which does not affect the quality of the environment
	Negative / Adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance)

[32] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

Significance of Effects	
'Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for the different topics the following definitions may be useful.	**Imperceptible** An effect capable of measurement but without noticeable consequences
	Not significant An effect which causes noticeable changes in the character of the environment but without noticeable consequences
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant Effects An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment
	Profound Effects An effect which obliterates sensitive characteristics
Context of Effects	
Context can affect the perception of significance. It is important to establish if the effect is unique or, perhaps, commonly, or increasingly experienced.	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)

Duration of Effects	
'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years
	Medium-term Effects Effects lasting seven to fifteen years
	Long-term Effects Effects lasting fifteen to sixty years
	Permanent Effects Effects lasting over sixty years
	Reversible Effects Effects that can be undone, for example through remediation or restoration
	Frequency of Effects Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

With regards to waste, TII guidance stipulates that options appraisal should consider the quantities of material to be disposed of off-site (suitable and unsuitable material (U1 and U2) as defined in TII Publication CC-SPW-00600 Specification for Road Works Series 600 Clause 601)), and also consider whether any contaminated land/hazardous material is being left in situ.

This assessment takes the above into account; however, in the absence of more detailed TII or other Irish Guidelines on this matter, the UK Guidance DMRB LA110 Material Assets and Waste Guidelines were used to determine the significance of effect in order to identify a score for each Route Corridor Option for use in the Options Appraisal. Specifically, the significance criteria in LA110 formed the basis of the criteria shown in Table 6.3. The DMRB categories are based around the EU Waste Framework Directive which mandates that at least 70% (by weight) of non-hazardous C&D waste is recovered or recycled. This is expressed as a target also in the Waste Regulations (2011).

The DMRB categories were adapted by converting them to TII categories and awarding a score in accordance with the TII scoring system. To facilitate options assessment, the criteria within each category are identified as primary or secondary. The rate of materials recovery / re-use to substitute primary materials is identified as the primary criterion, as this is the criterion used as a national target for construction and demolition waste in the Waste Regulations. It is also re-iterated that the ability of a route to re-use materials is directly linked to the quantity of waste for that route.

It is stressed that the adaptation of DMRB categories and sub-division of criteria has been carried out to allow differentiation, where possible, between potential Route Corridor Options. The sub-division of criteria and application of associated significance may change in later stages of the project as design is refined.

Table 6.3: Adapted DMRB LA110 Material Assets and Waste significance criteria

Significance Criteria	Description
Large = MAJOR Score 1	Primary Criterion: project achieves <50% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials Secondary Criteria: - >50% of material to be imported; - >30% reduction in regional capacity if excess material goes off-site to soil recovery facilities / landfill; - 1 or more peat resources impacted.
Moderate = MODERATE Score 2	Primary Criterion: project achieves 50-70% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials Secondary Criteria: - 20-50% of material to be imported; - 10-30% reduction in regional capacity if excess material goes off-site to soil recovery facilities / landfill.
Slight = MINOR Score 3	Primary Criterion: project achieves 70+% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials Secondary Criteria: - <20% of material to be imported; - <10% reduction in regional capacity if excess material goes off-site to soil recovery facilities / landfill.

6.3 Existing Environment

6.3.1 Ireland Waste Statistics

Under the EU Waste Framework, member states must achieve 70% of material recovery of non-hazardous, non-soil-and-stone construction and demolition waste. The target date for Ireland to achieve this by was December 2020. Material recovery is monitored biannually and provided as part of the EPA annual reporting process for waste. The first year of monitoring was 2014, during which 68% of C&D Waste was recovered; in 2016 71% was recovered and in 2018 77% was recovered. Data for later years is not yet available.

Each year, information on Construction and Demolition (C&D) waste collected by authorised collectors is provided to the EPA. Table 6.4 shows the statistics for Ireland from 2004 to 2018.

Table 6.4: Ireland Waste Statistics (C&D) 2018

Year	Soil and stones	Other construction and demolition waste	Total	Annual change in Waste Arisings (%)
2004	8,492	2,676	11,168	-
2005	12,646	2,286	14,931	34%
2006	13,883	2,937	16,820	13%
2007	13,560	4,232	17,792	6%
2008	10,537	2,986	13,523	-24%
2009	3,771	1,323	5,094	-62%
2010	2,553	1,089	3,642	-29%
2011	2,061	1,086	3,147	-14%
2012	2,254	889	3,143	0%
2013	2,029	906	2,935	-7%
2014	2,869	955	3,824	30%
2015	3,642	377	4,019	5%
2016	4,264	383	4,647	16%
2017	3,827	923	4,750	2%
2018	4,790	1,430	6,220	31%

6.3.2 Regional Waste Statistics

There are three Waste regions in Ireland: Southern Waste Region, Connacht Ulster Waste Region and Eastern and Midlands Waste Region. The Project is within the Southern Waste Region.

The Southern Waste Region comprises the 10 local authority areas of Carlow, Clare, Cork County, Cork City, Limerick City & County, Kerry, Kilkenny, Tipperary, Waterford City & County and Wexford. The region covers 42% of the land mass of the country and has a population of >1.5 million people.

As lead authorities for the Southern Waste Region, Limerick City & County Council and Tipperary County Council responsibilities include the preparation of the Southern Region Waste Management Plan, which covers the period 2015 to 2021.

The Regional Waste Management Plans (RWMPs) and the associated Annual Statistical Indicator Reports do not provide C&D Waste data to the same granularity as is available at a national level. However, the Construction & Demolition Waste Soil and Stone Recovery / Disposal Capacity Update Report 2020 provides statistics on relevant capacities and are included in the significance criteria; as a result, these are presented for the regional baseline and used in the assessment. Table 6.5 shows the waste statistics for the three waste regions in Ireland with regard to soil & stones disposal / recovery given that this will be by far the largest potential waste stream.

Table 6.5: Regional Waste Statistics – Capacity for Soil and Stones 2018

Region	Remaining Annual Capacity at Licenced Soil Recovery Facilities[1]	Lifetime Capacity Provided by Permitted and Registered sites[2]	Active Inert Landfill Capacity for Soils	Commentary
Southern	525,000	2,374,000	-	Two facilities in Cork offering 580,000 tonnes of annual capacity which are licenced but yet to commence activity. Two further facilities at application stage (total applied for 380,000 tonnes per annum) not included in total authorised number. These additional facilities will accommodate increased construction activity in the region, particularly in the urban centres of Cork and Limerick. No Inert landfills in region.
Connacht-Ulster	90,000	1,380,000	-	Available data suggests sufficient capacity in the region as a whole, although it is concentrated in Mayo and Galway. No Inert landfills in region.
Eastern Midlands	2,400,000	1,520,000	6,100,000	Capacity is concentrated in the Greater Dublin Area reflecting this is the centre of construction activity in the Region and nationally.

Notes
[1] Licenced Soil Recovery Facilities - Soil Recovery Facilities above a set capacity threshold (>200,000 tonnes lifetime capacity); have an annual capacity limit.
[2] Permitted and Registered Soil Recovery Facilities - Soil Recovery Facilities with lifetime capacity of <200,000 tonnes. Not subject to annual tonnage limits, rather permit holder has a maximum of 5 years to use capacity limit set.

6.4 Assessment of Route Corridor Options

6.4.1 Assessment of Potential Impacts

6.4.1.1 Earthworks

In the case of soil/earthworks, approximate earthworks quantities were calculated, which there are estimates based on the indicative working alignments of each Route Corridor Option. These are presented as 'cut and fill' in Table 6.7. It is highlighted that the primary purpose of the earthworks calculations for Stage 2 was to inform and support the Option Comparison Estimate (OCE), and the subsequent Cost Benefit Analysis (CBA). In accordance with OCE, the estimation of the earthworks quantities was used for the sole purpose of comparative assessment of the Route Corridor Options. The quantities are reflective of the level of design undertaken at the time of the estimation (which is at initial development during Phase 2) and are subject to further refinement, change and greater accuracy throughout TII's project delivery phases (i.e. Phases 3 to 7).

6.4.1.2 Other Waste

6.4.1.2.1 Construction

Table 6.6 shows a qualitative review of the types of construction waste likely to be generated during construction of the proposed N21, on any of the Route Corridor Options. It is not possible to quantify these at this stage, except in the case of soil. In the case of soil/earthworks, approximate earthworks quantities were calculated, for which there are estimates based on the indicative working alignments of each Route Corridor Option, which are presented 'cut and fill'. These are provided in Table 6.8.

Table 6.6: Resources used and Waste Generated During Construction

Waste Type	All Route Corridor Options
Drilling muds and other drilling wastes	Possible: small quantities; waste very small
Hydraulic oils	Use likely: small quantities; waste very small
Waste engine, gear and lubricating oils	Use likely: small quantities; waste very small
Liquid fuels	Use likely: medium quantities; waste unlikely
Packaging	Yes – no quantities available
Wood, glass and plastic	Yes – wood for fencing during construction- quantities tbc
Bituminous mixtures, coal tar and tarred products	Yes – tarmac of road surfaces – quantities tbc; may be some waste
Metals (including their alloys)	Possible - demolition/removal of any existing bridge parapets and road restraint systems; construction of new parapets and road restraint systems – quantities tbc
Soil (including excavated soil from contaminated sites), stones	See Table 6.8
Concrete, bricks, tiles and ceramics	Yes - possibly for kerbing– quantities not yet known

6.4.1.2.2 Operation

Table 6.7 shows the types of waste likely to be generated during operation of any one of the Route Corridor Options; it would be similar type of waste generated for each. These cannot be quantified at this stage and there is no differentiator between the Route Corridor Options.

Table 6.7 Waste Generated During Operation

Waste Type	All Route Corridor Options
Concrete, bricks, tiles and ceramics	Yes - possibly for kerbing– quantities tbc
Wood, glass and plastic	Yes – wood for fencing during construction- quantities tbc
Bituminous mixtures, coal tar and tarred products	Yes – tarmac for repairs of road surfaces; may be some waste
Magnitude of Operational Effects	Negligible
Significance of Effects	Imperceptible

6.4.1.3 Material Reuse

As a member of the EU and signatory to the 7th Environment Programme for Europe, Ireland has included a target for 70% reuse of C&D waste (excluding soil) by 2020. Following the principal of maximising re-use, materials recovery was made the primary criterion for the option selection process. In this instance, current design assessed herein assumes that 20% of bulk cut material will be acceptable for re-use in the scheme, regardless of Route

Corridor Option. There is consequently no differentiation between Route Corridor Options using this criterion alone. Therefore, secondary criteria were employed to enable comparison of Route Corridor Options and comprised: quantity of imported material required (as percentage of overall earthworks) and reduction in regional capacity if material goes off-site to soil recovery facilities / for disposal at landfill (as a measure of quantity of material to be disposed of off-site).

6.4.2 Assessment of Potential Impacts

6.4.2.1 Assumptions and Limitations:

The following assumptions and limitations were applied in calculating impacts which are presented in Table 6.8.

- Potential for 70% of reuse of cut where fill requires it assumed for all Route Corridor Options;
- No account taken of potential reuse of cut elsewhere where fill does not require all, assume all excess arisings to be removed to soil recovery facilities / landfill (later iterations of design will likely identify other re-use options for some / all excess material);
- Imported material considered on basis of quantity required in accordance with a percentage of overall earthworks only, percentage of re-used / recycled content not known or assumed at this stage (to be determined in later stages of design);
- 1.7t per m^3 for soil and stones;
- While two potentially contaminated sites (an EPA licensed facility which is assumed to a poultry farm by the project agronomist, and an historical landfill) have been identified in the Study Area, it is considered unlikely that significant contaminated ground / hazardous waste will affect the selection process with regard to waste (ground contamination is also discussed further in Section 7); and
- Regional soil recovery / landfill capacity exceeds total excess arisings for all Route Corridor Options, therefore assumed that none will need to be disposed of outside region; and
- No peat resources are present in the Study Area and therefore have not been considered further in route comparison.

6.4.2.2 Route Corridor Option A

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 445,649m^3 imported material required (98% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by only 0.4%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.3 Route Corridor Option B

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 481,489m^3 imported material required (92% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by 1.9%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.4 Route Corridor Option C

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 657,339m^3 imported material required (91% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by 2.9%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.5 Route Corridor Option D

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 780,366m^3 imported material required (99% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by only 0.3%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.6 Route Corridor Option E

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 358,299m^3 imported material required (95% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by only 0.9%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.7 Route Corridor Option F

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 314,177m^3 imported material required (95% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by only 0.8%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.8 Route Corridor Option G

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 386,608m^3 imported material required (95% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by 1.0%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.9 Route Corridor Option H

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 747,024m^3 imported material required (99% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by only 0.3%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

6.4.2.10 Route Corridor Option I

As with all Route Corridor Options, it is assumed that 20% of cut can be re-used on the scheme. 545,113m^3 imported material required (88% of earthworks volume) with a potential impact on primary resources. If all excess material is removed from site, it would reduce regional capacity of soil recovery facilities / landfills by 3.6%.

This Route Corridor Option would have no impact on waste infrastructure outside the region.

Table 6.8 Estimate Cut and Fill and Reuse for each Route Corridor Option

Estimated Cut and Fill and Reuse Calculations	Calculation Code	Calculation	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Bulk Cut (m^3)	(A)		8,458	40,357	62,613	6,973	18,420	17,751	20,840	6,032	77,471
Fill Required (m^3)	(B)		447,389	489,560	669,862	781,761	361,983	317,727	390,776	748,230	560,607
Bulk Cut Acceptable (20%) (m^3)	(C)	= (A) X 20%	1,692	8,071	12,523	1,395	3,684	3,550	4,168	1,206	15,494
Disposal of Unacceptable Cut, U2 (30%) (m^3)	(D)	= (A) x 30%	6,766	32,286	50,090	5,578	14,736	14,201	16,672	4,826	61,977
Disposal of Acceptable Cut, U1, surplus to requirements (m^3)	(E)	= (C) - (B) If < 0 = 0	0	0	0	0	0	0	0	0	0
Total Cut Disposed	(F)	= (D) + (E)	6,766	32,286	50,090	5,578	14,736	14,201	16,672	4,826	61,977
Weight of Cut disposed (tonnes) (1.7t/m^3)	(G)	= (F) X 1.7	11,503	54,886	85,154	9,483	25,051	24,141	28,342	8,204	105,361
Regional capacity for soil & stones at landfill and soil stone recovery facilities (t)	(H)		2,900,000	2,900,000	2,900,000	2,900,000	2,900,000	2,900,000	2,900,000	2,900,000	2,900,000
Total disposed cut as percentage of regional capacity	(I)	= (G)/(H) x 100	0.4%	1.9%	2.9%	0.3%	0.9%	0.8%	1.0%	0.3%	3.6%
Weight of cut to be exported out of region (t)	(J)	= (G) – (H) If < 0 = 0	0	0	0	0	0	0	0	0	0
Percentage weight of project waste to be exported	(K)	(J)/(G) x 100	0	0	0	0	0	0	0	0	0
Import required (m^3)	(L)	= (B) – (C) If < 0 = 0	445,697	481,489	657,339	780,366	358,299	314,177	386,608	747,024	545,113
Import required as percentage of earthworks	(M)	= ((L)/(A) + (D) + (L)) x 100	98%	92%	91%	99%	95%	95%	95%	99%	88%

6.4.3 Assessment of Effects of Route Corridor Options

There is limited differentiation between Route Corridor Options with all Route Corridor Options requiring the import of over 90% of the earthworks volume. The minor differences between Route Corridor Options are outlined below.

6.4.3.1 Route Corridor Option A

Required imported material represents ~98% of the earthworks volume resulting in a major negative impact. However, it should be noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. Negligible impacts are anticipated on regional soil recovery facilities / landfills as <1% of capacity would be used during construction of Route Corridor Option A.

Despite this, the greatest potential impact is as a result of import of materials and Route Corridor Option A will therefore have a Major Negative impact with regard to waste.

6.4.3.2 Route Corridor Option B

Required imported material represents ~92% of the earthworks volume resulting in a major negative impact. Again, it is noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. A minor impact is anticipated on regional soil recovery facilities / landfills as 2% of capacity would be used during construction of Route Corridor Option B.

The greatest potential impact is as a result of import of materials and consequently Route Corridor Option B will have a Major Negative impact with regard to Waste.

6.4.3.3 Route Corridor Option C

Required imported material represents ~91% of the earthworks volume resulting in a major negative impact. Again, it is noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. A minor impact is anticipated on regional soil recovery facilities / landfills as 3% of capacity would be used during construction of Route Corridor Option C.

The greatest potential impact is as a result of import of materials and consequently Route Corridor Option C will have a Major Negative impact with regard to Waste.

6.4.3.4 Route Corridor Option D

Required imported material represents ~99% of the earthworks volume resulting in a major negative impact. However, it should be noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. Negligible impacts are anticipated on regional soil recovery facilities / landfills as <1% of capacity would be used during construction of Route Corridor Option D.

Despite this, the greatest potential impact is as a result of import of materials and Route Corridor Option D will therefore have a Major Negative impact with regard to Waste.

6.4.3.5 Route Corridor Option E

Required imported material represents ~95% of the earthworks volume resulting in a major negative impact. However, it should be noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. Negligible impacts are anticipated on regional soil recovery facilities / landfills as <1% of capacity would be used during construction of Route Corridor Option E.

Despite this, the greatest potential impact is as a result of import of materials and Route Corridor Option E will therefore have a Major Negative impact with regard to Waste.

6.4.3.6 Route Corridor Option F

Required imported material represents ~95% of the earthworks volume resulting in a major negative impact. However, it should be noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. Negligible impacts are anticipated on regional soil recovery facilities / landfills as <1% of capacity would be used during construction of Route Corridor Option F.

Despite this, the greatest potential impact is as a result of import of materials and Route Corridor Option F will therefore have a Major Negative impact with regard to Waste.

6.4.3.7 Route Corridor Option G

Required imported material represents ~95% of the earthworks volume resulting in a major negative impact. However, it should be noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. Negligible impacts are anticipated on regional soil recovery facilities / landfills as only 1% of capacity would be used during construction of Route Corridor Option G.

Despite this, the greatest potential impact is as a result of import of materials and Route Corridor Option G will therefore have a Major Negative impact with regard to Waste.

6.4.3.8 Route Corridor Option H

Required imported material represents ~99% of the earthworks volume resulting in a major negative impact. However, it should be noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. Negligible impacts are anticipated on regional soil recovery facilities / landfills as <1% of capacity would be used during construction of Option H. Despite this, the greatest potential impact is as a result of import of materials and Route Corridor Option H will therefore have a Major Negative impact with regard to Waste.

6.4.3.9 Route Corridor Option I

Required imported material represents ~88% of the earthworks volume resulting in a major negative impact. Again, it is noted that imported materials are assumed to be primary materials at this stage of the assessment and subsequent stages of more detailed design may identify sources of re-used or recycled materials, thus reducing the potential impact on primary materials. A minor impact is anticipated on regional soil recovery facilities / landfills as 4% of capacity would be used during construction of Route Corridor Option I.

The greatest potential impact is as a result of import of materials and consequently Route Corridor Option I will have a Major Negative impact with regard to Waste.

Table 6.9: Significance of Effects of Route Corridor Options

Appraisal Criteria Cut and Fill and Reuse Calculations Scenario 1	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Primary Criterion: Material Recovery (Reuse) %	20	20	20	20	20	20	20	20	20
Secondary Criteria: Percentage weight of material to be imported	98	92	91	99	95	95	95	95	88
Secondary Criteria: Percentage reduction in regional capacity if excess material goes off-site to soil recovery / landfill	0.4	1.9	2.9	0.3	0.9	0.8	0.98	0.3	3.6
Effect Description (per appraisal criteria)	<50% reuse; >50% material imported; <1% reduction in regional capacity	<50% reuse; >50% material imported; >1 to 15% reduction in regional capacity	<50% reuse; >50% material imported; >1 to 15% reduction in regional capacity	<50% reuse; >50% material imported; <1% reduction in regional capacity	<50% reuse; >50% material imported; <1% reduction in regional capacity	<50% reuse; >50% material imported; <1% reduction in regional capacity	<50% reuse; >50% material imported; <1% reduction in regional capacity	<50% reuse; >50% material imported; <1% reduction in regional capacity	<50% reuse; >50% material imported; >1 to 15% reduction in regional capacity
Commentary	*Reuse criterion is a primary criterion but cannot be used as no differentiation between Route Corridor Options, so excluded from significance criteria in this case.*								
Significance of Effect	**Major Negative**	**Major Negative**	**Major Negative**	**Major Negative**	**Major Negative**	**Major Negative**	**Major Negative**	**Major Negative**	**Major Negative**
PAG Score	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Table 6.10 Summary of Significance of Effect and Scores for Each Route Corridor Option - Waste

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Major Negative	1
Option B	Major Negative	1
Option C	Major Negative	1
Option D	Major Negative	1
Option E	Major Negative	1
Option F	Major Negative	1
Option G	Major Negative	1
Option H	Major Negative	1
Option I	Major Negative	1

6.5 Conclusion

Based on the criteria discussed, all Route Corridor Options would potentially have a major negative impact. Despite similar overall scores, there is some minor differentiation between Route Corridor Options, such as the quantity of import required by volume (as opposed to import required as a percentage of overall earthworks) whereby the Route Corridor Options requiring the smallest volumes of imported material would be of slightly lower impact. Route Corridor Options E, F & G have a slightly lower quantity of import required compared to other Route Corridor Options.

As an additional note, it is re-iterated that while this assessment identified each Route Corridor Option as having a potentially major negative impact due to the volumes of imported material required, subsequent stages of more detailed design may identify sources of re-used or recycled materials for import, which will reduce impact on primary materials.

7. Soils, Geology and Hydrogeology

7.1 Introduction

This chapter contains two discrete and separate assessments of the impact of the Route Corridor Options proposed for the N21 Newcastle West Road Scheme in relation to:

1) Soils and Geology; and
2) Hydrogeology

This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

The assessment has been completed by Jacobs in accordance with the Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes[33] produced by the National Roads Authority (now Transport Infrastructure Ireland (TII)).

This assessment examines the soils and geological conditions and the hydrogeological conditions along each Route Corridor Options with respect to their sensitivity, importance, and the possible impacts resulting from the construction of a road.

Figures showing the Route Corridor Options mapped on geological and hydrogeological information are presented in Volume 2 Figures 7.1 - 7.5.

It is noted that the optimum Route Corridor Option from a soils, geology and hydrogeology perspective may not be the overall optimum Route Corridor Option when other environmental, social or economic aspects are taken into account.

7.2 Methodology

7.2.1 Assessment Criteria

The assessment of Route Corridor Options was assisted by scoring of impacts to sensitive receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis[34]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the Scores detailed within the PAG Unit 7.0, as shown in Table 7.1 and a number was assigned according to the level of significance of the effect.

In order to provide an indication of which Route Corridor Options are more or less preferable, the average score across soils & geology factors and across hydrogeology factors for each Route Corridor Option has been calculated, following on from the methodology in the Stage 1 assessment. Where an average score falls exactly halfway between categories (e.g. 3.5), the score will be rounded down to the more conservative category.

[33] NRA. Undated. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Unreferenced. Obtained from: www.tii.ie/technical-services/environment/planning/ (accessed March 2020).
[34] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

Table 7.1: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

Each of the proposed Route Corridor Options was assessed in relation to:

Soils & Geology

- Bedrock geology;
- Soils and Quaternary geology;
- Mines, Quarries, and mineral resources
- Geological heritage and karst features;
- Economic Resources: (sand & gravel, granular aggregate and crushed rock); and
- Potential Contaminated Land sites (recorded landfill sites and licensed waste facilities).

Hydrogeology

- Aquifer Classification (Vulnerable and Regionally Important Aquifers and Sand & Gravel Aquifers)
- Aquifer Vulnerability (the importance of the underlying groundwater resource and the ease with which a contaminant incident, e.g. accidental spill, can affect the aquifer);
- Proximity to Public Groundwater Supplies, Springs and Wells;
- Water Supplies (Public & Group Supply Source Protection Areas or equivalent); and
- Risk to groundwater dependent water bodies and terrestrial environments.

In some cases, there may be very little difference in potential impacts between Route Corridor Options and the impact scores may be the same. Where possible, expert judgement has been used to compare Route Corridor Options, taking into account the quantitative and qualitative assessments.

7.2.2 Information Sources

The options assessment was based on desk study, using available published information and other information obtained for the Project. No ground investigations or other on-site surveys for relevant information had been conducted at the time of this assessment.

Information on soils, geology and hydrogeology was obtained from the following sources:

- Geological Survey of Ireland (GSI) geological and hydrogeological data (including well database, aquifer classification data and groundwater vulnerability maps)[35];
- Environmental Protection Agency (EPA) online maps[36];
- Ordnance Survey Ireland[37];

[35] www.gsi.ie (accessed June 2021)
[36] http://gis.epa.ie (accessed June 2021)
[37] http://map.geohive.ie/mapviewer.html (accessed June 2021)

- Limerick City and County Council;
- Department of Communications Energy and Natural Resources (DCENR) minerals licensing information[38];
- Irish Soil Information System (Teagasc) online maps[39];
- Britvic Ireland Ltd; and
- Aerial imagery.

7.3 Existing Environment

7.3.1 Geology

7.3.1.1 Bedrock Geology

Geological mapping indicates changes in the bedrock geology from east to west across the Study Area. The Study Area comprises undifferentiated Old Red Sandstone strata, Lower Limestones Shales and dark muddy limestone shales of the Ballysteen Formation in the east (notably beyond the eastern extent of the Route Corridor Options considered here); massive, unbedded limestones and mudstones of the Waulsortian Limestone Formation through the central section of the Study Area; and undifferentiated Visean Limestones in the west.

7.3.1.2 Soils and Quaternary Geology

Within the Newcastle West Study Area, the superficial deposits predominantly comprise glacial till derived from limestones. Till derived from sandstones and shales is present in the far west of the Study Area. An area of glacial till derived from sandstones also occupies the eastern extremity of the Study Area but is remote from the Route Corridor Options considered here.

Gravel beds derived from limestones are indicated over significant areas to the east and to the northwest of Newcastle West. There are areas of alluvial deposits associated with the River Deel, the Dooally River, the River Darr and other larger watercourses. In addition, made ground is associated with the development of Newcastle West. Superficial deposits are absent from small areas located to the west of Newcastle West where karstified bedrock outcrops or subcrops are identified.

Peat was not identified in the Study Area and is not considered further in this assessment.

7.3.1.3 Geological Heritage Sites and Karst Features

One Geological Heritage Site (St. Bridget's well, a warm spring) is recorded within the Study Area, to the southwest of Newcastle West.

Karstic landforms were not identified and are not considered further in this assessment.

7.3.2 Mines, Quarries and Mineral Resources

There is one active quarry in the northwest of the Study Area, however it is remote from the Route Corridor Options. There are ~35 disused pits and quarries in the Study Area, although only a small number are located within the 400m wide Route Corridor Options (discussed further in Section 7.4). A potential lead resource is recorded by GSI at the townland of Mahoonagh More, in the southeast of the Study Area, however this location is remote from any of the Route Corridor Options considered here.

Information from Department of Communications, Energy and Natural Resources (DCENR) shows that much of the Study Area has previously been licensed for prospecting although all licenses have been surrendered, with no records of current, ongoing licenses. The entire area is open for new license applications.

7.3.3 Contaminated Land

An EPA licensed facility (holding an Industrial Emissions (IE) License and Integrated Pollution Prevention Control (IPPC) license) is located to the west of Newcastle West. Inspection of aerial images indicates that the facility may

[38] http://dcenr.maps.arcgis.com/apps/webappviewer/index.htm (accessed June 2021)
[39] http://gis.teagasc.ie/soils/map.php (accessed January 2020)

be a poultry farm. One contaminated land site (an historical landfill) was identified in the northwest periphery of Newcastle West and the location corresponds to an historical pit / quarry which may therefore have been infilled.

7.3.4 Hydrogeology

7.3.4.1 Water Framework Directive

The central portion of the Study Area lies within Newcastle West (IE_SH_G_190) WFD Groundwater Body which has a Karstic flow regime.

The east of the Study Area (remote from the Route Corridor Options) is underlain by the Feenagh (IE_SH_G_088) and Ballyallinan (IE_SH_G_024) WFD Groundwater Bodies which are both poorly productive and the Knockaderry (IE_SH_G_128) WFD Groundwater Body which is a productive fissured bedrock. The west of the Study Area lies within Shanagolden (IE_SH_G_203) WFD Groundwater Body which is a poorly productive bedrock.

7.3.4.2 Aquifers

The Waulsortian Limestone which underlies the central portion of the Study Area is classed as a diffuse karstic aquifer and is a Regionally Important Aquifer (Newcastle West WFD Groundwater Body).

A small area of sand and gravel aquifer also encroaches onto the east of the overall Study Area; however, it is remote from the Route Corridor Options considered here.

The underlying aquifer vulnerability rating across the much of the Study Area is Low although localised areas of High vulnerability are sporadically distributed across the northwest, centre and east of the Study Area. In addition, highly localised areas of Extreme vulnerability or 'Rock at or near surface or Karst' are recorded to the west of Newcastle West and at the eastern extremity of the Study Area. These are generally located remote from the proposed Route Corridor Options although one such area has potential to encroach onto the southern end of the indicative R521 link road.

7.3.4.3 Groundwater Resources

Geological Survey of Ireland (GSI) geological and hydrogeological data records indicate a large number (~200) of groundwater abstraction features mapped throughout the Study Area, including wells (dug wells and boreholes) and springs. Recorded uses comprise: Public supply; Group Scheme; Domestic; Industrial; and Agricultural. While total number of springs and wells along each Route Corridor Options is considered later in this chapter, it is noted that NRA guidance[40] highlights that *"Low yielding* wells*, used mainly for domestic and farm water supply, are very common in Ireland…"* and that *"It is almost inevitable that any large national road scheme will result in at least a small number of low-yielding water supply wells having to be abandoned."*

There are no Public or Group Supply Source Protection Areas within the Study Area. However, information provided by Britvic Ireland Ltd showed that they abstract groundwater for bottled drinking water at a location in the west of Newcastle West.

7.3.4.4 Groundwater Dependant Water Bodies and Terrestrial Ecosystems

At this stage of the assessment no groundwater dependant water bodies or groundwater dependent terrestrial ecosystems (GWDTEs) have been identified by the project ecologist and these features do not contribute to the Stage 2 options assessment presented in this Chapter. However, the potential exists for such features to be present within the Study Area and it cannot be conclusively determined at this stage whether or not they may be a constraint for the Project.

If such features are later identified, they will be assessed further during subsequent stages of the project.

[40] NRA. Undated. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Unreferenced. Obtained from: www.tii.ie/technical-services/environment/planning/ (accessed June 2021).

7.4 Assessment of Route Corridor Options

7.4.1.1 Assumptions and Limitations

The following features were not considered in the assessment of Route Corridor Options, either because insufficient information was available at this stage of assessment to allow meaningful consideration, or because the value and distribution of the feature was not present within the 400m corridors, or considered to provide a differentiating factor:

- Peat;
- Karst features;
- Groundwater Dependent Terrestrial Ecosystems; and
- Extent of cuttings (potential to alter the groundwater flow regime).

7.4.2 Assessment of Potential Impacts

The scoring of potential impacts for each Route Corridor Option, based on 400m corridors, as described in Section 7.2, is presented in Tables 7.2 & 7.3. The assessment of Route Corridor Options is discussed further in this section.

7.4.2.1 Route Corridor Option A

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Crushed Rock and Sand and Gravel). Quantitatively, 18% of the Route Corridor Option lies over economic potential Crushed Rock reserves in the central portion of the Route Corridor Option. However overall, such reserves are present across large parts of the region and the availability of these resources will therefore not be significantly affected by the Route Corridor Option. In addition, 7% of the corridor of Route Corridor Option A lies over economic potential Sand and Gravel deposits. One former mine or quarry is located along the Route Corridor Option. Impact on these features is expected to be minimal. One potentially contaminated land site (an industrial site likely comprising a chicken farm) is located towards the southwest end of the Route Corridor Option and could potentially impact the Route Corridor Option.

There are no predicted impacts on Geological Heritage Sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 51% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). 2% of the Route Corridor Option, the indicative R521 link road has potential to encroach an area of high groundwater vulnerability (and rock is also recorded as being at or near surface or Karst in close proximity). This feature also lies within the Regionally Important Aquifer and the greatest potential impact is therefore at this location, although it is small in extent.

While no public water supplies are present in the Study Area, 29% of the Route Corridor Option (its western central portion) crosses the outermost aquifer protection zone of a groundwater abstraction used for bottled water (Britvic Ireland Ltd[41]). However, with the exception of a small area to the south of the study area for the potential link road to the R521 as mentioned above, the relevant part of the Route Corridor Option is situated within a different hydrogeological unit than the abstraction, which would be expected to limit hydraulic conductivity between the two hydrogeological units. In addition, groundwater vulnerability is classified as low across the relevant area of the proposed Route Option. Therefore, potential impact from this Route Option is expected to be limited.

Eleven wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

[41] Aquifer protection Zones 1 (innermost) to 3 (outermost) categorised by Britvic Ireland Ltd for their abstraction in the west of Newcastle West.

There are no predicted impacts on sand and gravel aquifers.

7.4.2.2 Route Corridor Option B

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Sand & Gravel, 13% of the Route Corridor Option; and Granular Aggregate, 9% of the corridor), mainly present in the central section of the Route Corridor Option. Overall, such reserves are more widespread elsewhere in the region and the availability of these resources will not be significantly affected.

For all other soils and geology aspects, no impacts are predicted.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 33% of the Route Corridor Option (at the eastern end) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). While 9% of the Route Corridor Option crosses an area of high groundwater vulnerability (in the Route Corridor Option's central section), the poorly productive bedrock at this location is not a significant aquifer.

While no public water supplies are present in the study area, 20% of the Route Corridor Option (its western central portion) crosses the outermost aquifer protection zone of a groundwater abstraction used for bottled water (Britvic Ireland Ltd). However, the relevant part of the Route Corridor Option is situated within a different hydrogeological unit than the abstraction, which would be expected to limit hydraulic conductivity between the two hydrogeological units. In addition, groundwater vulnerability is classified as low across the relevant area of the proposed Route Option. Therefore, potential impact from this Route Option is expected to be limited.

Only 3 wells or springs are potentially impacted by the Route Corridor Option. In any case, as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

There are no predicted impacts on sand and gravel aquifers.

7.4.2.3 Route Corridor Option C

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Sand & Gravel, 12% of the Route Corridor Option; Granular Aggregate, 10% of the corridor; Crushed Rock, 1% of the corridor), mainly present in the eastern section of the Route Corridor Option. As noted above, such reserves are more widespread elsewhere in the region and the availability of these resources will not be significantly affected. One former mine or quarry is located along the Route Corridor Option but impact on this feature is expected to be minimal.

There are no predicted impacts on potential contaminated land sites or Geological Heritage Sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 51% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). 6% of the route crosses an area of high groundwater vulnerability (towards the Route Corridor Option's northeast end and therefore within the Regionally Important Aquifer) and the greatest potential impact would be at this location.

Eleven wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

There are no predicted impacts on sand and gravel aquifers or Public and Group Supply Source Protection Areas.

7.4.2.4 Route Corridor Option D

Soils and Geology

One geological heritage site, located at the southwest end of the Route Corridor Option, could be impacted. Only 6% of the Route Corridor Option crosses areas of potential economic Sand & Gravel deposits and only 6% of the Route Corridor Option crosses potential economic Granular Aggregate deposits. Taking this into account and the widespread occurrences of such deposits across the region the Route Corridor Option will not significantly affect the availability of these resources.

There are no predicted impacts on mines and quarries or potential contaminated land sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 56% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer); however, none of the Route Corridor Option crosses areas of high groundwater vulnerability so potential impact is likely to be limited.

Only 4 wells or springs are potentially impacted by the Route Corridor Option. In any case, as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

For all other hydrogeology aspects, no impacts are predicted.

7.4.2.5 Route Corridor Option E

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Crushed Rock and Sand and Gravel). Quantitatively, 17% of the Route Corridor Option lies over economic potential Crushed Rock reserves in the central portion of the Route Corridor Option. However overall, such reserves are present across large parts of the region and the availability of these resources will therefore not be significantly affected by the Route Corridor Option. In addition, 6% of the Route Corridor Option lies over economic potential Sand and Gravel deposits. One former mine or quarry is located along the Route Corridor Option. Impact on these features is expected to be minimal. One potential contaminated land site (an industrial site likely comprising a chicken farm) is located towards the southwest end of the Route Corridor Option and could potentially impact the Route Corridor Option.

There are no predicted impacts on Geological Heritage Sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 55% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). 2% of the Route Corridor Option, the indicative R521 link road has potential to encroach an area of high groundwater vulnerability (and rock is also recorded as being at or near surface or Karst in close proximity).

This feature also lies within the Regionally Important Aquifer and the greatest potential impact is therefore at this location, although it is small in extent.

While no public water supplies are present in the study area, 28% of the Route Corridor Option (its western central portion) crosses the outermost aquifer protection zone of a groundwater abstraction used for bottled water (Britvic Ireland Ltd). However, with the exception of a small area to the south of the study area for the potential link road to the R521 as mentioned above, the relevant part of the Route Corridor Option is situated within a different hydrogeological unit than the abstraction, which is expected to limit hydraulic conductivity between the two hydrogeological units. In addition, groundwater vulnerability is classified as low across the relevant area of the proposed Route Option. Therefore, potential impact from this Route Option is expected to be limited.

Ten wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

There are no predicted impacts on sand and gravel aquifers or Public and Group Supply Source Protection Areas.

7.4.2.6 Route Corridor Option F

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Crushed Rock and Sand and Gravel). Quantitatively, 19% of the Route Corridor Option lies over economic potential Crushed Rock reserves in the central portion of the Route Corridor Option. As noted above, such reserves are present across large parts of the region and the availability of these resources will therefore not be significantly affected by the Route Corridor Option. In addition, 7% of the Route Corridor Option lies over economic potential Sand and Gravel deposits. One former mine or quarry is located along the Route Corridor Option. Impact on these features is expected to be minimal.

There are no predicted impacts on potential contaminated land sites or Geological Heritage Sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 54% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). 2% of the Route Corridor Option, the indicative R521 link road has potential to encroach an area of high groundwater vulnerability (and rock is also recorded as being at or near surface or Karst in close proximity).

This feature also lies within the Regionally Important Aquifer and the greatest potential impact is therefore at this location, although it is small in extent.

While no public water supplies are present in the study area, 23% of the Route Corridor Option (its western central portion) crosses the outermost aquifer protection zone of a groundwater abstraction used for bottled water (Britvic Ireland Ltd). However, with the exception of a small area to the south of the study area for the indicative link road to the R521 as mentioned above, the relevant part of the Route Corridor Option is situated within a different hydrogeological unit than the abstraction, which is expected to limit hydraulic conductivity between the two hydrogeological units. In addition, groundwater vulnerability is classified as low across the relevant area of the proposed Route Option. Therefore, potential impact from this Route Option is expected to be limited.

Eight wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

There are no predicted impacts on sand and gravel aquifers or Public and Group Supply Source Protection Areas.

7.4.2.7 Route Corridor Option G

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Crushed Rock and Sand and Gravel). Quantitatively, 18% of the Route Corridor Option lies over economic potential Crushed Rock reserves in the central portion of the Route Corridor Option. As noted above, such reserves are present across large parts of the region and the availability of these resources will therefore not be significantly affected by the Route Corridor Option. In addition, 6% of the Route Corridor Option lies over economic potential Sand and Gravel deposits. One former mine or quarry is located along the route. Impact on these features is expected to be minimal.

There are no predicted impacts on potential contaminated land sites or Geological Heritage Sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 60% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). 2% of the Route Corridor Option, the indicative R521 link road has potential to encroach an area of high groundwater vulnerability (and rock is also recorded as being at or near surface or Karst in close proximity).

This feature also lies within the Regionally Important Aquifer and the greatest potential impact is therefore at this location, although it is small in extent.

While no public water supplies are present in the study area, 22% of the Route Corridor Option (its western central portion) crosses the outermost aquifer protection zone of a groundwater abstraction used for bottled water (Britvic Ireland Ltd). However, with the exception of a small area to the south of the study area for the indicative link road to the R521 as mentioned above, the relevant part of the Route Corridor Option is situated within a different hydrogeological unit than the abstraction, which is expected to limit hydraulic conductivity between the two hydrogeological units. In addition, groundwater vulnerability is classified as low across the relevant area of the proposed Route Option. Therefore, potential impact from this Route Option is expected to be limited.

Seven wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

There are no predicted impacts on sand and gravel aquifers or Public and Group Supply Source Protection Areas.

7.4.2.8 Route Corridor Option H

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits, although only 4% of the Route Corridor Option goes through areas of Sand & Gravel and Granular Aggregate. Noting again that such reserves are more widespread elsewhere in the region, the availability of these resources will not be significantly affected. One former mine or quarry is located along the Route Corridor Option but impact on this feature is expected to be minimal.

There are no predicted impacts on potential contaminated land sites or Geological Heritage Sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 42% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer); however, it is noted that none of the Route Corridor Option crosses areas of high groundwater vulnerability and impact is therefore expected to be limited.

Seven wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

There are no predicted impacts on sand and gravel aquifers or Public and Group Supply Source Protection Areas.

7.4.2.9 Route Corridor Option I

Soils and Geology

The greatest potential impacts on soils and geology relate to the potential loss of economic deposits (Sand & Gravel, 15% of the Route Corridor Option; Granular Aggregate, 13% of the Route Corridor Option; Crushed Rock, 2% of the Route Corridor Option). Noting again that such reserves are more widespread elsewhere in the region, the availability of these resources will not be significantly affected. One geological heritage site, located at the southwest end of the Route Corridor Option, could be impacted.

There are no predicted impacts on mines and quarries or potential contaminated land sites.

Hydrogeology

The greatest potential impacts on hydrogeology relate to potential interaction with areas of vulnerable aquifer, associated risk of pollution, and disruption of the groundwater resource. Quantitatively, 64% of the Route Corridor Option (its eastern portion) crosses an area of Regionally Important Aquifer (diffuse karstic aquifer). 7% of the Route Corridor Option crosses an area of high groundwater vulnerability (towards the Route Corridor Option's northeast end and within the Regionally Important Aquifer) and the greatest potential impact would be at this location.

Eight wells or springs are potentially impacted by the Route Corridor Option, although as noted above, wells are very common across Ireland and any large road scheme will inevitably encounter them.

For all other hydrogeology aspects, only Neutral impacts are predicted.

Table 7.2: Route Corridor Option Impact Scoring –Soils and Geology[42]

Route Corridor Option	PAG Unit 7.0 Impact Level								
	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Geology & Soils									
No. Mines and Quarries within the 400m corridor	3	4	3	4	3	3	3	3	4
Economic Deposits - % of 400m corridor through Sand & Gravel deposits, Potential Granular Aggregate deposits (High or Very High potential), Potential Crushed Rock deposits (High or Very High potential)	3	3	3	3	3	2	3	3	2
No. Landfill sites or industrial sites within 400m corridor	3	4	4	4	3	4	4	4	4
% of 400m corridor through Geological Heritage Sites	4	4	4	3	4	4	4	4	3
PAG Unit 7.0 Impact Level / Significance of Effect	**3**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
PAG Unit 7.0 Score based on Highest Potential Impact	**Minor negative**	**Neutral**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**

[42] The Stage 1 assessment allocated an impact of '3 – minor negative' to Option B; the neutral impact above is due to rounding of numbers within the economic deposit sub-categories.

Table 7.3: Route Corridor Option Impact Scoring - Hydrogeology

Route Corridor Option	PAG Unit 7.0 Impact Level								
	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Hydrogeology									
% of 400m corridor within Vulnerable and Regionally Important Aquifer (Karstified bedrock, Fissured bedrock or Extensive sand & gravel)	1	1	1	1	1	1	1	1	1
% of 400m corridor within Sand & Gravel Aquifer	4	4	4	4	4	4	4	4	4
% of 400m corridor within high Groundwater Vulnerability (Extreme, High, Rock near surface or Karst)	3	2	2	4	3	3	3	4	2
Number of wells, springs, pump sites within 400m corridor	1	3	1	3	1	2	2	2	2
% of 400m corridor within Public & Group Supply Source Protection Area (Inner)	4	4	4	4	4	4	4	4	4
% of 400m corridor within Public & Group Supply Source Protection Area (Outer)	3	3	4	4	3	3	3	4	4
PAG Unit 7.0 Impact Level / Significance of Effect	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
PAG Unit 7.0 Score based on Highest Potential Impact	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**	**Minor negative**

7.4.3 Assessment of Effects of Route Corridor Options

7.4.3.1 Route Corridor Option A

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option A are limited to low level impacts on potential economic deposits, mines, quarries, and a low-level impact as a result of one industrial site (potential contamination source) in the 400m corridor. Impact on Geological Heritage Sites will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option A is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option A is underlain by a regionally important aquifer; however, groundwater vulnerability in the area is generally not high. There would be a potential low-level impact on a groundwater abstraction used for bottled water (Britvic Ireland Ltd). There is a greater impact on wells / springs compared to other Route Corridor Options. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option A is anticipated to be Minor Negative.

7.4.3.2 Route Corridor Option B

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option B are limited to low level impacts on potential economic deposits. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option B is anticipated to be Neutral.

Hydrogeology

A significant portion of Route Corridor Option B is underlain by a regionally important aquifer; however, groundwater vulnerability in the area is generally not high. While groundwater vulnerability is high in a portion of the route, impact is low given that no significant aquifer is present at that location. There would be a potential low-level impact on a groundwater abstraction used for bottled water (Britvic Ireland Ltd). There is a lower impact on wells / springs compared to other Route Corridor Options. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option B is anticipated to be Minor Negative.

7.4.3.3 Route Corridor Option C

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option C are limited to low level impacts on potential economic deposits, mines, and quarries. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option C is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option C is underlain by a regionally important aquifer and a small part of this is also within an area of high groundwater vulnerability resulting in a moderate impact. There is a greater impact on wells / springs compared to other Route Corridor Options. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option C is anticipated to be Minor Negative.

7.4.3.4 Route Corridor Option D

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option D are limited to low level impacts on potential economic deposits, and a low-level impact due to a single Geological Heritage site. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option D is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option D is underlain by a regionally important aquifer; however, no areas of high groundwater vulnerability are present. There is a lower impact on wells / springs compared to other Route Corridor Options. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option D is anticipated to be Minor Negative.

7.4.3.5 Route Corridor Option E

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option E are limited to low level impacts on potential economic deposits, mines, quarries, and a low-level impact as a result of one industrial site (potential contamination source) in the 400m corridor. Impact on Geological Heritage Sites will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option E is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option E is underlain by a regionally important aquifer; however, groundwater vulnerability in the area is generally not high. There would be a potential low-level impact on a groundwater abstraction used for bottled water (Britvic Ireland Ltd). There is a greater impact on wells / springs compared to other Route Corridor Options. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option E is anticipated to be Minor Negative.

7.4.3.6 Route Corridor Option F

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option F are limited to moderate impacts on potential economic deposits, low-level impacts on mines, and quarries. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option F is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option F is underlain by a regionally important aquifer; however, groundwater vulnerability in the area is generally not high. There would be a potential low-level impact on a groundwater abstraction used for bottled water (Britvic Ireland Ltd). There would be a moderate impact on wells / springs. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option F is anticipated to be Minor Negative.

7.4.3.7 Route Corridor Option G

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option G are limited to low level impacts on potential economic deposits, mines, and quarries. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option G is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option G is underlain by a regionally important aquifer; however, groundwater vulnerability in the area is generally not high. There would be a potential low-level impact on a groundwater abstraction used for bottled water (Britvic Ireland Ltd). There would be a moderate impact on wells / springs. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option G is anticipated to be Minor Negative.

7.4.3.8 Route Corridor Option H

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option H are limited to low level impacts on potential economic deposits, mines, and quarries. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Option H is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option H is underlain by a regionally important aquifer; however, no areas of high groundwater vulnerability are present. There would be a moderate impact on wells / springs. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Option H is anticipated to be Minor Negative.

7.4.3.9 Route Corridor Option I

Soils and Geology

The impacts on Soils and Geology as a result of Route Corridor Option I are limited to moderate impacts on potential economic deposits, and a low-level impact due to a single Geological Heritage site. Impact on all other receptors will be neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option I is anticipated to be Minor Negative.

Hydrogeology

A significant portion of Route Corridor Option I is underlain by a regionally important aquifer and a small part of this is also within an area of high groundwater vulnerability resulting in a moderate impact. There would be a moderate impact on wells / springs. Impacts on all other receptors will be Neutral. With impacts averaged across all receptors, the overall impact associated with Route Corridor Option I is anticipated to be Minor Negative.

Table 7.4: Significance of Effects of Route Corridor Options – Soils & Geology

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Minor Negative	3
Option B	Neutral	4
Option C	Minor Negative	3
Option D	Minor Negative	3
Option E	Minor Negative	3
Option F	Minor Negative	3
Option G	Minor Negative	3
Option H	Minor Negative	3
Option I	Minor Negative	3

Table 7.5: Significance of Effects of Route Corridor Options – Hydrogeology

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Minor Negative	3
Option B	Minor Negative	3
Option C	Minor Negative	3
Option D	Minor Negative	3
Option E	Minor Negative	3
Option F	Minor Negative	3
Option G	Minor Negative	3
Option H	Minor Negative	3
Option I	Minor Negative	3

7.5 Conclusion

The soils, geology, and hydrogeology effects of the nine proposed Route Corridor Options have been assessed in accordance with the Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes produced by TII.

The scoring within the options assessment does not differentiate between the majority of Route Corridor Options at a significant level for the Project. However, there are some minor differentiations allowing some Route Corridor Options to be identified as having slightly greater impacts compared to others.

Route Corridor Option B performs slightly better than other Route Corridor Options from a Soils and Geology point of view due to the absence of pits / quarries, and lower impact in relation to contaminated land sites. Route

Corridor Option I has the highest level of impact in relation to Soils and Geology due to a higher level of impact on Economic Deposits and a potential impact on a Geological Heritage Site.

From a Hydrogeology point of view, Route Corridor Option C is considered to have a slightly higher impact due to its potential impact on hydrogeology factors, specifically groundwater vulnerability and the slightly higher number of wells / springs potentially impacted by this Route Corridor Option. Route Corridor Option D has the lowest level of impact of all Route Corridor Options from a hydrogeology perspective.

It should be noted that the differences between Route Corridor Options are relatively small and may not be considered significant compared to other factors.

8. Hydrology

8.1 Introduction

This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options. These corridors are made up of four 400m wide key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

This section (prepared by Jacobs) discusses the impact of each of the proposed Route Corridor Options on the hydrology in the project Study Area. Road schemes have the potential to significantly affect surface water bodies such as rivers, lakes/ponds, estuaries, and reservoirs.

This hydrology assessment considers the impacts on the following:

- Surface Water Quality; and
- Flood Risk.

Please note that groundwater is assessed as hydrogeology in Chapter 7 above.

Surface Water Quality

Increased sediment in surface water run-off during construction as a result of direct works within or close to water bodies such as culverting, diversions or bridge construction as well as cement run-off or hydrocarbon / oil spillages can negatively impact water quality. Operational impacts to surface water bodies include surface water run-off with routine road contaminants such as suspended solids, heavy metals and hydrocarbons; increased surface wate runoff may result in changes to hydrological flows and geomorphological features; new crossing structures may also impact upon geomorphological features.

Flood Risk

The associated floodplain of each watercourse was also considered in the assessment as:

- There is the potential for flood risk to be increased if an existing watercourse and/or floodplain flows are impeded by the new road construction;
- Flooding of the new road from watercourses overtopping their banks could create hazardous conditions and prevent its use; and
- Increased flooding can in turn cause a greater impact in terms of water quality in the event of an unexpected hydrocarbon or oil spillage.

8.2 Methodology

The hydrology assessment considers the TII Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes as recommended in the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis.

The Guidelines refer to a list of requirements to be assessed for each Route Corridor Option in the Phase 2 assessments and details a list of information to be included in the assessment where available. The information available and relevant to the Project and therefore included in the assessment is detailed in Table 8.1 below.

Table 8.1: TII Assessment and Data Requirements

TII Requirement	Included Yes/No	Reasons for Including / Not Including	Data included
Watercourses crossed and impacted by surface water run-off	Yes	Information readily available.	• Aerial photography and mapping of Study Area (GSI, OSI and online sources); • Environmental Protection Agency, (www.epa.ie) – WFD waterbody status (2013-2018).
Aquatic ecological sites close to and downstream of water crossings	Yes	Consultation between hydrologist and ecologist for the project. The ecology chapter addresses such ecological sites and no water dependent habitats with direct hydrological connection to Route Corridor Options were identified.	None
Surface water abstractions close to and downstream of water crossings	No	Information not publicly available. Therefore, none identified and so these features do not contribute to the Stage 2 options assessment. However, there is potential for such features to be present within the Study Area and may be investigated in subsequent stages of assessment.	None
Established amenity value of surface waters traversed by each Route Corridor Option	No	Information is available from online sources to assist in determining amenity value of watercourses for fishing, water sports, walking and cycling trails, but it cannot be determined for all surface waters impacted by Route Corridor Options. Therefore, to ensure consistency, amenity value has been excluded.	None

TII Requirement	Included Yes/No	Reasons for Including / Not Including	Data included
Potential increase (or reduction) in flood risk to existing properties	Yes	Information readily available.	• Aerial photography and mapping (GSI, OSI and online sources); • Office of Public Works Historical Flood Reports (www.floodmaps.ie); • CFRAM Data (www.floodmaps.ie) and Flood Risk Types (Preliminary Flood Risk Assessment Data) Mapping, (http://www.cfram.ie/pfra/interactive-mapping); • OPW Flood information (https://www.floodinfo.ie). including outputs from the CFRAM Studies. • OPW Preliminary Flood Risk Assessment (PFRA), fluvial flood extents[43].

8.2.1 Assessment Criteria

The comparative evaluation of Route Corridor Options was assisted by scoring the effects to receptors using the Stage 2 project appraisal matrix, put forward in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis[44] against Surface Water Quality and Flood Risk.

In order to determine the overall significance of effect, it was noted that mitigation measures will be built into the design of the Project to reduce or remove impacts that may reduce the quality of the water body and increase flood risk to and/or from the Project, although there will still be a residual risk/impact for both aspects. The design of the Project will include future proofing for flood risk in terms of climate change which should reduce the residual risk to very low. Whereas with water quality, while the road drainage can be designed to deal with road run-off and common pollutants, some issues cannot be mitigated for in design, for example spillage of miscible substances such as milk or farm slurry. As a result, the residual risk to water quality from the Project is higher than that for flood risk.

8.2.1.1 Surface Water Quality

A desktop study of all surface water bodies crossed by a proposed Route Corridor Option identified the number of receptors potentially impacted. A qualitative assessment was then carried out to determine the sensitivity of each receptor and likely magnitude of impacts from each proposed Route Corridor Option;

- Sensitivity of the receptor to changes in water quality impacts to high sensitivity water bodies can have greater overall significance of effect than impacts to lower sensitivity water bodies;
- Determination of Magnitude includes:

[43] The CFRAM study data is a more detailed flood risk assessment than the PFRA however it covers a smaller area. The preference is to use CFRAM data over PFRA data when available, however where available CFRAM data is unavailable PFRA data is used...

[44] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

- Magnitude of impact (1): the number of watercourse crossings on any particular Route Corridor Option - the increased risk of a pollution incident occurring as a result of a higher number of crossings. The more crossings there are present on any Route Corridor Option, the increased risk of a pollution incident;
- Magnitude of impact (2): the cumulative impact of a number of crossings on the same water body on any particular Route Corridor Option the more crossings of a single water body. The greater the risk of cumulative impacts leading to a significant impact on the status of the water body; and
- Magnitude of impact (3): Design Embedded Mitigation.

The sensitivity of each receptor was determined based on a combination of things such as WFD water quality status and the hydrological connection to protected areas which are more sensitive to change. The presence of water dependent habitats will also be considered. The criteria to determine the sensitivity of a waterbody to changes in water quality is detailed in Table 8.2.

Table 8.2: Criteria to determine the Sensitivity of a water body to changes in Surface Water Quality

Sensitivity	Criteria
High	A water body which has: • High or Good WFD Status (Unassigned water bodies are presumed Good); and/or • Hydrological connectivity to an Internationally Designated Site (SAC).
Medium	A water body which has: • Moderate / Poor / Bad WFD Status; and • Hydrological connectivity to Annex I Water Dependant Habitats present (in non-Designated site(s)). • Hydrological connectivity to a nationally or locally protected area (NHA, pNHA) or a Drinking Water Protected Area or Nutrient Sensitive Area)
Low	A water body which has: • Bad WFD Status; • No Annex I Water Dependent Habitats present; and • No Protected Areas.

For the purposes of this assessment, hydrological connectivity is determined to be within 2km of a water body crossed by a proposed Route Corridor Option (in line with the English Environment Agency's guidance on Water Framework Directive assessment: estuarine and coastal waters and the English Planning Inspectorate Advice Note 18 on WFD Assessment. This guidance was used in the absence of Irish guidance on WFD assessment and the use of hydrological connectivity in the determination of sensitivities of receptors.) It is determined that any runoff or accidental spills or links will have sufficiently dispersed and diluted after 2km and there should be no impacts to water bodies or protected areas this distance from the Project.

The magnitude of the surface water quality impact on each receptor was considered to determine the overall impact. The criteria for determining magnitude are detailed below in Table 8.3.

Table 8.3: Criteria for determining magnitude of impacts

Magnitude of Impact	Criteria
High Negative	Results in loss of receptor and/or significant decrease in water quality of receptor
Medium Negative	Results in a moderate impact on water quality of receptor or loss of part of receptor
Low Negative	Results in minor impact on quality of receptor or loss of small part of receptor

Magnitude of Impact	Criteria
Negligible	Results in an impact on receptor but of insufficient magnitude to affect either use or integrity
Low Positive	Results in minor improvement of receptor quality
Medium Positive	Results in moderate improvement of receptor quality
High Positive	Results in major improvement of receptor quality

The significance of the overall effect of each Route Corridor Option was then determined based on professional judgement of the in combination impacts on each receptor along that Route Corridor Option. The significance of effect is determined by considering sensitivity of the receptor and magnitude of impacts. Therefore, the higher the sensitivity of a watercourse the more significant the impact could be depending on the magnitude.

The effect of each Route Corridor Option on surface water quality is scored based on the seven-point scale as shown in Table 8.4 and a number will be assigned according to the level of significance of the effects.

Table 8.4: Surface Water Key for Scoring Effects

Score	Significance Level	Description of Impact
7	Major Positive	Measures that might result in an overall improvement in surface water quality status of a WFD waterbody, also positively enhancing a water dependent habitat. Given the current stage of the design, there are no known positive impacts arising from any of the Route Corridor Options.
6	Moderate Positive	
5	Minor Positive	
4	Neutral	No change to surface water quality and therefore no risk to water dependent habitats.
3	Minor Negative	Potential for minor changes to surface water quality and therefore some potential to impact water dependant habitats. Potentially minor change to hydrological flows and hydromorphological conditions.
2	Moderate Negative	Potential for moderate risk to surface water quality and therefore some risk to water dependent habitats. Potentially moderate change to hydrological flows and hydromorphological conditions.
1	Major Negative	Major risk to water quality therefore high risk to water dependent habitats. Potentially major change to hydrological flows and hydromorphological conditions.

8.2.1.2 Flood Risk

It is not possible to assign sensitivity of water bodies for Flood Risk in the same way as can be done for other surface water attributes, such as water quality and geomorphology. Therefore, sensitivity of water bodies to Flood Risk has not been considered in determining the overall effect of each Route Corridor Option.

Instead, the effect of each Route Corridor Option was determined based on professional judgement of the overall Flood Risk along each Route Corridor Option.

A desktop analysis of all flood risk zones crossed by a proposed Route Corridor Option assessed:

- quantitative (no. crossings or 100m sections of flood plain crossed); and
- qualitative assessment (potential severity and magnitude of the predicted flood risk impact).

The two main sources of Flood Risk mapping available for the Study Area are the outputs from the OPW:

- Catchment and Flood Risk Assessment and Management (CFRAM) Studies; and
- Preliminary Flood Risk Assessment (PFRA) Studies.

The CFRAM study data is a more detailed flood risk assessment than the PFRA, therefore, the CFRAM data is used in preference to the PFRA data when available. However, the CFRAM study data covers a smaller area, therefore where the CFRAM data is not available, the PFRA data is used.

As a result, the assessment has considered the level of confidence that can be assigned to the available data to determine the overall Flood Risk. A higher degree of confidence can be placed on sections of Route Corridor Options which can be assessed using the CFRAM datasets.

The criteria to determine the potential flood risk impacts is detailed in Table 8.5.

Table 8.5: Criteria for determining magnitude of impacts on Flood Risk

Magnitude of Impact	Criteria
Major Negative	Increased risk of flooding affecting highly vulnerable development and/or Flood Zone A / B lands based on OPW Catchment Flood Risk Assessment and Mapping (CFRAM programme mapping or OPW Preliminary Flood Risk Assessment (PFRA mapping).
Moderate Negative	Increased risk of flooding affecting low vulnerability development and/or Flood Zone A / B lands based on OPW Catchment Flood Risk Assessment and Mapping (CFRAM programme mapping or OPW Preliminary Flood Risk Assessment (PFRA mapping).
Low Negative	Minor increase (<25mm) in channel water levels but no impact on floodplain flood depths or extents
Neutral	No impact on flooding or existing channel flow processes
Low Positive	Results in minor, moderate or significant decrease in flood risk to surrounding lands. Given the current stage of the design, there are no known positive impacts arising from any of the Route Corridor Options.
Medium Positive	
High Positive	

The overall impact of each Route Corridor Option is scored based on the seven-point scale as shown in Table 8.6 and a number assigned according to the level of significance of the impacts.

Table 8.6: Flood Risk Key for Scoring Effects

Score	Significance of Effect	Scoring Criteria
7	Major Positive	Measures that might result in a positive impact on flood risk include upsizing of existing culverts to reduce flood risk. Given the current stage of the design, there are no known positive impacts arising from any of the Route Corridor Options.
6	Moderate Positive	
5	Minor Positive	
4	Not Significant or Neutral	No change to the existing flooding regime
3	Minor Negative	Potential for minor change in in-channel water levels but no impact on floodplain depths or extents.

Score	Significance of Effect	Scoring Criteria
2	Moderate Negative	Increased risk of flooding to potential Flood Zone A or B lands as identified by the PFRA mapping.
1	Major Negative	Increased risk of flooding to Flood Zone A or B lands as identified by the by the PFRA or CFRAM mapping

8.2.2 Determining Overall Significance of Effects on Hydrology Route Corridor Option

Where the score for water quality and flood risk are the same, the overall significance of effect will be the same. However, where they differ, a professional judgement is made to determine the overall score based on a qualitative analysis of the data.

A number of aspects will be considered as part of the professional judgement. The assessment considers a quantitative analysis of the number of crossings and interactions with the water environment, however using professional judgement, qualitative judgements will also be considered. This will include mitigation and likely residual risk. For both Water Quality and Flood Risk, mitigation measures will be built into the design of the Project, however, residual risks remain for both aspects. For example, the Water Quality assessment considers that some issues for water quality cannot be mitigated for the design, i.e., spillage of miscible substances such as milk or slurry. In addition, the Flood Risk Assessment considers that, despite the fact that the design of the Project will allow for the effects of future climate change, design mitigation is more complex for broad expanses of floodplain. In accordance with Flood Risk Assessment Guidelines, an overarching objective for the project should also be to seek to minimise its impact on natural floodplain processes and divert development to the lands at the lowest of flooding.

8.3 Existing Environment

8.3.1 Surface Water Catchments

The Project lies within three WFD sub-catchments: Deel [Newcastle West] _SC_020 [45]; Deel [Newcastle West_SC_030; and Deel [Newcastle West] _SC_040. There are two large rivers within these sub-catchments namely the: River Arra (Arra_010) and River Deel (Deel (Newcastle West) _090 and Deel (Newcastle West) _100).

The overarching topography means that watercourses typically flow west to east through the town of Newcastle West. Tributaries of the River Arra commence from Knocanimpaha Mountain and flow in an easterly direction to meet the west of Newcastle West and flow through the town as the River Arra. To the south east of Newcastle West, the River Arra meets the River Deel. The River Deel flows in a predominantly northerly direction before eventually discharging into the Shannon Estuary.

The proposed Route Corridor Options are mostly through undeveloped greenfield land. All of the proposed Route Corridor Options cross numerous watercourses of varying size and form, from small ditches to larger rivers. The River Arra flows through a broad floodplain to west of Newcastle West and there are also extensive floodplains at the confluence of the Rivers Arra and Deel. There is a history of flooding at the confluence of the Arra and Deel, with the floodplain up to 400m wide. Watercourses to the north of Newcastle West are typically steeper with narrower floodplains.

To ensure consistency with official mapping, some watercourses in this section are referred to by the WFD waterbody codes (names) assigned to them by the Environmental Protection Agency (EPA). The watercourses will be known locally by other names, however, by using the EPA codes the references in this section will be consistent with EPA mapping and text.

The constraints in the river network and flood risk areas have been mapped, and are presented in Volume 2 Figure 8.2.

[45] These technical names are the names assigned by the EPA and OPW. They have been used in this report instead of local names for technical consistency

8.3.2 Surface Water Body Status

The WFD water body status of water bodies crossed, and whether they are 'At Risk' or 'Not At Risk' of achieving or maintain Good Ecological Status (GES) by 2027 has been identified in Table 8.7. The sensitivity of each receptor (WFD Water Body) has been defined based on the WFD status and hydrological connection to protected areas. Volume 2, Figure 8.1 illustrates which Route Corridor Options intersect each WFD water body.

Table 8.7: WFD Status and Sensitivity Rating of Watercourses crossed by a Route Corridor Option

Catchment	Sub catchments	WFD Waterbody Name	WFD Status	At Risk Status	Protected Areas	Water Dependent Habitats	Sensitivity
24 Shannon Estuary South	24_14 Deel [Newcastle West] _SC_020	Arra_010	Poor	At Risk	Drink Water Protection Area	No	Moderate
	24_14 Deel[Newcastle west]_SC_020 24_4 Deel[Newcastle west]_SC_030	Deel (Newcastle West) _090	Moderate	At Risk	Drink Water Protection Area	No	Moderate
	24_1 Deel[Newcastle west]_SC_040 24_4 Deel[Newcastle west]_SC_030	Deel (Newcastle West) _100	Moderate	At Risk	Drink Water Protection Area	No	Moderate

None of the water bodies are determined to be high sensitivity, as WFD status ranges from Poor to Moderate. With no internationally sensitive protected areas hydrologically connected to the water bodies, they are of Moderate sensitivity.

8.4 Assessment of Route Corridor Options

8.4.1 Assessment Assumptions and Limitations

There are a number of regulations which ensure that impacts in relation to water quality and flood risk are mitigated through design. Therefore, design embedded mitigation has been assumed compliance with these regulations and guidelines in the assessment of impacts throughout this chapter.

In relation to water quality, it is assumed that the Preferred Route will be designed with reference to the following guidelines:

- TII Publications (Standards), 2015. Drainage Systems for National Roads, DN-DNG-03022;
- TII Publications (Standards), 2015. Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015), DN-DNG-03065;
- TII Publications (Standards), 2015. Vegetated Drainage System for Road Runoff, DN-DNG-03063;
- TII Publications (Standards), 2015. Design of Soakaways, DN-DNG-03072;

- TII Publications (Standards), 2015. Grassed Surface Water Channels for Road Runoff, DN-DNG-03073;
- CIRIA C648 Control of Water Pollution from Linear Construction Projects: Technical Guide (Murnane et al. 2006);
- CIRIA C649 Control of Water Pollution from Linear Construction Projects: Site Guide (Murnane et al. 2006);
- 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001); and
- Inland Fisheries Board document 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters'.

In relation to flood risk, it is assumed the Preferred Route will be designed to comply with the following:

- Section 50: Arterial Drainage Act (1945) and EU Assessment and Management Flood Risk Regulations (2010) for the construction of any new or modification to existing culverts;
- Section 9: Arterial Drainage Amendment Act (1995) for the modification to or alteration of any watercourse to ensure no increase in flood risk or negative impact on the drainage of land; and
- Planning System and Flood Risk Management Guidelines (2009) and specifically the Justification Test.

There are also limitations to this assessment which must be noted in the outset:

- For the purposes of this Stage 2 comparative assessment, ecological sites have only been identified by the ecologists from a high-level desktop study. Therefore, it can be anticipated that there may be other water dependent habitats in the Study Area that may not have been identified at this point.
- The accuracy of the available Flood Risk Mapping information has not been assessed at the is stage. Whilst it is judged to be sufficiently accurate to allow a relative comparison of the flood risk impacts between various Route Corridor Options, a detailed Flood Risk Assessment will be required at later Phases of the project to confirm the flood risk impacts of the Project in the subsequent Phase 3 (Design and Environmental Evaluation). Where no flood mapping is available for a watercourse, it is assumed to have no limited natural floodplain with flows constrained to the watercourse channel.

8.4.2 Assessment of Potential Impacts

Tables 8.8 and 8.9 summarise the quantitative assessment conducted, detailing the number of crossings within each proposed Route Corridor Option and the sensitivity of waterbodies in terms of water quality and flood risk. The number of crossings has been used to guide the assessment primarily, and a qualitative assessment has also been conducted. As part of this, rivers running parallel in close proximity to a proposed Route Corridor Option are also considered.

8.4.2.1 Surface Water Quality

The number of WFD water body crossings for each of the Route Corridor Options ranges from 4 to 11. The crossings are listed in Table 8.8 below. In terms of magnitude of impacts, as is set out in the Section 8.2.1.1, the options assessment concluded:

- Sensitivity of the water bodies.
    - All water bodies crossed are Moderate or Poor status water bodies and are at risk of failing to meet Good status, with no hydrological connectivity to internationally designated sites. Therefore, these water bodies are not particularly sensitive to change in baseline conditions. All water bodies crossed by the Route Corridor Options are Drinking Water Protected Areas, so they have Moderate sensitivity to change.
- Number of watercourse crossings on any particular Route Corridor Option.
    - The number of crossings ranges from 4 to 11, therefore some Route Corridor Options have the greater potential to result in a pollution incident due to the higher number of crossings, for example Route Corridor Option A, B, E, F and G. Whereas Options C, D, H and I would have less

chance for a pollution incident. Despite this, 11 crossings is not considered to result in a high likelihood of a pollution incident.

- Cumulative impact of a number of crossings on the same water body on any particular Route Corridor Option.
    - Due to the nature of the water body, the Arra_010 is crossed numerous times by all Route Corridor Options to the north of Newcastle West, Route Corridor Option A, B, E, F and G. There is a slightly greater potential for cumulative impacts on this waterbody compared to the River Deel as a result of these Route Corridor Options. However, this is not considered to be significant.
- Design Embedded Mitigation.
    - Considering the mitigation and best practice construction methods which will be in place (as outlined in Section 8.4.1), it is assumed that all impacts to these watercourses will be of low magnitude.

8.4.2.2 Flood Risk

All Route Corridor Options cross the floodplains of the Rivers Arra and the Deel. All these crossings have the potential to have a negative impact on flood risk to varying degrees without suitable mitigation from impeding channel and floodplain flowpaths.

The Route Corridor Options located to the north of Newcastle West cross the smaller, steeper watercourses, which are tributaries of the Arra and Deel. The flood risk potential from these watercourses would be expected to be less than from either the Arra or Deel, as they have smaller floodplains. They are also steeper, meaning the backwater effects from any works would be less extensive.

There is the potential for the works to be located at a high risk of flooding resulting in unsafe conditions if rivers overtop their banks. The introduction of new impermeable surfaces could also increase flood risk due to increased run-off rates. For this analysis it is however assumed that Sustainable Drainage Solutions will be implemented as part of the design to maintain run-off rates from new works to existing greenfield rates.

The options assessment considered the number and nature of floodplain and the potential impact on flood risk. There is a range in the number and nature of crossings of flood risk areas made by each route. The land to south of Newcastle West, is flatter and contains broad floodplains, associated with Rivers Arra and the Deel. There is a therefore greater risk of adverse flood impacts from the Route Corridor Options located to the south of Newcastle West (Route Corridor Options C. D, H and I), as it will be more difficult to provide mitigation within the design. This area is also more developed meaning there is a greater potential for an adverse impact on sensitive receptors including properties and other infrastructure.

The Route Corridor Options located to the north of Newcastle West (Route Corridor Options A, B, E, F and G) are likely to cross more watercourses than the southern Route Corridor Options. The watercourses crossed by the northern Route Corridor Options are however steeper and narrower in nature and therefore likely to be impacted less by the proposed works. It will also be easier to provide mitigation for any adverse flood risk impacts where the floodplain is narrow. There are also fewer sensitive receptors potentially impacted by the works.

For the purposes of this analysis, it is assumed that flood risk impacts will be mitigated in the design to ensure compliance with Section 50 of Arterial Drainage Act, Section 9: Arterial Drainage Amendment Act and Planning System and Flood Risk Management Guidelines (FRM Guidelines) to maintain run-off rates from new works to existing greenfield rates, which will mitigate the potential increase in run-off rates. Even with this assumption, it is determined that there is a much greater flood risk associated with Route Corridor Options to south of Newcastle West compared the Route Corridor Options to the north. The land to south is much flatter compared to the land to the north which will have better natural drainage in the area.

Table 8.8: Surface Water Quality Assessment of Watercourses Crossings by proposed Route Corridor Option

Watercourse Crossings	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
High Sensitivity	0	0	0	0	0	0	0	0	0
Waterbody Names	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Medium Sensitivity	3	2	3	2	3	3	3	2	3
Waterbody Names	Deel (Newcastle West) _090 (3)	Deel (Newcastle West) _090 (1) Deel (Newcastle West) _100 (1)	Deel (Newcastle West) _090 (3)	Deel (Newcastle West) _090 (2)	Deel (Newcastle West) _090 (2) Deel (Newcastle West) _100 (1)	Deel (Newcastle West) _090 (2) Deel (Newcastle West) _100 (1)	Deel (Newcastle West) _090 (2) Deel (Newcastle West) _100 (1)	Deel (Newcastle West) _090 (2)	Deel (Newcastle West) _090 (3)
Low Sensitivity	8	8	5	2	8	7	7	5	2
Waterbody Names	Arra_010 (8)	Arra_010 (8)	Arra_010 (5)	Arra_010 (2)	Arra_010 (8)	Arra_010 (7)	Arra_010 (7)	Arra_010 (5)	Arra_010 (2)
Total Number of Crossings	11	10	8	4	11	10	10	7	5
PAG Unit 7.0 Significance of Effect	2	2	3	3	2	2	2	3	3

Table 8.9: Flood Risk Assessment of Watercourses Crossings Route Corridor Option

Flood Risk Zones Crossed	Number of Crossings of 100m sections of Flood Risk Locations Per Route Corridor Option								
	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
1 – Potential increased flooding in Flood Zone A and B identified by CFRAM or PFRA mapping (Major negative Significance)	1	0	8	17	1	1	1	11	18
2 – Potential increased flooding in Potential Flood Zone A and B identified by PFRA mapping (Moderate negative Significance)	2	2	3	1	2	2	5	2	2
3 – Potential change in in-channel water levels but no impact on floodplain depths or extents (Minor negative Significance)	9	10	13	4	10	9	9	7	4
Total No. of Major or Moderate Flood Risk Interfaces	3	2	11	18	3	3	6	13	20
PAG Unit 7.0 Significance of Effect	2	2	1	1	2	2	2	1	1

8.4.3 Assessment of Effects of Route Corridor Options

8.4.3.1 Surface Water Quality

The highest number of crossings of WFD water bodies associated with any Route Corridor Option is 11 (Route Corridor Option A & E[46]) and the lowest number of crossings is 4 (Route Corridor Option D).

There are no high sensitivity water bodies crossed within the Study Area. All water bodies are of Medium sensitivity considering their WFD Status and hydrological connectivity to Drinking Water Protected Areas. Therefore, sensitivity of water bodies has not been a defining factor in determining impacts.

In addition to this, the total number of crossings associated with each Route Corridor Option is not considered too significant. Therefore, crossings of the same water body have been determined. Route Corridor Option A, B, E, F and G all cross the same water body (Arra_010) seven or eight times. These Route Corridor Options are therefore considered to have a slightly higher impact on water quality in the area compared to others. They are determined to be of Moderate negative impact to water quality, whilst Route Corridor Options C, D, H and I are Minor negative impact.

8.4.3.2 Flood Risk

The options assessment considered the number and nature of floodplain and the potential impact on flood risk. There is a range in the number and nature of crossings of flood risk areas made by each Route Corridor Option. The land to south of Newcastle West contains extensive floodplains associated with the Rivers Arra and Deel. This is consistent with the nature of the landscape, which is flat and relatively large, lowland watercourses. The land to the north of Newcastle West is steeper and drained by narrower watercourses that are more upstream in nature.

The Route Corridor Options passing to the north of Newcastle West cross more watercourses than the southern Route Corridor Options, however these have narrower floodplains and there are fewer potential receptors that might be impacted by any works. The Route Corridor Options to the south of Newcastle West have a greater potential to increase flood risk due to the extent of the floodplains and presence of sensitive receptors.

Even with the assumption of mitigation discussed in Section 8.4.2.2, it is determined that there is a much greater flood risk associated with Route Corridor Options to south of Newcastle West compared the Route Corridor Options to the north given the topography, form of the rivers and presence of sensitive flood risk receptors.

It is therefore assumed that the overall impact of the Route Corridor Options, with mitigation, all Route Corridor Options to the south of Newcastle West (Route Corridor Option C, D, H and I) are determined to have Major Negative impact on Flood Risk and all Route Corridor Options north of Newcastle West (Route Corridor Option A, B, E, F and G) will have Minor Negative impact on Flood Risk.

8.4.3.3 Overall Score

Overall, the Route Corridor Options which have scored Moderate for Water Quality have also been scored Moderate for Flood Risk. Therefore, these Route Corridor Options (A, B, E, F and G) are Moderate negative effect overall.

On the other hand, those Route Corridor Options which scored Minor for Water Quality were scored Major for Flood Risk (Route Corridor Options C, D, H and I). Considering the Major negative effect as a result of Flood Risk, and the indirect impacts flooding events have on water quality, these Route Corridor Options receive a Major negative score overall.

[46] This includes an additional crossing of the Deel (Newcastlewest)_090 by the indicative R521 Link Road.

Table 8.10: Overall Hydrological Assessment of Watercourses Crossings by proposed Route Corridor Options

Overall Significance	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Water Quality									
Significance	2	2	3	3	2	2	2	3	3
Flood Risk									
Significance	2	2	1	1	2	2	2	1	1
Overall Hydrology									
Significance	2	2	1	1	2	2	2	1	1

Table 8.11: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
Option A	Moderate Negative	2
Option B	Moderate Negative	2
Option C	Major Negative	1
Option D	Major Negative	1
Option E	Moderate Negative	2
Option F	Moderate Negative	2
Option G	Major Negative	1
Option H	Major Negative	1

8.5 Conclusion

Route Corridor Options to the south of Newcastle West score Major negative for flood risk. Despite fewer crossings from a water quality perspective and less significant direct impacts from a water quality perspective, these Route Corridor Options are still considered to be Major negative from a hydrology point of view due to the indirect impacts flooding can have on water quality. Route Corridor Options to the north of Newcastle West score Moderate negative for water quality and Moderate negative from a Flood Risk Point of view, therefore they score Moderate negative overall from a hydrology perspective.

There is minor differentiation between these Route Corridor Options. Route Corridor Option F is the best scoring Route Corridor Option from a flood risk perspective and scores relatively well from water quality perspective compared to other Route Corridor Options.

9. Cultural Heritage

9.1 Introduction

This chapter outlines the Cultural Heritage Assessment carried out as part of the Option Selection Study for the proposed N21 Newcastle West Road Scheme. The assessment was carried out by Archaeological Management Solutions (AMS) on behalf of Limerick City & County Council (LCCC) and the Mid-West National Road Design Office (MWNRDO).

This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options. These corridors are made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

The objective of the Option Selection Study was to produce a common assessment and detailed technical comparative evaluation for each Route Corridor Option with reference to its potential archaeological and architectural heritage impacts. The methodology for the appraisal of the Route Corridor Options with regards to archaeological and architectural heritage was based on the National Roads Authority's (NRA) *Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes* (NRA 2005a) and *Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes* (NRA 2005b) (the NRA Guidelines),[47] and the Environmental Protection Agency's (EPA's) *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA 2017). Other guidance of relevance to the assessment includes:

- Department of Arts, Heritage, Gaeltacht and the Island's *Framework and Principles for the Protection of the Archaeological Heritage* (DAHGI 1999);
- Department of Arts, Heritage and the Gaeltacht's *Architectural Heritage Protection Guidelines for Planning Authorities* (DAHG 2011);
- Department of Housing, Local Government and Heritage's *NIAH Handbook* (DHLGH 2021);
- EPA's *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (EPA 2003);
- EPA's *Guidelines on the information to be contained in Environmental Impact Statements* (EPA 2002);
- NRA's *Environmental Impact Assessment of National Road Schemes – A Practical Guide* (NRA 2008); and
- TII's *Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis* (TII 2016).

This assessment should be read in conjunction with Volume 2, Figures 9.1 to 9.3.

Under Annex IV(4) of amended EIA Directive 2014/52/EU, 'cultural heritage' including architectural and archaeological aspects, is an environmental factor to be addressed in an Environmental Impact Assessment Report (EIAR). Cultural heritage comprises archaeology, architectural heritage, folklore and history (EPA 2017). Archaeology is the study of past societies through surviving structures, artefacts and environmental data, and is concerned with known archaeological sites and monuments, areas of archaeological potential and underwater archaeology. Architectural heritage comprises structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of architectural, historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents. Architectural heritage and archaeology together form 'built heritage' or 'tangible heritage'. Folklore and history are aspects of 'intangible heritage', which also includes language, musical traditions, traditional crafts and skills, townland names, poetry and so on. These forms of cultural heritage are "non-moveable, non-material and largely non-environmental although by their associations with certain sites and places, add to the character of an area" (EPA 2015).

In this assessment, tangible cultural heritage assets (built heritage) are captured under the relevant sections on archaeology and architectural heritage, while non-tangible associations with these sites and the wider study area (i.e. historical and folklore associations) are referred to, where known, in the archaeological and historical

[47] The functions of the former NRA have now been assumed by Transport Infrastructure Ireland (TII).

background with further information presented in the appendices. Additional information on non-tangible associations will be collected during the EIA assessment (the next phase of the scheme) through further documentary research and where reported through public consultation.

9.2 Methodology

The Cultural Heritage Assessment built upon the Archaeology and Cultural Heritage Constraints Study (hereafter referred to as the 'Constraints Study'), in Chapter 5 of Volume 1. The aim of the Constraints Study was to identify, using readily available sources, the known archaeological, architectural heritage and other cultural heritage assets within the defined Study Area to assist with the identification of Route Corridor Options. For the purposes of the study, assets were categorised broadly as follows:

- Archaeological (AY) — World Heritage Sites; National Monuments; archaeological sites and monuments listed on the Sites and Monuments Record (SMR) and/or the Record of Monuments and Places (RMP);
- Architectural (AH) — designated Protected Structures and Architectural Conservation Areas (ACAs); structures and other items listed on the National Inventory of Architectural Heritage (NIAH); and undesignated structures of potential architectural heritage interest;
- Cultural Heritage (CH) — any other sites, areas or features of potential cultural heritage value including areas where undesignated archaeological sites, material and deposits potentially occur.

The Option Selection Study for Cultural Heritage was divided into four main components:

1. Further appraisal of known and potential archaeological sites and monuments and architectural heritage within a 500m-wide Study Area (250m either side of the centreline of each of the Route Corridor Options) including collation and analysis of previous archaeological investigations, archaeological finds known to the National Museum of Ireland (NMI), townland names and local folklore;
2. Field surveys of archaeological and architectural heritage assets to supplement the desktop research;
3. Quantitative and qualitative assessment of Route Corridor Options; and
4. Technical write up of potential impacts associated with each Route Corridor Option.

9.2.1 Establishing the Baseline

9.2.1.1 Archaeology

At present, archaeological sites and monuments in the Republic of Ireland are protected under the *National Monuments Act 1930–2014* in one of four ways:

1. Being recorded in the Record of Monuments and Places (RMP);
2. Being registered in the Register of Historic Monuments;
3. Being a National Monument in the ownership or guardianship of the Minister for Housing, Local Government and Heritage or a Local Authority; or
4. Being a National Monument subject to a Preservation Order or Temporary Preservation Order.

The principal sources for the identification of archaeological heritage assets are outlined below. Reference numbers (e.g. N21/NCW-AY001, abbreviated to AY001 etc.), have been assigned to each identified archaeological heritage asset, in line with the referencing convention outlined in the NRA guidelines.

World Heritage Sites and Tentative World Heritage List

There are no UNESCO World Heritage Sites, or sites included on the Tentative List (an inventory of properties that each State intends to consider for nomination to the UNESCO World Heritage List), within the Study Area. The closest World Heritage Site, Scelig Mhichíl, lies *c.*125km to the southwest of the Study Area. The Royal Sites of Ireland are included (since 2010) on the Tentative List for World Heritage Site status, and were proposed again in

2021 as part of a serial nomination for same. The Rock of Cashel (County Tipperary), is the closest of the Royal Sites and is located *c*.80km to the east of Newcastle West.

National Monuments Lists

A National Monument, as defined in Section 2 of the *National Monuments Act 1930*, means 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…." The current List of National Monuments in State Care (Ownership and Guardianship) for County Limerick was published in 2009. There are no National Monuments in State Care listed within the Route Corridor Options for the proposed scheme; however, the Desmond Hall and Great Hall (RMP No. L1036-067002), in Newcastle West are National Monuments (Nos. 636 and 582). The Anglo-Norman masonry castle, which occurs in the townland of Castle Demesne, is located *c*.800m due south of the proposed study area for the indicative R521 link road and *c*.1.2km to the north-northwest of Route Corridor Options D and H.

Record of Monuments and Places (RMP)

The Record of Monuments and Places (RMP) is the statutory list of protected places and monuments established under Section 12(1) of the *National Monuments (Amendment) Act 1994*. The RMP for County Limerick was published in 1997, in paper form with accompanying location maps which have been scanned and published online.[48] During the current assessment, the scanned lists and maps were used to check whether a monument or place is subject to legal protection under the *National Monuments Acts* through its inclusion on the RMP.

Sites and Monuments Record (SMR)

The Archive Unit of the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage (DHLGH) maintains a publicly accessible database known as the Sites and Monuments Record (SMR).[49] This contains current information on known archaeological sites and monuments, including whether or not they are scheduled for inclusion in the next issue of the statutory RMP. The SMR sites dataset includes a 'Zone of Notification' (ZoN) for sites and monuments. The zones do not define the exact extent of the monuments, but rather are intended to identify them for the purposes of notification under Section 12(3) of the *National Monuments Act (1930–2004)*; each is referred to as a 'Zone of Notification'.

List of Monuments Subject to Preservation Orders

Section 8(1) of the *National Monuments Act 1930* provides for the Minister placing a Preservation Order on a monument which the Minister considers to be a National Monument under threat. The current list of Preservation Orders detailing all monuments that have had a Preservation Order or a Temporary Preservation Order placed on them was published by the NMS in June 2019.[50] There are no Preservation Orders relating to monuments within the Study Area for the proposed scheme; however; the Desmond Hall and Great Hall (RMP No. L1036-067002), in Newcastle West are subject to a Preservation Order (PO No. 1/1973).

Database of Irish Excavation Reports

The Database of Irish Excavation Reports (DIER), also commonly known as the 'Excavations Bulletin' (summary accounts of archaeological excavations in Ireland), is maintained by Wordwell publishers with the support of the DHLGH and is accessible online.[51] TII also makes available reports commissioned as a result of its projects via the TII Digital Heritage Collections.[52] Seven previous archaeological investigations are noted as having taken place within the Study Area for the scheme (Appendix 9.4).

[48] Available at: https://www.archaeology.ie/publications-forms-legislation/record-of-monuments-and-places
[49] Available at: https://maps.archaeology.ie/HistoricEnvironment/
[50] Available at: https://www.archaeology.ie/sites/default/files/media/publications/po19v1-all-counties.pdf
[51] Available at: https://excavations.ie/
[52] Available at: https://repository.dri.ie/catalog/v6936m966

Historical Maps and Satellite Imagery

Cartographic sources including the first-edition six-inch Ordnance Survey (OS) map for County Limerick (surveyed in 1840–41), and the first-edition 25-inch OS map (surveyed from 1897–1903), were reviewed online through the Historic Environment Viewer (HEV) and Ordnance Survey Ireland[53] (OSI) websites. In addition, the Down Survey maps [54] (1656–58) were also examined. Satellite and aerial imagery were also reviewed throughout the assessment.

National Museum of Ireland Online Finds Databases

The National Museum of Ireland (NMI) in conjunction with The Heritage Council has made freely available a database of finds on the heritagemaps.ie website.[55] This resource is current to the year 2010; post-pandemic appointments at the NMI Topographical Files will be undertaken for Phase 3 reporting for this scheme to update the information relating to stray finds as required.

Soil Information Database

The National Soil Database is a national database of soil geochemistry and accompanying mapping resource, and also includes the National Soil Archive. The data presented in the soils database are underpinned by underlying geology and parent material, and factors such as soil type, land use, anthropogenic effects and climatic effects are also incorporated.[56]

LiDAR Assessment

AMS carried out an archaeological assessment of a LiDAR (Light Detection and Ranging) survey in April 2021 (Bonsall 2021 – reproduced as Appendix 9.7 of this report). LCCC commissioned the analysis of high-resolution 0.5m-acquired LiDAR data covering 1,584ha. The LiDAR analysis study area for the Newcastle West Road Scheme consisted of 363 tiles of Digital Terrain Model (DTM tiles); each tile measured 250m by 250m. These were analysed and visualised as a Simple Local Relief Model (SLRM), Sky-View Factor (SVF) and a Multi-Direction Hillshade Model (Multi-HS).

The 1,584ha survey area was assessed using specialist software to produce visualisations of the LiDAR DTM, and then each LiDAR visualisation was systematically compared with existing geospatial information and the topographical characteristics of all known sites and newly identified features were recorded. A total of 105 LiDAR sites were identified by the assessment, which comprised 62 sites previously recorded in the SMR and 43 previously unrecorded potential sites discovered in the LiDAR data. The newly identified sites included enclosures (no. 20), mounds (no. 10), field systems (no. 7), roads (no. 2), mound groups (no. 2), a ring ditch (no. 1) and a townland boundary (no. 1) (see Appendix 9.7).

Where direct impacts are predicted on previously unrecorded potential sites discovered in the LiDAR data, these have been included in the Option Selection Assessment as a precaution due to the potential significant adverse effects. The presence or absence of archaeology in these areas can only be conclusively established through invasive investigation (i.e. test excavation).

9.2.1.2 Architectural Heritage

The principal sources for the identification of architectural heritage were the Record of Protected Structures (RPS), as published within the *Limerick County Development Plan 2010-2016 (as extended)*,[57] and the *Newcastle West Local Area Plan 2014*–2020 *(extended until April 2024)*,[58] in addition to the National Inventory of Architectural

[53] Available at: http://map.geohive.ie/mapviewer.html
[54] Available at: http://downsurvey.tcd.ie/down-survey-maps.php
[55] The Heritage Council (2020) Map Viewer. Available from http://www.heritagemaps.ie/ [Accessed: 16 March 2021]
[56] Available at: https://data.gov.ie/dataset/national-soils-database
[57] Available at: https://www.limerick.ie/council/services/planning-and-property/development-plans/county-development-plan. NOTE: Limerick City & County Council published the DRAFT Limerick Development Plan 2022–2028 on 26 June 2021: https://www.limerick.ie/council/services/planning-and-property/limerick-development-plan/limerick-development-plan-2022-2028.
[58] Available at: https://www.limerick.ie/council/services/planning-and-property/development-plans/local-area-plan-newcastle-west

Heritage (NIAH). Reference numbers (e.g. N21/NCW-AH001) were assigned to each identified architectural heritage asset, in line with the referencing convention outlined in the NRA guidelines.

Record of Protected Structures

Under the *Planning and Development Act 2000*, as amended, Local Authorities are required to maintain an RPS as part of their Development Plan. These are structures recognised by the Local Authority as having special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. The legal protections afforded to Protected Structures are set out in Part IV of the *Planning and Development Act 2000,* as amended.

The RPS provides positive recognition of a structure's importance and protection from adverse impacts. A Protected Structure, unless otherwise stated in the RPS, includes the interior of the structure, the land lying within its curtilage, any other structures and their interiors lying within that curtilage, plus all of the fixtures and features that form part of the interior or exterior of any of these structures. The *National Monuments Act 1930–2014* can also protect elements of the architectural heritage or offer dual/parallel protection.

The Development Plan also contains a list of Architectural Conservation Areas (ACAs). However, no ACAs are located inside the Study Area for the proposed scheme. The closest ACA comprises the Newcastle West ACA, the extent of which is depicted on Map 3 of the *Newcastle West Local Area Plan 2014–2020 (extended until April 2024*) (LCCC 2014). The ACA includes the collective arrangement of buildings on the Square and the streetscapes on Bridge Street, Maiden Street and along North Quay (LCCC 2014, Section 8.2.3), which is located *c.*700m to the south of the study area for the proposed R521 link road.

National Inventory of Architectural Heritage

The NIAH is a nationwide survey of post-1700 architectural heritage including buildings, structures and historic landscapes and gardens, carried out under the *Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999*. The NIAH comprises a Building Survey and a Survey of Historic Gardens and Designed Landscapes.[59] These surveys are used to advise Local Authorities in relation to structures of interest within their functional areas. The purpose of the surveys is to highlight a representative sample of the architectural heritage of each county and to raise awareness of the wealth of architectural heritage in Ireland. Not all buildings and structures listed on the NIAH are legally protected through inclusion on the RPS.

Folklore and History

A review of published and unpublished source material was undertaken to establish whether the Study Area, or particular sites within it, has any specific folk or historical significance that would be significantly impacted by the proposed scheme. This included a search of the Irish Folklore Commission (IFC) Schools' Collection, which is a rich source of local information. This is gradually being made accessible online as part of the Dúchas Project,[60] a collaboration between University College Dublin, Dublin City University and the (then) Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media to digitise the National Folklore Collection (Appendix 9.5).

Place names can also provide clues to a townland's historical associations (e.g. Ballinena = *Baile an Aonaigh* – The Town of the Fair/Assembly; Ballingowan = *Baile an Ghabhann* – The Town of the Smith), archaeology (e.g. Dungeeha = *Dún Gaoithe* – Fort of the Wind; Doocatteen = *Dumhach Chaitín* = The Mound of Caitín) and geography (e.g. Moveedy = *Maigh Mhíde* – The Plain of Míde). A search of the Placenames Database of Ireland[61] was undertaken for the 39 townlands that occur within the Study Area (see Appendix 9.6). Further research with respect to history and folklore will be carried out during Phase 3.

[59] Available at: https://www.buildingsofireland.ie/buildings-search/
[60] Available at: https://www.duchas.ie/en
[61] Available at: https://www.logainm.ie/en/

9.2.2 Appraisal Methodology

9.2.2.1 Desk Study

The information gathered during the Constraints Study, which informed the selection of the Route Corridor Options, provided the baseline for the desk study at the Option Selection phase. The sources outlined above were consulted again to cross-check and update this baseline. The results of the LiDAR analysis (Appendix 9.7) were also incorporated into the assessment to factor in potential impacts on previously unrecorded potential archaeological sites, some of which could prove to be significant constraints for the Preferred Option.

During the assessment of the Route Corridor Options, the Study Area was refined to encompass an overall width of 500m for each route corridor option (i.e. 250m either side of the centreline of each corridor), as required for archaeology by the NRA guidelines (NRA 2005a, 21). These assessment corridors were also used for the architectural heritage assessment, which exceeds the recommended width for architectural heritage (NRA 2005b, 17).

9.2.2.2 Compilation of Base Maps

The archaeological and architectural heritage assets identified during the Constraints Study were updated and digitally mapped using open-source GIS software QGIS (versions 3.10 & 3.16) and cross-checked with current RMP, SMR, NIAH and RPS datasets. The historical mapping, LiDAR and satellite imagery referred to above were further explored to identify other structures and features of potential cultural heritage interest for checking in the field. Vector data for each Route Corridor Option were also imported and examined to assess the potential impact on the identified heritage assets.

9.2.2.3 Field Survey

A targeted survey from publicly accessible lands was carried out in May 2021 to supplement the desktop research. The survey assisted in:

- Confirming the nature, location, condition and extent of archaeological sites and monuments and architectural heritage features potentially impacted by the Route Corridor Options;
- Noting additional unidentified archaeological sites and monuments and architectural heritage assets as defined under the *National Monuments Acts 1930–2014* and *Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999*;
- Evaluating potential magnitude of impact and significance of effect by the Route Corridor Options; and
- Providing a preliminary photographic record of individual features of potential archaeological and architectural heritage interest.

9.2.2.4 Archaeological and Architectural Heritage Inventories

Inventories of archaeological and architectural heritage assets were compiled, drawing on data and information recorded during the original Constraints Study, supplemented by the additional research and fieldwork. These inventories (Appendices 9.1, 9.2 & 9.3) include a brief description and appraisal of each feature or area of archaeological or architectural heritage interest, as well as the legal status and put forward importance of the asset.

The relative importance of each archaeological or architectural asset was rated in terms of Negligible, Low, Medium or High for archaeological sites, and Local, Regional, National and International for architectural heritage sites, in accordance with the NRA and EPA guidelines. Relative importance derives from a number of factors including current designation or listing (i.e. RMP, SMR, RPS, NIAH, or none), preservation/condition and archaeological, architectural, historical, artistic, cultural, scientific, social or technical interest.

The Existing Environment (see Section 9.3 below) places the Study Area into its wider spatial and temporal context, and where previous archaeological investigations or research works have been conducted, summary detail of the

relevant work is provided (Appendix 9.4). Summaries of pertinent extracts from the IFC's Schools' Collection and the Placenames Database of Ireland are also provided as appendices (Appendix 9.5 & 9.6).

9.2.2.5 Options Assessment

A comparative quantitative and qualitative evaluation of the cultural heritage assets identified within each Route Corridor Option was carried out to arrive at the identification of the Preferred Route Corridor Option as part of a wider Multi-Criteria Analysis. The future proposed road alignment within the selected Preferred Option will be narrower than the Route Corridor Option, and so the sites within the Route Corridor Option could potentially be avoided through careful routing. The assessment considered an indicative alignment, a 50m band within the 400m-wide Route Corridor Option. This band is 25m either side of the centreline (i.e. 50m-wide in total). This allowed the assessment to more accurately identify potential direct and indirect effects to cultural heritage sites. Sites within the 50m band were assessed for potential direct effects and sites beyond the 50m band were assessed for potential indirect effects – including on pertinent assets that occurred within an overall 500m-wide buffer for assessment. An 80m band was also assessed, which consisted of a 15m buffer either side of the 50m band, to anticipate potential direct negative effects which could arise through the development of junction alignments etc. At the next phase of the project (i.e. Phase 3 Design and Environmental Evaluation), there will be further surveys and assessments to inform the proposed alignment of the Preferred Corridor Option.

The quantitative attributes assessed when comparing Route Corridor Options were determined by analysing the known and potential cultural heritage assets likely to be adversely impacted by each Route Corridor Option. This part of the assessment also involved the application of professional judgement.

As part of the assessment a list of potential affected assets was compiled for each Route Corridor Option, along with approximate distance from the 50m band for each proposed Route Corridor Option to the known edge of archaeology (where possible), or to the edge of the relevant ZoN where no surface expression of the archaeological asset was determinable. The same approach was applied regarding distance for the limits of architectural heritage. The type and magnitude of the predicted impact is also stated, along with the quality and significance of effect (Tables 9.4–9.12).

The Route Corridor Option with the lowest predicted impact on cultural heritage is generally the emerging preferred option from a cultural heritage perspective, while the route with the greatest predicted impact is the least preferred. However, the NRA guidelines recognise that the Preferred Route may not necessarily be the route with the lowest number of impacts on archaeological sites (NRA 2005a, 27). The same principle applies to architectural heritage; for example, a route that has relatively minor indirect impacts on eight (no. 8) sites may be preferable to a route that has just one direct impact resulting in the demolition of a building of regional or national architectural heritage merit (NRA 2005b, 23). This is the qualitative assessment carried out using professional judgement.

More detailed research, including consultation and further fieldwork, will need to be carried out for the Preferred Option, in accordance with the NRA Guidelines (NRA 2005b, 28). This will be undertaken as part of an EIA for the scheme.

9.2.3 Assessment Criteria

Evaluation of impacts was carried out using metrics specific to archaeological and architectural heritage, and with reference to the published NRA guidelines for archaeological heritage (NRA 2005a) and architectural heritage (NRA 2005b), as outlined below. The assessment was undertaken on each option and included both quantitative and qualitative assessment.

The comparative evaluation of the Route Corridor Options was assisted by scoring impacts on sensitive assets/receptors using the Stage 2 Project Appraisal Matrix, similar to that shown in the Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis.[62] Each impact was scored based on the seven-point scale as shown in Table 9.1 and a number was assigned according to the significance of the effects.

[62] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

Table 9.1: Impact Scoring Key

Score	Significance Level
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

Likely impacts within each Route Corridor Option were categorised as one of three types in accordance with the NRA guidelines for archaeological heritage (NRA 2005a, 25) and architectural heritage (NRA 2005b, 21):

- **Direct Impact** — where a feature or site of archaeological or architectural heritage interest is physically located within 25m either side of the centreline (the 50m-wide indicative alignment), which potentially entails the removal of part, or all, of the monument or feature. Sites or features that occurred within the 15m buffer (80m band) were assessed for potential direct negative effects;

- **Indirect Impact** — where a feature or site of archaeological or architectural heritage interest, or its setting, is located more than 25m either side of the centreline (outside of the 50m-wide indicative alignment), but is in close proximity; or

- **No predicted impact** — where the Route Corridor Option does not adversely or positively affect a feature or site of archaeological or architectural heritage interest.

The quality of each predicted impact was classified as **Negative**, **Positive** or **Neutral**. Negative impacts include total or partial loss of a site, monument, structure or its attendant grounds, visual intrusion, severance, degradation of setting and/or amenity. Positive impacts include increased physical separation resulting in traffic relief, reduced visual and noise intrusion, and enhancement of setting or amenity. Where no impact is predicted, the quality of impact is rated as Neutral (None). The predicted magnitude (level) of impact was rated as **Low, Medium, High, or Very High** (NRA 2005b, 31).

The predicted significance of effect was evaluated by comparing the predicted magnitude of impact with the put forward importance of the asset using the schedule and definitions of significance adapted from the NRA guidelines (NRA 2005b, 32–33). Significance of effect for both archaeological and architectural heritage are classified and summarised below:

- **Imperceptible** — an impact on archaeological or architectural heritage of local importance that is capable of measurement but without noticeable consequences;

- **Slight** — an impact that causes some minor change in the character of archaeological or architectural heritage of local or regional importance without affecting its integrity or sensitivities. Although noticeable, the effects do not directly impact on the archaeological or architectural structure or feature. Impacts are reversible and of relatively short duration. Appropriate mitigation will reduce the impact;

- **Moderate** — an impact that results in a change to the archaeological or architectural heritage, which although noticeable, is not such that it 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;

- **Significant** — an impact that by its magnitude, duration or intensity alters the character and/or setting of the archaeological or architectural heritage. These effects arise where an aspect or aspects of the archaeological or architectural heritage is/are permanently impacted upon leading to a loss of character and integrity in the archaeological or architectural structure or feature. Appropriate mitigation is likely to reduce the impact;

- **Profound** — an impact that obliterates the archaeological or architectural heritage of a structure or feature of national or international importance. These effects arise where an archaeological or architectural structure or feature is completely and irreversibly destroyed by the proposed development. Mitigation is unlikely to remove adverse effects.

9.3 Existing Environment

The Study Area contains 62 previously recorded archaeological heritage assets, all of which are listed on the RMP and/or SMR (Table 9.2 & Appendix 9.1). The list includes 47 ringforts, nine (no. 9) enclosures, two (no. 2) moated sites, two (no. 2) holy wells, one (no. 1) mound and one (no. 1) redundant record that LiDAR analysis has shown represents the remains of a subcircular enclosure and associated palaeochannel.

There are six (no. 6) previously recorded architectural heritage assets within the Study Area (Table 9.3), which include the nineteenth-century Ballymackesy Cottage (AH004) and nineteenth-century bridges in Cloonyscrehane (AH005) and Churchtown (AH002); all of these assets are Protected Structures that are also listed in the NIAH. The eighteenth-century Churchtown House (AH001), nineteenth-century Killeline House (AH003) and its associated historic garden/demesne (AH006), are listed in the NIAH Building Survey and Garden Survey respectively. The types of buildings of architectural heritage interest identified within the Study Area are summarised in more detail below and described individually in the Architectural Heritage Inventory (Appendix 9.2).

9.3.1 Archaeological Background

9.3.1.1 Prehistoric Period (c.8000 BC-AD 400)

The Irish Mesolithic is subdivided into two phases on the basis of stone tool technologies and cultural traditions – the Early Mesolithic (8000–7000/6500 BC) and Late Mesolithic (7000/6500–4000 BC) (Bayliss & Woodman 2009; Woodman 2011). Evidence for the Irish Mesolithic tends to be concentrated around or in close proximity to coastal areas, along river and lake shores, and elevated river valley positions. Mesolithic society was characterised by small kin groups of nomadic hunter-fisher-gatherers that exploited seasonally available food resources such as fruit, nuts, berries, fish and wild fowl. The archaeological record of this period presents as the remains of temporary settlements, fishing technology, chipped stone implements and production waste (debitage). At Hermitage, County Limerick, *c.*45km to the northeast of the Study Area, evidence for some of the earliest known burials (7530–7320 cal. BC) in Ireland were discovered adjacent to the River Shannon (Collins & Coyne 2003, 25; Collins 2009). It is possible that similarly dated burials could exist in morphologically similar locations adjacent to rivers and water sources throughout the county. However, no finds or features of Mesolithic date are recorded within the Study Area.

The Neolithic period (4000–2400 BC) witnessed the introduction of agriculture to Ireland and the change from a highly mobile hunter-gatherer lifestyle to one of a more sedentary nature based on livestock husbandry and cereal cultivation. This brought with it corresponding changes in settlement form, food production, burial practices and material culture (e.g., Cooney 2000). The time between 3750 and 3600 BC saw a period of rapid expansion across the country, which included the construction of timber-built rectangular houses and monumental hilltop enclosures, as well as monumental court tombs and portal tombs (e.g., Whittle *et al.* 2011; Schulting *et al.* 2012; Lynch 2014). Evidence for these changes have been excavated at the important Neolithic site of Lough Gur, County Limerick which lies *c.*33km to the east-northeast of the Study Area. Both rectangular and circular post-built houses were excavated at Lough Gur, as well as possible animal pens and a megalithic tomb (Waddell 2000, 32–35). Burials from cave sites, such as Killuragh Cave, County Limerick, are also known from this time (Woodman *et al.* 2018). While no monuments within the Study Area are classified as definitive Neolithic funerary monuments, it is

possible that some of the mound sites, such as AY050 in Ballinvallig townland (LI036-140), could derive from this period.

Field systems, comprising arrangements of coaxial field systems "which appear to form a coherent whole",[63] also had their origins in the Neolithic period (Caulfield *et al*. 1998), and provide important information on prehistoric spatial arrangement and land use patterns. The Céide Fields on Ireland's northwest Atlantic coast are the best preserved of this feature type in Ireland, although traces of similar relict prehistoric landscapes lie fossilised throughout the modern landscape, particularly in upland areas. However, in a monument-rich landscape such as that of west Limerick, where early ringforts also sit within often fragmented field systems, it is often difficult to tease apart this multi-layered site-type, or to accurately assign them to an appropriate period. No field systems exist as Recorded Monuments within the Study Area; however, seven potential examples were identified through LiDAR analysis (L120-200, L128-156, L128-174, L130-170, L139-186, L158-196 & L135-182), with one possible additional example being noted in analysis of aerial imagery (CH008).

The Bronze Age (2400–500 BC) is typically associated with the introduction and development of metal technology, the production of a diverse range of copper, bronze and gold objects, and the emergence of a distinct warrior elite class defined by high-status weaponry towards the end of the period (Waddell 2000). The objects included not only weapons and tools, but also high-status items of personal adornment. This technological innovation went hand-in-hand with an intensification of agriculture that was largely facilitated by the availability of more efficient tools. Historic finds of artefacts greatly add to our archaeological understanding of this period; for example, a bronze dagger (NMI Reg. L1931:4) was recovered from Loghill townland, less than 1.75km to the east-northeast of the Study Area.

Evidence for Bronze Age settlement was uncovered in the townland of Garryduff, in advance of the construction of the N21 Killarney Pole to Barnagh Road Safety Scheme (Delaney 2014). A Middle Bronze Age roundhouse was excavated at Garryduff 2 (Licence No. 12E002), located 475m to the west of Route Corridor Options A and E. The structure, which was characterised by a curvilinear slot trench, postholes, stakeholes, hearths and pits, measured 7.3m in diameter. Alder charcoal obtained from the foundation trench was radiocarbon dated to 1620–1461 cal. BC. A second structure was identified to the east, which was defined by stakeholes and produced sherds of Middle Bronze Age ceramics (Delaney 2014, 44–45).

Bronze Age ritual activity in the Study Area is indicated by the presence of possible ring barrows AY050 and CH007. Ring barrows are burial monuments that date from the Bronze Age and Iron Age. They consist of a circular domed area enclosed by a ditch and occasionally also by an external bank. Other possible prehistoric funerary monuments include the mounds identified through LiDAR analysis (L121-161, L121-163, L127-175, L134-177, L134-178, L143-190 & L161-192), which may overlie a central burial.

However, it is also possible that some of these mounds are representative of *fulachtaí fia* (burnt mounds), which are amongst the most common site types in Ireland (Hawkes 2015). The sites are characterised by a low horseshoe or kidney-shaped mound of heat-shattered stone discarded from the process of heating water in a subsoil-cut trough. Generally found in low-lying ground where the water table is close to the surface, the often wood-lined troughs filled naturally with water. The functions of *fulachtaí fia* were many and varied, from cooking to bathing places to brewing sites and sweat houses. Of the mounds identified through LiDAR analysis (see above), a number of these have been interpreted as potential *fulachtaí fia* or burnt mounds in Dromin (Macturlogh) townland (L121-161), Killaghteen (L121-162, L121-163), Dooally (L127-175), Kilrodane (L134-177, L134-178), Churchtown (L135-184, L143-183, L143-189) and Garranekeevan (L143-190). A burnt spread was excavated at Garryduff 1 (Licence No. 12E001), located 585m to the west-southwest of the Study Area, while pits containing heat-shattered stone occurred at Garryduff 2. Radiocarbon dates derived from the features indicated they were Middle to Late Bronze Age in date (Delaney 2014).

Enclosures can be defined as areas delimited by an enclosing element (such as a wall, bank, ditch or scarp) which are frequently shown in early map sources, and can be of varying shape and size. There are frequently no diagnostic features associated with them to allow a more refined classification within other monument categories, such as

[63] Description of 'field system' from Archaeological Survey of Ireland (ASI) scope note on www.archaeology.ie. [Online]. Accessed: 22.10. 2019.

ringforts. Enclosures that are greater than 70m in diameter are classed by the Archaeological Survey of Ireland (ASI) as 'large enclosures'. The date range for enclosures can be from the prehistoric period onwards. Within the Route Corridor Options, nine (9) enclosures occur as Recorded Monuments (AY041, AY054, AY055, AY056, AY057, AY058, AY060, AY061, AY062; LiDAR analysis indicates that AY060 is a possible bivallate ringfort and AY061 is a clear ringfort). Two further possible oval enclosures were identified through analysis of aerial images (CH002, CH003) and twenty further probable enclosures (L115-153, L120-154, L120-155, L120-158, L121-160, L123-166, L127-176, L128-171, L130-169, L131-168, L134-180, L135-181, L135-203, L136-202, L139-188, L139-201, L151-205, L159-195, L160-194 & RAS151-204) were identified through LiDAR analysis within the Study Area. It is probable that some of these enclosures are ringforts, but this can only be proved through further archaeological investigation.

Ballylin Hillfort (LI028-085), which is located *c*.3km to the north-northwest of Route Corridor Option B, is suggestive of Late Bronze Age to Iron Age ceremonial activity within the hinterlands of the Study Area. The substantial hillfort (20.5ha) comprises a widely-spaced multiple enclosure positioned on a prominent position on Ballylin Hill (243m O.D.), with extensive views over the surrounding landscape (Cody 1981). Radiocarbon dates returned from samples taken from the inner and outer enclosing elements indicated they were constructed in the Late Bronze Age. LiDAR survey, geophysical survey and targeted test excavations were undertaken at the hillfort, which put forward Ballylin formed part of a wider settlement landscape that included small farm holdings with roundhouses, *fulachtaí fiadh* and monuments such as barrows and standing stones (O'Brien & O'Driscoll 2017, 142–59).

Regarding other Iron Age (500 BC–AD 400) activity in the Study Area, there is a possibility that some of the mounds ascribed to the Bronze Age (see above) may more accurately belong to this period. In addition, some of the enclosures could represent monuments of Iron Age date. An iron axehead (NMI Reg. IA/164/1987) from Ballyconway, to the southwest of Newcastle West, may also derive from this period. An Iron Age pit was excavated at Garryduff 2; the sub-rectangular feature, which was filled with heat-shattered stone, retuned a radiocarbon date of 37 BC–AD 132 (Delaney 2012, 55).

9.3.1.2 Early Medieval Period (AD 400–1100)

The early medieval period saw significant social, cultural, political and technological changes in Ireland. The beginning of the period saw the arrival of Christianity, the gradual conversion of the population, the flourishing of Irish monasteries, the development of church sites and the spread of literacy. The period spans 700 years and also encompasses huge economic and environmental changes. Surviving law tracts provide valuable insights into the nature of Irish society at the time, which suggest Ireland was roughly divided into small kingdoms (*tuatha*), which operated largely as pastoral communities bounded by ties of kinship (Edwards 1996, 8).

Ringforts-raths and related monuments, such as cashels and raised/platform raths, are all traditionally considered forms of early medieval enclosed settlement (Stout 1997), and 47 ringfort-raths occur as Recorded Monuments within the Study Area (AY001, AY003–AY027, AY029, AY030, AY032–AY040, AY042–AY045, AY047–AY049, AY051, AY052 and AY059). Excavation and topographical studies have shown that within the ringfort classifications are a wide variety of morphologies and dates (O'Sullivan *et al.* 2013, 51–72). They can be univallate, bivallate or trivallate, can vary greatly in size, can occur singly or in dense concentrations and may or may not contain evidence of settlement. Stout (2015, 73) suggests that of the *c*.60,000 ringforts recorded in Ireland, most of these were occupied between the early seventh and ninth centuries AD. Although the vast majority appear to have been built during the second half of the first millennium AD, in areas of Gaelic-Irish rule they were sometimes inhabited into later times (e.g. O'Conor 1998). This is particularly true west of the Shannon, especially in the Burren of County Clare where there are examples of continued occupation in cashels as late as the seventeenth century (Fitzpatrick 2009).

It is also important to note, when considering what the early medieval inhabited landscape was like, that other forms of settlement existed; these included unenclosed settlements, crannogs, settlement cemeteries, rectangular enclosures and ecclesiastical sites (e.g. O'Sullivan *et al*. 2013). Ringforts are also representative of a predominantly cattle economy. Many of the ringforts in the Study Area are prominent in the landscape, though

outlying subsurface archaeological remains (e.g. trackways, field systems and souterrains) also have the potential to occur, as do ringfort sites with no surface expression. It is also likely that some of the LiDAR features identified as enclosures (e.g. L115-153, L120-154, L120-155, L120-158, L121-160, L123-166, L127-176, L128-171, L130-169, L131-168, L134-180, L135-181, L159-195, L160-194), as well as some of the enclosures which are Recorded Monuments (AY041, AY054–AY058, AY060, AY061, AY062) could transpire to be ringforts (as LiDAR analysis has shown with AY060 and AY061), but this may only be proven through further investigation.

It is also possible that the field systems described above could relate to this period rather than the Neolithic, and could be directly associated with the agricultural use of the ringfort-raths within the Study Area. This is likely in the case of CH008 in Cloonyscrehane townland, where an association with enclosure LI036-215 is put forward, while a second example (L130-170) in Shangarry townland, which may be associated with a ringfort-rath AY030 (LI036-060001) and holy well AY031 (LI036-060002). Similarly, two road-trackways (L131-167 & L120-159) identified through LiDAR analysis could be related to this period and highlight potential access routes through the landscape to ringforts and contemporary features in the area.

9.3.1.3 Medieval Period (AD 1100–1650)

The influx of the Anglo-Norman manorial system of territorial organisation resulted in considerable change to the settlement pattern of west Limerick in the thirteenth century. A landscape previously characterised by displaced rural settlement now witnessed the founding of its first urban centres, with a borough established at Newcastle West, as well as Adare, Ardagh, Clonshire, Croagh and Rathkeale. These boroughs became the focus of economic, political and ecclesiastical activity in the region and served to consolidate and centralise the power of the Anglo-Norman magnates.

Moated sites are generally regarded as being the fortified rural farmsteads of Anglo-Norman settlers, which were constructed towards the end of the thirteenth and into the fourteenth centuries, although in some counties – such as Roscommon, they were also constructed by Gaelic-Irish lords (O'Conor 1998). Moated sites may present as a rectilinear or circular enclosed area, occasionally raised, with a water-filled ditch and causewayed entrance. A key factor in classification of this site type is the 'water in, water out' element associated with the ditch, whereby a constant flow of water is ensured. Two moated sites (AY002 & AY028) occur in Killard and Killaghteen townlands as Recorded Monuments within the Study Area. In addition, a sub-square cropmark (CH005) was identified through analysis of historical maps and aerial imagery; however, it is unlikely that this represents a *bona fide* moated site.

While an in-depth analysis of the townland boundaries within the Route Corridor Options is not required for this Phase/Stage of assessment, it is worth noting that evidence for a relict townland boundary (L138-185) was identified through LiDAR analysis in Ballymackesy townland. The archaeological potential of these features should not be overlooked, as extant examples may preserve older archaeological features below their banks and/or ditches.

Additional features within the Study Area, which may have their origins in pre-Christian cults or votive rituals that continued in use through the medieval and post-medieval periods are holy wells. Two examples which have associations with Christian religious practices (prayers, ceremonies, devotions and making 'rounds' of the well) are known from the Study Area in Shangarry (AY031) associated with St Brigid, and Ballyshane (AY046), which was attributed with curative or restorative properties for lameness and blindness (Appendix 9.5); no evidence for this well was identified through LiDAR analysis (see L131-198 [LI036-131] in Appendix 9.7). O'Danachair (1955, 193–217) provides an in-depth account of the holy wells of County Limerick, including the known examples from the Study Area. The local oral folklore associated with these sites extended into the twentieth century, as evidenced in entries associated with these sites in the IFC Schools Collection (see Appendix 9.5).

9.3.2 Previous Archaeological Investigations

Seven archaeological investigations have been undertaken within the Study Area, but nothing of archaeological significance was uncovered during any of the investigations (Appendix 9.4). However, a series of investigations in

Garryduff in advance of the N21 Killarney Pole to Barnagh Road Safety Scheme, to the west of the study area, uncovered prehistoric remains (Delaney 2014). The remains from Garryduff 1[64] (Licence No. 12E001), which was located 585m to the west-southwest of Route Corridor Options A and E, consisted of the remains of a small burnt spread that occurred in association with a centrally placed pit and flanking postholes that were interpreted as the remains of a spit or rack. Radiocarbon dates obtained from the central pit and a posthole indicated they derived from the Middle to Late Bronze Age. Four distinct phases of activity were identified at Garryduff 2[65] (Licence No. 12E002), which lay 475m west of Route Corridor Options A and E. The earliest remains consisted of a Middle Bronze Age roundhouse that presented as a curvilinear slot trench, postholes, stakeholes, hearths and pits. A second structure was identified to the east, which was defined by stakeholes and produced sherds of Middle Bronze Age ceramics. A series of pits filled with burnt stone were located to the east of the two structures and were dated to the Middle to Late Bronze Age, while an Iron Age pit was investigated to the west. The latest feature excavated comprised a section of a nineteenth-century vernacular dwelling. Garryduff 3[66] (Licence No. 12E003), lay 110m west of the Study Area, consisted of an early medieval charcoal-production kiln associated with four sterile pits.

9.3.3 Known and Potential Archaeological Sites and Monuments

Table 9.2 (below) lists identified archaeological sites and monuments within the 500m study areas, with put forward importance ratings for each. More detailed descriptions are provided in Appendices 9.1, 9.3 and 9.7. The importance rating for each individual asset was assessed on the basis of their being (a) included on the RMP and being indicated for inclusion on the next revision of same; (b) inclusion on the SMR; (c) their being previously excavated in full or in part; and (d) professional judgement. In addition, the relative categories of archaeological, architectural, historical, artistic, cultural, scientific, social, or technical interest are also used in deriving the importance of previously unrecorded features or sites, using professional judgement, and with reference to Appendix 2 of the NRA Guidelines (2005a) for archaeology.

The Negligible rating is considered when previous excavations have removed/preserved by record archaeological sites discovered during former infrastructural schemes; in this scheme there are no such examples. The High rating was applied where upstanding sites or monuments are recorded on the RMP or SMR, and are scheduled for inclusion on the next revision of the RMP.

In addition, undesignated potential archaeological sites were identified through analysis of aerial photography, satellite imagery, historical mapping and LiDAR, some of which were verified during fieldwork in May 2021. These features were factored into the assessment when a direct impact is likely to occur from any of the Route Corridor Options and are included in the Option Assessment tables below. However, the archaeological significance of many of these features is currently unknown, with the result that the significance of effect cannot be accurately determined at this through stage.

Areas of Archaeological Potential identified to date include the vicinity of the Ehernagh Stream, Ballyfraley Stream, Dooally River, River Deel and River Daar (CH011–CH015). Such environments have the potential to contain subsurface archaeological remains including organic and palaeoenvironmental material. The presence or absence of archaeology in these areas can generally only be established through invasive investigation (e.g. test excavation and palaeoenvironmental assessment), with other forms of investigation (e.g. geophysical surveys, metal detector surveys and underwater surveys) undertaken as appropriate.

[64] https://excavations.ie/report/2012/Limerick/0023347/ [Online]. Accessed November 2021.
[65] https://excavations.ie/report/2012/Limerick/0023348/ [Online]. Accessed November 2021.
[66] https://excavations.ie/report/2012/Limerick/0023348/ [Online]. Accessed November 2021.

Table 9.2: Archaeological Baseline

Asset Ref.	Site Type	Ref.	Townland	ITM_E	ITM_N	Importance	Source
AY001	Ringfort – rath	LI028-132	Ballylahiff	527738	636542	High	RMP, SMR, LiDAR Assessment (L134-126)
AY002	Moated site	LI028-135	Killard	528764	636696	Medium	RMP, SMR, LiDAR Assessment (L142-141), OS 6-inch map (1840–41), OS 25-inch map (1897–1903)
AY003	Ringfort – rath	LI028-138	Coolacokery	529425	636418	High	RMP, SMR, LiDAR Assessment (L150-142)
AY004	Ringfort – rath	LI028-142	Ballyfraley	530341	636287	High	RMP, SMR, LiDAR Assessment (L158-152)
AY005	Ringfort – rath	LI028-180	Ballyfraley	529765	636161	High	RMP, SMR, LiDAR Assessment (L150-143)
AY006	Ringfort – rath	LI036-011	Dromin (Macturlogh)	525985	633876	High	RMP, SMR, LiDAR Assessment (L129-099)
AY007	Ringfort – rath	LI036-012	Dooally	526196	635190	High	RMP, SMR, LiDAR Assessment (L127-121)
AY008	Ringfort – rath	LI036-013	Dooally	526381	634866	High	RMP, SMR, LiDAR Assessment (L128-119)
AY009	Ringfort – rath	LI036-014	Dooally	526402	635018	High	RMP, SMR, LiDAR Assessment (L127-120)
AY010	Ringfort – rath	LI036-015	Doocatteen	526538	636080	High	RMP, SMR, LiDAR Assessment (L126-125)
AY011	Ringfort – rath	LI036-016	Dooally	526659	635296	High	RMP, SMR, LiDAR Assessment (L127-122), Survey from accessible lands 2021
AY012	Ringfort – rath	LI036-018	Churchtown	526935	635750	High	RMP, SMR, LiDAR Assessment (L127-124)
AY013	Ringfort – rath	LI036-021	Churchtown	527352	635895	High	RMP, SMR, LiDAR Assessment (L135-128)
AY014	Ringfort – rath	LI036-022	Churchtown	527372	635108	Medium	RMP, SMR, LiDAR Assessment (L135-130), Survey from accessible lands 2021, OS 25-inch map (1897–1903)
AY015	Ringfort – rath	LI036-023	Doocatteen	527471	636160	High	RMP, SMR, LiDAR Assessment (L134-127)
AY016	Ringfort – rath	LI036-025	Churchtown	527590	635604	High	RMP, SMR, LiDAR Assessment (L135-129)
AY017	Ringfort – rath	LI036-026	Garranekeevan	528334	635577	High	RMP, SMR, LiDAR Assessment (L143-140)
AY018	Ringfort – rath	LI036-030	Ballingowan	529712	635334	High	RMP, SMR
AY019	Ringfort – rath	LI036-031	Ballingowan	529871	635054	High	RMP, SMR, LiDAR Assessment (L151-145)
AY020	Ringfort – rath	LI036-032	Ballyfraley	530215	631427	High	RMP, SMR, LiDAR Assessment (L159-150)
AY021	Ringfort – rath	LI036-033	Gortroe	530444	634219	Medium	RMP, SMR, LiDAR Assessment (L160-094), OS 6-inch map (1840–41)
AY022	Ringfort – rath	LI036-039	Coolanoran	530876	636075	Medium	RMP, SMR, LiDAR Assessment (L158-093), OS 6-inch map (1840–41)

Asset Ref.	Site Type	Ref.	Townland	ITM_E	ITM_N	Importance	Source
AY023	Ringfort – rath	LI036-051	Garryduff	524325	632359	High	RMP, SMR, LiDAR Assessment (L114-096), Survey from accessible lands 2021
AY024	Ringfort – rath	LI036-053	Killaghteen	524641	632317	Medium	RMP, SMR, LiDAR Assessment (L114-097), OS 25-inch map (1897–1903)
AY025	Ringfort – rath	LI036-054	Killaghteen	524808	633259	High	RMP, SMR, LiDAR Assessment (L113-098), OS 6-inch map (1840–41)
AY026	Ringfort – rath	LI036-055	Killaghteen	525028	632706	Medium	RMP, SMR, LiDAR Assessment (L122-102), OS 25-inch map (1897–1903)
AY027	Ringfort – rath	LI036-056	Killaghteen	525194	632347	High	RMP, SMR, LiDAR Assessment (L122-103)
AY028	Moated site	LI036-058	Killaghteen	525850	632931	High	RMP, SMR, LiDAR Assessment (L122-101)
AY029	Ringfort – rath	LI036-059	Killaghteen	526234	632685	High	RMP, SMR, LiDAR Assessment (L130-117), Survey from accessible lands 2021
AY030	Ringfort – rath	LI036-060001	Shangarry	526532	632723	High	RMP, SMR, LiDAR Assessment (L130-115)
AY031	Ritual site – holy well	LI036-060002	Shangarry	526509	632729	High	RMP, SMR, LiDAR Assessment (L130-116)
AY032	Ringfort – rath	LI036-061	Shangarry	526602	632383	High	RMP, SMR, LiDAR Assessment (L130-114)
AY033	Ringfort – rath	LI036-063	Knockane	526976	632229	Medium	RMP, SMR, LiDAR Assessment (L130-113), OS 25-inch map (1897–1903)
AY034	Ringfort – rath	LI036-065	Ballymackesy	527272	632131	High	RMP, SMR, LiDAR Assessment (L138-133)
AY035	Ringfort – rath	LI036-066	Ballymackesy	527490	631741	High	RMP, SMR, LiDAR Assessment (L139-137)
AY036	Ringfort – rath	LI036-071	Ballymackesy	527834	631992	High	RMP, SMR, LiDAR Assessment (L139-134)
AY037	Ringfort – rath	LI036-073	Killeline	528111	631982	High	RMP, SMR, LiDAR Assessment (L147-138)
AY038	Ringfort – rath	LI036-077	Killeline	528641	632687	High	RMP, SMR, LiDAR Assessment (L146-139)
AY039	Ringfort – rath	LI036-080	Cloonyscrehane	529399	632592	High	RMP, SMR, LiDAR Assessment (L154-147), Survey from accessible lands 2021
AY040	Ringfort – rath	LI036-081	Dromin	529425	633611	High	RMP, SMR, LiDAR Assessment (L153-146)
AY041	Enclosure	LI036-084	Dromin	530583	633948	Medium	RMP, SMR, LiDAR Assessment (L161-149), OS 6-inch map (1840–41)
AY042	Ringfort – rath	LI036-120	Ballintubbrid	525670	631299	High	RMP, SMR, LiDAR Assessment (L123-106), Survey from accessible lands 2021

Asset Ref.	Site Type	Ref.	Townland	ITM_E	ITM_N	Importance	Source
AY043	Ringfort – rath	LI036-123	Ballintubbrid	525824	631489	High	RMP, SMR, LiDAR Assessment (L123-105), Survey from accessible lands 2021
AY044	Ringfort – rath	LI036-126	Ballintubbrid	526139	631145	High	RMP, SMR, LiDAR Assessment (L131-107)
AY045	Ringfort – rath	LI036-128	Ballyshane	526389	631261	High	RMP, SMR, LiDAR Assessment (L131-108)
AY046	Ritual site – holy well	LI036-131	Ballyshane	526531	631421	Medium	RMP, SMR
AY047	Ringfort – rath	LI036-132	Ballintubbrid	526731	632055	Medium	RMP, SMR, LiDAR Assessment (L130-111), OS 25-inch map (1897–1903)
AY048	Ringfort – rath	LI036-134	Ballinvallig	526808	631527	Medium	RMP, SMR, LiDAR Assessment (L131-109), OS 25-inch map (1897–1903)
AY049	Ringfort – rath	LI036-139	Ballinvallig	527003	631568	High	RMP, SMR, LiDAR Assessment (L139-110), Survey from accessible lands 2021
AY050	Mound	LI036-140	Ballinvallig	527073	631889	High	RMP, SMR, LiDAR Assessment (L139-135), Survey from accessible lands 2021
AY051	Ringfort – rath	LI036-141	Ballinvallig	527101	631847	High	RMP, SMR, LiDAR Assessment (L139-136), Survey from accessible lands 2021
AY052	Ringfort – rath	LI036-197	Killaghteen	526218	633198	Medium	SMR, LiDAR Assessment (L129-118)
AY053	Enclosure	LI036-201	Ballintubbrid	525651	631632	Medium	SMR, LiDAR Assessment (L123-104)
AY054	Enclosure	LI036-202	Shangarry	526867	632188	Medium	SMR, LiDAR Assessment (L130-112)
AY055	Enclosure	LI036-204	Dooally	526546	635494	Medium	SMR, LiDAR Assessment (L127-123)
AY056	Enclosure	LI036-206	Ballyfraley	529633	635943	Medium	SMR, LiDAR Assessment (L151-144)
AY057	Enclosure	LI036-207	Churchtown	527345	634876	Medium	SMR, LiDAR Assessment (L136-131)
AY058	Enclosure	LI036-208	Killaghteen	525943	633283	Medium	SMR, LiDAR Assessment (L121-100)
AY059	Ringfort – rath	LI036-212	Ballyfraley	530235	635513	Medium	SMR, LiDAR Assessment (L159-151), Survey from accessible lands 2021
AY060	Enclosure	LI036-215	Cloonyscrehane	529703	632731	Medium	SMR, LiDAR Assessment (L154-148)
AY061	Enclosure	LI036-218	Ballymackesy	527383	631789	Medium	SMR, LiDAR Assessment (L139-187)
AY062	Enclosure	LI036-217	Killeline	528316	632311	Medium	SMR

Asset Ref.	Site Type	Ref.	Townland	ITM_E	ITM_N	Importance	Source
CH001	Circular cropmark	None	Dungeeha	529077	635635	Unknown	Online Aerial Photography
CH002	Oval cropmark	None	Ballyfraley	529489	635647	Unknown	Online Aerial Photography
CH003	Oval enclosure	None	Dooally	526407	634768	Unknown	Online Aerial Photography, OS 6-inch map (1840–41), OS 25-inch map (1897–1903)
CH004	Circular cropmark	None	Killaghteen	524932	632753	Unknown	Online Aerial Photography
CH005	Sub-square cropmark	None	Doocatteen	527330	636406	Unknown	Online Aerial Photography, OS 6-inch map (1840–41), Survey from accessible lands 2021
CH006	Circular cropmark	None	Dooally	526599	635191	Unknown	Online Aerial Photography & HEV Aerial
CH007	Possible barrow	None	Churchtown	527677	635485	Unknown	Online Aerial Photography
CH008	Field system	None	Cloonyscrehane	529709	632702	Unknown	Online Aerial Photography
CH009	Circular cropmark	None	Cloonyscrehane	529264	632749	Unknown	Online Aerial Photography
CH010	Circular cropmark	None	Cloonyscrehane	529279	632764	Unknown	Online Aerial Photography
CH011	Area of Potential (Ehernagh Stream)	None	Various	Various	Various	Unknown	EPA Soil Information Database
CH012	Area of Potential (Ballyfraley Stream)	None	Various	Various	Various	Unknown	EPA Soil Information Database
CH013	Area of Potential (Dooally River)	None	Various	Various	Various	Unknown	EPA Soil Information Database
CH014	Area of Potential (River Deel)	None	Various	Various	Various	Unknown	EPA Soil Information Database
CH015	Area of Potential (River Daar)	None	Various	Various	Various	Unknown	EPA Soil Information Database
L120-159	Road/trackway	None	Dromin (Macturlogh)	525797	634187	Unknown	LiDAR Assessment
L120-200	Field system	None	Dromin (Macturlogh)	525920	634125	Unknown	LiDAR Assessment
L121-162	Mound	None	Killaghteen	525089	633408	Unknown	LiDAR Assessment, Survey from accessible lands 2021
L127-176	Enclosure	None	Ashgrove	526358	635640	Unknown	LiDAR Assessment
L128-156	Field system	None	Dooally	526037	634798	Unknown	LiDAR Assessment
L128-174	Field system	None	Dooally	526409	634837	Unknown	LiDAR Assessment
L131-168	Enclosure	None	Ballyshane	526602	631423	Unknown	LiDAR Assessment

Asset Ref.	Site Type	Ref.	Townland	ITM_E	ITM_N	Importance	Source
L134-178	Mound	None	Kilrodane	527430	636491	Unknown	LiDAR Assessment
L135-181	Enclosure	None	Churchtown	527297	635544	Unknown	Online Aerial Photography & LiDAR Assessment
L135-182	Field systems	None	Churchtown	527821	635447	Unknown	LiDAR Assessment
L139-186	Field system	None	Ballymackesy	527424	631941	Unknown	LiDAR Assessment

9.3.4 Historical Background

A castle was reputedly founded in the Barony of Glenquin at Newcastle West by the Knights Templar *c.*1184. By 1298 the castle remained as a well-established fortification used as a base for the Anglo-Norman attainment of lands in the Limerick area. The manor of Newcastle West is recorded in the same year, with immigrant tenant names such as le Blund, Dundonenald, de Valle and Coterel being associated, and the town was also one of nineteen medieval boroughs recorded in Limerick (O'Connor 1987, 11). A mill is recorded at Newcastle West by the later thirteenth century (O'Connor 1987, 15).

By the fourteenth century, Newcastle West had become a territorial base for the earls of Desmond, who remained in succession until 1583 when Gerald Fitzgerald, the 14th Earl of Desmond, was beheaded. The story of the acculturation of the earls of Desmond from the thirteenth to sixteenth centuries, and their stance in relation to the English crown is complex. As their lordship in Munster expanded to encompass territories as far as Waterford, their armed defence of lands appropriated from the Gaelic-Irish was a regular feature, as was their power struggle with the rival Butler earls of Ormond. Their power was such that two of the Desmond earls were appointed Lord Deputy of Ireland, and at one point, reputedly, one of the Desmond earls attempted to have himself declared King of Ireland (McCormack 2005, 19). However, during the Elizabethan Era the scale of the devastation associated with Desmond Rebellion (the second rebellion of 1579–83) was such that an estimated one-third of the population of Munster died, either through conflict or associated famine and illness (Mc Cormack 2005, 17). Following the death of the earl in 1583, much of the Desmond lands were forfeited to the crown, and schemes for a new plantation of Munster were enacted by 1586 (McCormack 2005, 196). Significant anti-planter feeling grew in the province and James Fitzgerald claimed the title of Earl of Desmond and supported rebellion in the province; the crown countered by granting the title without lands to his cousin in an attempt to placate (unsuccessfully) rebellious sentiment and the last Earl of Desmond died penniless and unsupported in London in 1607 (McCormack 2005, 197).

In 1591, as a consequence of late sixteenth century land transfers and the Munster Plantation, Catholic Sir William Courtenay, Knight of Powerham in Devonshire, was granted the lands of Newcastle West. The town became a centrepiece of the developing Courtenay estate (O'Connor 1987, 64). Courtenay re-patented the Saturday market and annual fair in 1625 to facilitate trade and economic growth (O'Connor 1987, 29). During the turbulent mid-seventeenth century years and Confederate Wars, under the Courtenay stewardship, Newcastle West was seen as a safe haven for the newly settled English. This did not prevent the destruction of the town, which was razed to the ground in an attack of 1642, an event which allowed for the remodelling of the town by successive Courtenay landlords. O'Connor (1987, 64–85) provides an in-depth account of the town between 1700 to *c.*1850, during which time the estate had reached its maximum limit (79,622 statute acres). The town's key infrastructure was in place by 1750, and estate improvements were documented in contemporary land surveyors' records (O'Connor 1987, 67). The River Arra was realigned through the town by 1776, with further improvements in repairs to houses and public buildings, street and road improvements and the upkeep of woods, nurseries and plantations post-1800 highlight the continuing landlord influence in the town and environs (O'Connor 1987, 68).

Lewis' (1837) description of the town and environs of Newcastle in the early nineteenth century supports the documented investments that were made in the town in the previous years. He described the town as comprising four main streets arranged around a square, with town hall on the north side; parish church and castle on the south side and with large attractive houses lining the streets on the east and west sides. He further described the 'shambles' on the south side of the river, as well as a fever hospital, dispensary, and a bridewell. Several locations where wool was dyed, a brewery and numerous shoemakers as well as a bleaching enterprise within the town were noted. Lewis also commented on the opening of several new roads, which he put forward would be a catalyst for further economic enhancement for the town. In the vicinity of the town, Lewis described the lands within the parish (5,008 statute acres) of Newcastle as being extremely fertile and productive, with *c.*300 acres of mountainous terrain suitable for grazing of young cattle. He noted quarrying activity in the upland areas, with coal and culm being used for production of lime, and with grits for road construction being present. The manufacture of coarse cloth (both linen and woollen) produced in the areas surrounding the town are also noted. Local folklore records the growing of flax and the presence of flax pools in the vicinity of Newcastle West, and an associated 'bleaching factory' in South Quay (Appendix 9.5).

The population of the province of Munster was severely impacted during the Great Famine, with many of the urban centres and rural countryside experiencing a significant decline. However, Newcastle West was to an extent, cushioned because of its position as a strong market town, and Smyth (2012a, 252) notes a total population decrease of 655 persons for the famine years. Nonetheless, the workhouse at Newcastle West witnessed a protest during which a crowd threatened to attack it unless work or food were provided to them (Smyth 2012a, 251), attesting to the desperate conditions experienced by the local population. At the height of the famine, the main workhouse at Newcastle West and its four auxiliary workhouses were vastly overcrowded, with conditions in these workhouses being particularly severe (Smyth 2012b, 363). Unsurprisingly, emigration from the area during this time was a feature; Newcastle West is recognised as being a moderate emigrant source area with between ten and twelve percent emigration between the years of 1841 and 1851 (Smyth 2012c, 496). Famine graveyards were a notable feature of this era and one such example is located in the townland of Churchtown (c. 0.21km to the south of the proposed study area for the proposed R521 link road), which continued in use following the famine years. Within this graveyard, a plaque commemorates the burial place of Paddy Flanagan, one of two persons (Jim Quinn being the other), attributed with the discovery of the Ardagh Chalice in Reerasta in 1868.[67]

The nineteenth century witnessed many of the formative events and persons that contributed to the shaping of modern Ireland. Daniel O'Connell ('The Liberator') held a monster meeting at Newcastle West on 22 January 1843 (Ruddy 2015). The Great Famine spurred the development of significant movements concerned with the cause for Irish Freedom, land reform and cultural concerns. The Land League, founded in 1879, spurred the collaboration of nationalists and land reformers, and the eventual collapse of the landlord system, as well as the development of tenant rights through the Land Acts of 1860 onwards. Newcastle West and its surrounding hinterlands, which were part of the Earl of Devon's estate, were sold following complex interactions and negotiations between tenants, clergy and agents for the Earl.

Throughout this period, the development of railway infrastructure began to open up the country to industry, trade and the widescale movement of people. The Limerick to Tralee railway line was completed after fourteen years of construction through the Barnagh Gap in the hills surrounding Newcastle West in 1880 (Anon 1980), and a branch line linked Newcastle West to the port of Foynes from the 1860s. The Rathkeale and Newcastle Junction Company initially operated the northeastern section of the line, while the Limerick and Kerry Railway Company operated the line from Newcastle West to Tralee until 1901, when it was purchased by the Great Southern and Western Railway (GS&WR). In the mid-1940s, Córas Iompair Éireann (CIE) took over the running of the service, and the line remained operational for passengers until 1963 and for freight until 1977. As early as 1868, day trips from Ennis to Newcastle West on the new branch line were popular, as evidenced by ticket sales representing over six hundred persons on one single day (Anon 1980).

In spite of the welcome employment, investment and economic growth generated through the construction of the railways, the projects were undertaken during a period of political and social unrest. Agrarian Societies were active in targeting landlords and rent collectors, and the railways along with their building stores and workers along the line were seen as legitimate targets. The Civil War period in Ireland saw continued political and social unrest throughout the country, and Munster (particularly Tipperary) was a hotbed of activity. The railway lines were regarded as a viable target by 'Irregulars' of the Irish Republican Army, who opposed the National Army forces in their guerrilla campaigns. On the Limerick Tralee line, anti-Treaty forces set an unmanned train carrying live pigs careering from Barnagh into Newcastle station, where it was derailed and crashed into a neighbouring house where it went on fire and its cargo was roasted alive (Anon 1980). A monument commemorating seventeen local residents who were killed during the War of Independence and the Civil War between 1916–22 was erected in the town in 1955.

The local folklore collected as part of the IFC Schools' Collection (Appendix 9.5) contains a wealth of local information, particularly with regard to forts, where treasure was reputedly hidden, sought, found and lost, and supernatural stories were associated with them. Of note is the record of a golden pin and antlers which were discovered during drainage works in a fort 'near the Daar river' about 1.5km outside Newcastle West. The finders broke the ring from the pin and gave it to their schoolmaster. Valuable information regarding events of the Irish Civil War are also noted, in particular with reference to a roadside memorial in Killeline townland (not identified during fieldwork or assessment survey), which marks the location of the shooting dead of two civilians by Free

[67] https://www.Limerick Diocesan Heritage Project -Newcastlewest Parish (limerickdioceseheritage.org) [Online] Accessed: 04.07.2021.

State soldiers in 1922. Information relating to holy wells are also found throughout the records, and include stories concerning the local St Ita, with reference to the townland of Shangarry.

9.3.5 Architectural Heritage

Architectural heritage assets, including industrial heritage, where known to occur within the 500m study areas, are listed below in Table 9.3 and described in more detail in the Architectural Heritage Inventory (Appendix 9.2).

Previously recorded architectural heritage assets within the 500m Study Area listed on the RPS and/or the NIAH are included in Table 9.3. The put forward importance of architectural heritage assets follows their NIAH assigned ratings, or where these are not available the importance was attributed using the criteria outlined in the NIAH Handbook (2021). These ratings are for guidance purposes only to assist with the impact assessments and route selection and have no legal effect. In addition, a number of structures and other features of potential architectural heritage interest identified from the Constraints Study, further research and fieldwork are listed. Where these assets are extant and are directly impacted by the proposed Route Corridor Options, or where an indirect impact is envisaged, they are given an asset reference number (Architectural Heritage (AH) number). These potential architectural heritage assets are in various states of preservation ranging from occupied dwellings in good condition to abandoned ruins.

Table 9.3: Architectural Heritage Baseline

Asset Ref.	Site Name/Type	Ref.	Townland	ITM_E	ITM_N	Importance	Sources
AH001	Churchtown House: Country house (1760–1800)	21903602 (NIAH Building Survey)	Churchtown	527522	635664	Regional	NIAH Building Survey, OS 6-inch (1840–41), OS 25-inch map (1897–1903)
AH002	Bridge (1860–1870): Road bridge over R&NJR Railway	1442 (RPS); 21903603 (NIAH Building Survey)	Churchtown	527573	635008	Regional (Protected Structure)	RPS, NIAH Building Survey, OS 25-inch map (1897–1903), Survey from accessible lands 2021
AH003	Killeline House: Country house (1800–1805)	21903606 (NIAH Building Survey)	Killeline	528173	632376	Regional	NIAH Building Survey, OS 6-inch (1840–41), OS 25-inch map (1897–1903), Survey from accessible lands 2021
AH004	Ballymackesy Cottage: Country house (1840–1880)	116 (RPS); 21903607 (NIAH Building Survey)	Ballymackesy	528016	632087	Regional (Protected Structure)	RPS, NIAH Building Survey, OS 25-inch map (1897–1903), Survey from accessible lands 2021
AH005	Bridge (1850–1860): Bridge over River Deel	1511 (RPS); 21903613 (NIAH Building Survey)	Cloonyscrehane	529903	632800	Regional (Protected Structure)	RPS, NIAH Building Survey, OS 25-inch map (1897–1903), Survey from accessible lands 2021
AH006	Killeline House: historic garden/ demesne	1373 (NIAH Garden Survey)	Killeline	528134	632336	Local	NIAH Garden Survey, OS 6-inch (1840–41), OS 25-inch map (1897–1903), Ireland British War Office 1:25k (GSGS 3906 Military Maps) (1895–1915), Survey from accessible lands 2021
AH007	W&LR Limerick Tralee Line: Railway line (site of)	None	Various	Various	Various	Local	OS 25-inch map (1897–1903), Online Aerial Photography, Survey from accessible lands 2021
AH008	Vernacular buildings	None	Coolacokery	529317	636289	Local	OS 25-inch map (1897–1903), Online Aerial Photography
AH009	Vernacular building	None	Ballymackesy	527164	631796	Local	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Online Aerial Photography, Survey from accessible lands 2021
AH010	Vernacular buildings	None	Dromin	530163	633211	Local	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Online Aerial Photography
AH011	Vernacular building	None	Ballingowan	530002	634995	Local	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Online Aerial Photography, Survey from accessible lands 2021
AH012	Rathkeale & Newcastle Junction Railway (R&NJR): Railway (site of)	None	Dungeeha	528169	635463	Local	OS 25-inch map (1897–1903), Online Aerial Photography, Survey from accessible lands 2021

Asset Ref.	Site Name/Type	Ref.	Townland	ITM_E	ITM_N	Importance	Sources
AH013	Vernacular buildings	None	Churchtown	527498	635960	Local	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Online Aerial Photography
AH014	Daar Bridge: Bridge over River Daar	None	Churchtown	527522	635996	Local	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Online Aerial Photography, Survey from accessible lands 2021
AH015	Vernacular buildings	None	Churchtown	527484	635939	Local	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Online Aerial Photography

9.4 Assessment of Route Corridor Options

9.4.1 Description of Potential Impacts

As outlined above, a comparative quantitative and qualitative evaluation was carried out to assess the potential impact of each Route Corridor Option on the identified cultural heritage assets within the 500m Study Area, in line with the 2005 NRA guidelines for the assessment of impacts on archaeological and architectural heritage. The results of these assessments are outlined in the tables below.

These tables identify known cultural heritage assets within each Route Corridor Option based on currently available information with details including category (archaeological and architectural heritage); legal designation or listing where applicable; and distance measurements. As the route footprints are not yet defined, for the purposes of the assessment, 25m from the Route Corridor Option centreline is considered to be the indicative alignment, and therefore all assets within this 50m band are considered direct impacts, while assets within the 30m buffer (80m band), were assessed for potential direct negative effects. The measurements (unless otherwise stated) represent the distance between the edge of the 50m band and the lateral limit of the archaeological or architectural heritage site. Where this is not determinable for an archaeological asset listed on the RMP/SMR, the distance is to the edge of the ZoN, as defined by the NMS of the DHLGH.

The potential impacts of the Route Corridor Options on each site have been considered individually on a case-by-case basis in terms of the type, quality and magnitude of impact and the predicted significance of the effect. Where the likely significance of effect is rated as Moderate or higher, the relevant rows are highlighted in bold text. Indirect impacts were only noted at this phase where they were considered Significant.

The Preferred Option will be assessed in more detail during the next project phase (i.e. Phase 3 Design and Environmental Evaluation). This will include further investigations, including a full walkover of the Preferred Option and targeted geophysical surveys. Archaeological test excavations may be undertaken at selected locations, if required. A more detailed assessment of potential direct and indirect impacts on individual assets, including visual intrusion and setting impacts, will also be undertaken at the next stage.

A quantitative appraisal of each Route Corridor Option and its potential impacts is given in Table 9.13.

Table 9.4: Route Corridor Option A Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH001	Architecture	Country house (1760–1800)	NIAH	Churchtown	115m	N/A	None	Neutral	N/A	N/A
AH002	Architecture	Bridge (1860–1870)	RPS & NIAH	Churchtown	100m	N/A	None	Neutral	N/A	N/A
AH007	Architecture	Railway line (site of)	None	Dooally	0m	N/A	Direct	Negative	Medium	Slight
AH012	Architecture	Railway line (site of)	None	Dungeeha	0m	N/A	Direct	Negative	Medium	Slight
AH013	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AH014	**Architecture**	**Bridge**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Significant**
AH015	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AY008	Archaeology	Ringfort – rath	RMP	Dooally	31m	5m	None	Neutral	N/A	N/A
AY009	Archaeology	Ringfort – rath	RMP	Dooally	75m	40m	None	Neutral	N/A	N/A
AY011	Archaeology	Ringfort – rath	RMP	Dooally	20m	0m	None	Neutral	N/A	N/A
AY013	Archaeology	Ringfort – rath	RMP	Churchtown	19m	12m	None	Neutral	N/A	N/A
AY014	**Archaeology**	**Ringfort – rath**	**RMP**	**Churchtown**	**0m**	**0m**	**Direct**	**Negative**	**Medium**	**Moderate**
AY015	Archaeology	Ringfort – rath	RMP	Doocatteen	43m	33m	None	Neutral	N/A	N/A
AY016	Archaeology	Ringfort – rath	RMP	Churchtown	30m	3m	None	Neutral	N/A	N/A
AY017	**Archaeology**	**Ringfort – rath**	**RMP**	**Garranekeevan**	**5m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY018	Archaeology	Ringfort – rath	RMP	Ballingowan	233m	195m	None	Neutral	N/A	N/A
AY020	Archaeology	Ringfort – rath	RMP	Ballyfraley	110m	96m	None	Neutral	N/A	N/A
AY023	Archaeology	Ringfort – rath	RMP	Garryduff	125m	120m	None	Neutral	N/A	N/A
AY024	Archaeology	Ringfort – rath	RMP	Killaghteen	25m	0m	None	Neutral	N/A	N/A
AY025	Archaeology	Ringfort – rath	RMP	Killaghteen	203m	185m	None	Neutral	N/A	N/A
AY026	Archaeology	Ringfort – rath	RMP	Killaghteen	45m	8m	None	Neutral	N/A	N/A
AY057	Archaeology	Enclosure	SMR	Churchtown	66m	38m	None	Neutral	N/A	N/A
AY059	Archaeology	Ringfort – rath	SMR	Ballyfraley	21m	0m	None	Neutral	N/A	N/A

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
CH001	Archaeology	Circular cropmark	None	Dungeeha	0m	N/A	Direct	Negative	Very High	Unknown
CH002	Archaeology	Oval cropmark	None	Ballyfraley	0m	N/A	Direct	Negative	Very High	Unknown
CH003	Archaeology	Oval enclosure	None	Dooally	0m	N/A	Direct	Negative	Very High	Unknown
CH004	Archaeology	Circular cropmark	None	Killaghteen	0m	N/A	Direct	Negative	Very High	Unknown
CH007	Archaeology	Possible barrow	None	Churchtown	0m	N/A	Direct	Negative	Very High	Unknown
CH012	Archaeology	Area of potential (Ballyfraley Stream)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L120-159	**Archaeology**	**Road – road/trackway**	**None**	**Dromin (Macturlogh)**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L120-200	**Archaeology**	**Field system**	**None**	**Dromin (Macturlogh)**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L121-162	**Archaeology**	**Mound**	**None**	**Killaghteen**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Potentially Significant**
L128-174	**Archaeology**	**Field system**	**None**	**Dooally**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-181	**Archaeology**	**Enclosure**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-182	**Archaeology**	**Field system**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.5: Route Corridor Option B Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH007	Architecture	Railway line (site of)	None	Dooally	0m	N/A	Direct	Negative	Medium	Slight
AH008	**Architecture**	**Vernacular buildings**	**None**	**Coolacokery**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AY001	**Archaeology**	**Ringfort – rath**	**RMP**	**Ballylahiff**	**7m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY002	Archaeology	Moated site	RMP	Killard	137m	135m	None	Neutral	N/A	N/A
AY003	Archaeology	Ringfort – rath	RMP	Coolacokery	75m	45m	None	Neutral	N/A	N/A
AY004	**Archaeology**	**Ringfort – rath**	**RMP**	**Ballyfraley**	**4m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY005	Archaeology	Ringfort – rath	RMP	Ballyfraley	30m	5m	None	Neutral	N/A	N/A
AY006	Archaeology	Ringfort – rath	RMP	Dromin (Macturlogh)	70m	57m	None	Neutral	N/A	N/A
AY007	Archaeology	Ringfort – rath	RMP	Dooally	55m	12m	None	Neutral	N/A	N/A
AY010	Archaeology	Ringfort – rath	RMP	Doocatteen	200m	173m	None	Neutral	N/A	N/A
AY012	Archaeology	Ringfort – rath	RMP	Churchtown	185m	152m	None	Neutral	N/A	N/A
AY022	Archaeology	Ringfort – rath	RMP	Coolanoran	130m	103m	None	Neutral	N/A	N/A
AY026	Archaeology	Ringfort – rath	RMP	Killaghteen	220m	206m	None	Neutral	N/A	N/A
AY027	**Archaeology**	**Ringfort – rath**	**RMP**	**Killaghteen**	**13m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY028	**Archaeology**	**Moated site**	**RMP**	**Killaghteen**	**10m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY052	Archaeology	Ringfort – rath	SMR	Killaghteen	166m	117m	None	Neutral	N/A	N/A
AY055	Archaeology	Enclosure	SMR	Dooally	115m	66m	None	Neutral	N/A	N/A
AY058	Archaeology	Enclosure	SMR	Killaghteen	23m	0m	None	Neutral	N/A	N/A
CH005	Archaeology	Sub-square cropmark	None	Doocatteen	0m	N/A	Direct	Negative	Very High	Unknown
CH012	Archaeology	Area of potential (Ballyfraley Stream)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L127-176	**Archaeology**	**Enclosure**	**None**	**Ashgrove**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L128-156	**Archaeology**	**Field system**	**None**	**Dooally**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Potentially Significant**
L134-178	**Archaeology**	**Mound**	**None**	**Kilrodane**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Potentially Significant**

Table 9.6: Route Corridor Option C Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH003	Architecture	Country house (1800–1805)	NIAH	Killeline	80m	N/A	None	Neutral	N/A	N/A
AH004	Architecture	Country house (1840–1880)	RPS & NIAH	Ballymackesy	60m	N/A	None	Neutral	N/A	N/A
AH005	Architecture	Bridge (1850–1860)	RPS & NIAH	Cloonyscrehane	40m	N/A	None	Neutral	N/A	N/A
AH006	**Architecture**	**Historic garden/demesne (Killeline House)**	**NIAH**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Moderate**
AH009	Architecture	Vernacular building	None	Ballymackesy	5m	N/A	Potential Direct	Negative	Medium	Slight
AH010	Architecture	Vernacular buildings	None	Dromin	10m	N/A	Potential Direct	Negative	Medium	Slight
AH011	Architecture	Vernacular building	None	Ballingowan	5m	N/A	Potential Direct	Negative	Medium	Slight
AY019	Archaeology	Ringfort – rath	RMP	Ballingowan	112m	75m	None	Neutral	N/A	N/A
AY021	Archaeology	Ringfort – rath	RMP	Gortroe	6m	2m	Potential Direct	Negative	Low	Slight
AY024	Archaeology	Ringfort – rath	RMP	Killaghteen	101m	77m	None	Neutral	N/A	N/A
AY034	Archaeology	Ringfort – rath	RMP	Ballymackesy	183m	166m	None	Neutral	N/A	N/A
AY035	Archaeology	Ringfort – rath	RMP	Ballymackesy	152m	104m	None	Neutral	N/A	N/A
AY036	Archaeology	Ringfort – rath	RMP	Ballymackesy	71m	35m	None	Neutral	N/A	N/A
AY037	Archaeology	Ringfort – rath	RMP	Killeline	194m	140m	None	Neutral	N/A	N/A
AY039	**Archaeology**	**Ringfort – rath**	**RMP**	**Cloonyscrehane**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Significant**
AY041	Archaeology	Enclosure	RMP	Dromin	110m	100m	None	Neutral	N/A	N/A
AY042	Archaeology	Ringfort – rath	RMP	Ballintubbrid	59m	2m	None	Neutral	N/A	N/A
AY043	Archaeology	Ringfort – rath	RMP	Ballintubbrid	87m	60m	None	Neutral	N/A	N/A
AY044	Archaeology	Ringfort – rath	RMP	Ballintubbrid	98m	62m	None	Neutral	N/A	N/A
AY045	Archaeology	Ringfort – rath	RMP	Ballyshane	30m	0m	None	Neutral	N/A	N/A

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AY046	**Archaeology**	**Ritual site – holy well**	**RMP**	**Ballyshane**	**0m**	**0m**	**Direct**	**Negative**	**Medium**	**Moderate**
AY048	**Archaeology**	**Ringfort – rath**	**RMP**	**Ballinvallig**	**0m**	**0m**	**Direct**	**Negative**	**Very High**	**Significant**
AY049	Archaeology	Ringfort – rath	RMP	Ballinvallig	37m	0m	None	Neutral	N/A	N/A
AY050	Archaeology	Mound	RMP	Ballinvallig	100m	103m	None	Neutral	N/A	N/A
AY051	Archaeology	Ringfort – rath	RMP	Ballinvallig	37m	20m	None	Neutral	N/A	N/A
AY053	Archaeology	Enclosure	SMR	Ballintubbrid	125m	166m	None	Neutral	N/A	N/A
AY060	**Archaeology**	**Enclosure**	**SMR**	**Cloonyscrehane**	**0m**	**0m**	**Direct**	**Negative**	**Very High**	**Significant**
AY061	Archaeology	Enclosure	SMR	Ballymackesy	40m	N/A	None	Neutral	N/A	N/A
AY062	**Archaeology**	**Enclosure**	**SMR**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Significant**
CH008	Archaeology	Field system	None	Cloonyscrehane	0m	N/A	Direct	Negative	Medium	Unknown
CH011	Archaeology	Area of potential (Ehernagh Stream)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH014	Archaeology	Area of potential (River Deel)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L131-168	**Archaeology**	**Enclosure**	**None**	**Ballyshane**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Potentially Significant**
L139-186	**Archaeology**	**Field system**	**None**	**Ballymackesy**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.7: Route Corridor Option D Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH003	Architecture	Country house (1800–1805)	NIAH	Killeline	80m	N/A	None	Neutral	N/A	N/A
AH004	Architecture	Country house (1840–1880)	RPS & NIAH	Ballymackesy	60m	N/A	None	Neutral	N/A	N/A
AH006	**Architecture**	**Historic garden/demesne (Killeline House)**	**NIAH**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Moderate**
AY029	Archaeology	Ringfort – rath	RMP	Killaghteen	6m	0m	None	Neutral	N/A	N/A
AY030	Archaeology	Ringfort – rath	RMP	Shangarry	150m	130m	None	Neutral	N/A	N/A
AY031	Archaeology	Ritual site – holy well	RMP	Shangarry	175m	130m	None	Neutral	N/A	N/A
AY032	**Archaeology**	**Ringfort – rath**	**RMP**	**Shangarry**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Significant**
AY033	Archaeology	Ringfort – rath	RMP	Knockane	155m	151m	None	Neutral	N/A	N/A
AY034	Archaeology	Ringfort – rath	RMP	Ballymackesy	160m	142m	None	Neutral	N/A	N/A
AY035	Archaeology	Ringfort – rath	RMP	Ballymackesy	152m	103m	None	Neutral	N/A	N/A
AY036	Archaeology	Ringfort – rath	RMP	Ballymackesy	46m	13m	None	Neutral	N/A	N/A
AY037	Archaeology	Ringfort – rath	RMP	Killeline	185m	128m	None	Neutral	N/A	N/A
AY038	Archaeology	Ringfort – rath	RMP	Killeline	138m	121m	None	Neutral	N/A	N/A
AY039	Archaeology	Ringfort – rath	RMP	Cloonyscrehane	157m	138m	None	Neutral	N/A	N/A
AY040	Archaeology	Ringfort – rath	RMP	Dromin	183m	147m	None	Neutral	N/A	N/A
AY047	**Archaeology**	**Ringfort – rath**	**RMP**	**Ballintubbrid**	**7m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY050	**Archaeology**	**Mound**	**RMP**	**Ballinvallig**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Significant**
AY051	Archaeology	Ringfort – rath	RMP	Ballinvallig	19m	0m	None	Neutral	N/A	N/A
AY054	Archaeology	Enclosure	SMR	Shangarry	57m	43m	None	Neutral	N/A	N/A
AY061	Archaeology	Enclosure	SMR	Ballymackesy	60m	N/A	None	Neutral	N/A	N/A
AY062	**Archaeology**	**Enclosure**	**SMR**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Significant**

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
CH009	Archaeology	Circular cropmark	None	Cloonyscrehane	0m	N/A	Direct	Negative	Very High	Unknown
CH010	Archaeology	Circular cropmark	None	Cloonyscrehane	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L139-186	**Archaeology**	**Field system**	**None**	**Ballymackesy**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.8: Route Corridor Option E Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH001	Architecture	Country house (1760–1800)	NIAH	Churchtown	111m	N/A	None	Neutral	N/A	N/A
AH002	Architecture	Bridge (1860–1870)	RPS & NIAH	Churchtown	100m	N/A	None	Neutral	N/A	N/A
AH007	Architecture	Railway line (site of)	None	Dooally	0m	N/A	Direct	Negative	Medium	Slight
AH012	Architecture	Railway line (site of)	None	Dungeeha	0m	N/A	Direct	Negative	Medium	Slight
AH013	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AH014	**Architecture**	**Bridge**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Significant**
AH015	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AY004	Archaeology	Ringfort – rath	RMP	Ballyfraley	46m	19m	None	Neutral	N/A	N/A
AY005	Archaeology	Ringfort – rath	RMP	Ballyfraley	123m	86m	None	Neutral	N/A	N/A
AY008	Archaeology	Ringfort – rath	RMP	Dooally	33m	5m	None	Neutral	N/A	N/A
AY009	Archaeology	Ringfort – rath	RMP	Dooally	73m	42m	None	Neutral	N/A	N/A
AY011	Archaeology	Ringfort – rath	RMP	Dooally	16m	0m	None	Neutral	N/A	N/A
AY013	Archaeology	Ringfort – rath	RMP	Churchtown	19m	12m	None	Neutral	N/A	N/A
AY014	**Archaeology**	**Ringfort – rath**	**RMP**	**Churchtown**	**0m**	**0m**	**Direct**	**Negative**	**Medium**	**Moderate**
AY015	Archaeology	Ringfort – rath	RMP	Doocatteen	43m	33m	None	Neutral	N/A	N/A
AY016	Archaeology	Ringfort – rath	RMP	Churchtown	30m	3m	None	Neutral	N/A	N/A
AY017	**Archaeology**	**Ringfort – rath**	**RMP**	**Garranekeevan**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Moderate**
AY022	Archaeology	Ringfort – rath	RMP	Coolanoran	N/A	78m	None	Neutral	N/A	N/A
AY023	Archaeology	Ringfort – rath	RMP	Garryduff	125m	120m	None	Neutral	N/A	N/A
AY024	Archaeology	Ringfort – rath	RMP	Killaghteen	25m	0m	None	Neutral	N/A	N/A
AY025	Archaeology	Ringfort – rath	RMP	Killaghteen	203m	185m	None	Neutral	N/A	N/A
AY026	Archaeology	Ringfort – rath	RMP	Killaghteen	45m	8m	None	Neutral	N/A	N/A
AY056	**Archaeology**	**Enclosure**	**SMR**	**Ballyfraley**	**2m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AY057	Archaeology	Enclosure	SMR	Churchtown	66m	38m	None	Neutral	N/A	N/A
CH003	Archaeology	Oval enclosure	None	Dooally	0m	N/A	Direct	Negative	Very High	Unknown
CH004	Archaeology	Circular cropmark	None	Killaghteen	0m	N/A	Direct	Negative	Very High	Unknown
CH007	Archaeology	Possible barrow	None	Churchtown	0m	N/A	Direct	Negative	Very High	Unknown
CH012	Archaeology	Area of potential (Ballyfraley Stream)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L120-159	**Archaeology**	**Road – road/trackway**	**None**	**Dromin (Macturlogh)**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L120-200	**Archaeology**	**Field system**	**None**	**Dromin (Macturlogh)**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L121-162	**Archaeology**	**Mound**	**None**	**Killaghteen**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Potentially Significant**
L128-174	**Archaeology**	**Field system**	**None**	**Dooally**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-181	**Archaeology**	**Enclosure**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-182	**Archaeology**	**Field system**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.9: Route Corridor Option F Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH001	Architecture	Country house (1760–1800)	NIAH	Churchtown	111m	N/A	None	Neutral	N/A	N/A
AH002	Architecture	Bridge (1860–1870)	RPS & NIAH	Churchtown	100m	N/A	None	Neutral	N/A	N/A
AH007	Architecture	Railway line (site of)	None	Dooally	0m	N/A	Direct	Negative	Medium	Slight
AH012	Architecture	Railway line (site of)	None	Dungeeha	0m	N/A	Direct	Negative	Medium	Slight
AH013	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AH014	**Architecture**	**Bridge**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Significant**
AH015	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AY006	Archaeology	Ringfort – rath	RMP	Dromin (Macturlogh)	141m	132m	None	Neutral	N/A	N/A
AY008	**Archaeology**	**Ringfort – rath**	**RMP**	**Dooally**	**9m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY009	Archaeology	Ringfort – rath	RMP	Dooally	45m	19m	None	Neutral	N/A	N/A
AY011	**Archaeology**	**Ringfort – rath**	**RMP**	**Dooally**	**2m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY013	Archaeology	Ringfort – rath	RMP	Churchtown	19m	12m	None	Neutral	N/A	N/A
AY014	**Archaeology**	**Ringfort – rath**	**RMP**	**Churchtown**	**0m**	**0m**	**Direct**	**Negative**	**Medium**	**Moderate**
AY015	Archaeology	Ringfort – rath	RMP	Doocatteen	43m	33m	None	Neutral	N/A	N/A
AY016	Archaeology	Ringfort – rath	RMP	Churchtown	40m	15m	None	Neutral	N/A	N/A
AY017	**Archaeology**	**Ringfort – rath**	**RMP**	**Garranekeevan**	**11m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY020	Archaeology	Ringfort – rath	RMP	Ballyfraley	112m	94m	None	Neutral	N/A	N/A
AY026	Archaeology	Ringfort – rath	RMP	Killaghteen	178m	162m	None	Neutral	N/A	N/A
AY027	Archaeology	Ringfort – rath	RMP	Killaghteen	27m	0m	None	Neutral	N/A	N/A
AY028	Archaeology	Moated site	RMP	Killaghteen	52m	7m	None	Neutral	N/A	N/A
AY052	Archaeology	Ringfort – rath	SMR	Killaghteen	175m	119m	None	Neutral	N/A	N/A

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AY057	Archaeology	Enclosure	SMR	Churchtown	66m	38m	None	Neutral	N/A	N/A
AY058	Archaeology	Enclosure	SMR	Killaghteen	19m	0m	None	Neutral	N/A	N/A
AY059	Archaeology	Ringfort – rath	SMR	Ballyfraley	25m	0m	None	Neutral	N/A	N/A
CH001	Archaeology	Circular cropmark	None	Dungeeha	0m	N/A	Direct	Negative	Very High	Unknown
CH002	Archaeology	Oval cropmark	None	Ballyfraley	0m	N/A	Direct	Negative	Very High	Unknown
CH003	Archaeology	Oval enclosure	None	Dooally	0m	N/A	Direct	Negative	Very High	Unknown
CH006	Archaeology	Circular cropmark	None	Dooally	5m	N/A	Potential Direct	Negative	Medium	Unknown
CH007	Archaeology	Possible barrow	None	Churchtown	0m	N/A	Direct	Negative	Very High	Unknown
CH012	Archaeology	Area of potential (Ballyfraley Stream)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L128-174	**Archaeology**	**Field system**	**None**	**Dooally**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-181	**Archaeology**	**Enclosure**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-182	**Archaeology**	**Field system**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.10: Route Corridor Option G Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH001	Architecture	Country house (1760–1800)	NIAH	Churchtown	115m	N/A	None	Neutral	N/A	N/A
AH002	Architecture	Bridge (1860–1870)	RPS & NIAH	Churchtown	100m	N/A	None	Neutral	N/A	N/A
AH007	Architecture	Railway line (site of)	None	Dooally	0m	N/A	Direct	Negative	Medium	Slight
AH012	Architecture	Railway line (site of)	None	Dungeeha	0m	N/A	Direct	Negative	Medium	Slight
AH013	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AH014	**Architecture**	**Bridge**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Significant**
AH015	**Architecture**	**Vernacular buildings**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Moderate**
AY004	Archaeology	Ringfort – rath	RMP	Ballyfraley	46m	19m	None	Neutral	N/A	N/A
AY005	Archaeology	Ringfort – rath	RMP	Ballyfraley	123m	86m	None	Neutral	N/A	N/A
AY006	Archaeology	Ringfort – rath	RMP	Dromin (Macturlogh)	141m	132m	None	Neutral	N/A	N/A
AY008	**Archaeology**	**Ringfort – rath**	**RMP**	**Dooally**	**4m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY009	Archaeology	Ringfort – rath	RMP	Dooally	50m	21m	None	Neutral	N/A	N/A
AY011	Archaeology	Ringfort – rath	RMP	Dooally	16m	0m	None	Neutral	N/A	N/A
AY013	Archaeology	Ringfort – rath	RMP	Churchtown	19m	12m	None	Neutral	N/A	N/A
AY014	**Archaeology**	**Ringfort – rath**	**RMP**	**Churchtown**	**0m**	**0m**	**Direct**	**Negative**	**Medium**	**Moderate**
AY015	Archaeology	Ringfort – rath	RMP	Doocatteen	43m	33m	None	Neutral	N/A	N/A
AY016	Archaeology	Ringfort – rath	RMP	Churchtown	25m	2m	None	Neutral	N/A	N/A
AY017	**Archaeology**	**Ringfort – rath**	**RMP**	**Garranekeevan**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Moderate**
AY022	Archaeology	Ringfort – rath	RMP	Coolanoran	N/A	78m	None	Neutral	N/A	N/A
AY026	Archaeology	Ringfort – rath	RMP	Killaghteen	178m	162m	None	Neutral	N/A	N/A
AY027	Archaeology	Ringfort – rath	RMP	Killaghteen	27m	0m	None	Neutral	N/A	N/A
AY028	Archaeology	Moated site	RMP	Killaghteen	49m	7m	None	Neutral	N/A	N/A

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AY052	Archaeology	Ringfort – rath	SMR	Killaghteen	175m	119m	None	Neutral	N/A	N/A
AY056	**Archaeology**	**Enclosure**	**SMR**	**Ballyfraley**	**2m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**
AY057	Archaeology	Enclosure	SMR	Churchtown	66m	38m	None	Neutral	N/A	N/A
AY058	Archaeology	Enclosure	SMR	Killaghteen	19m	0m	None	Neutral	N/A	N/A
CH003	Archaeology	Oval enclosure	None	Dooally	0m	N/A	Direct	Negative	Very High	Unknown
CH012	Archaeology	Area of potential (Ballyfraley Stream)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L128-174	**Archaeology**	**Field system**	**None**	**Dooally**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-181	**Archaeology**	**Enclosure**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**
L135-182	**Archaeology**	**Field system**	**None**	**Churchtown**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.11: Route Corridor Option H Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH003	Architecture	Country house (1800–1805)	NIAH	Killeline	80m	N/A	None	Neutral	N/A	N/A
AH004	Architecture	Country house (1840–1880)	RPS & NIAH	Ballymackesy	60m	N/A	None	Neutral	N/A	N/A
AH006	**Architecture**	**Historic garden/demesne (Killeline House)**	**NIAH**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Moderate**
AH009	Architecture	Vernacular building	None	Ballymackesy	12m	N/A	Potential Direct	Negative	Medium	Slight
AY024	Archaeology	Ringfort – rath	RMP	Killaghteen	101m	77m	None	Neutral	N/A	N/A
AY034	Archaeology	Ringfort – rath	RMP	Ballymackesy	192m	177m	None	Neutral	N/A	N/A
AY035	Archaeology	Ringfort – rath	RMP	Ballymackesy	144m	101m	None	Neutral	N/A	N/A
AY036	Archaeology	Ringfort – rath	RMP	Ballymackesy	63m	26m	None	Neutral	N/A	N/A
AY037	Archaeology	Ringfort – rath	RMP	Killeline	190m	140m	None	Neutral	N/A	N/A
AY038	Archaeology	Ringfort – rath	RMP	Killeline	138m	121m	None	Neutral	N/A	N/A
AY039	Archaeology	Ringfort – rath	RMP	Cloonyscrehane	157m	138m	None	Neutral	N/A	N/A
AY040	Archaeology	Ringfort – rath	RMP	Dromin	183m	147m	None	Neutral	N/A	N/A
AY042	Archaeology	Ringfort – rath	RMP	Ballintubbrid	59m	2m	None	Neutral	N/A	N/A
AY043	Archaeology	Ringfort – rath	RMP	Ballintubbrid	85m	60m	None	Neutral	N/A	N/A
AY044	Archaeology	Ringfort – rath	RMP	Ballintubbrid	100m	62m	None	Neutral	N/A	N/A
AY045	Archaeology	Ringfort – rath	RMP	Ballyshane	30m	0m	None	Neutral	N/A	N/A
AY046	Archaeology	Ritual site – holy well	RMP	Ballyshane	6m	0m	None	Neutral	N/A	N/A
AY048	**Archaeology**	**Ringfort – rath**	**RMP**	**Ballinvallig**	**0m**	**0m**	**Direct**	**Negative**	**Very High**	**Significant**
AY049	Archaeology	Ringfort – rath	RMP	Ballinvallig	35m	0m	None	Neutral	N/A	N/A
AY050	Archaeology	Mound	RMP	Ballinvallig	111m	103m	None	Neutral	N/A	N/A
AY051	Archaeology	Ringfort – rath	RMP	Ballinvallig	40m	20m	None	Neutral	N/A	N/A
AY053	Archaeology	Enclosure	SMR	Ballintubbrid	125m	166m	None	Neutral	N/A	N/A

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AY061	Archaeology	Enclosure	SMR	Ballymackesy	33m	N/A	None	Neutral	N/A	N/A
AY062	**Archaeology**	**Enclosure**	**SMR**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Significant**
CH009	Archaeology	Circular cropmark	None	Cloonyscrehane	0m	N/A	Direct	Negative	Very High	Unknown
CH010	Archaeology	Circular cropmark	None	Cloonyscrehane	0m	N/A	Direct	Negative	Very High	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L131-168	**Archaeology**	**Enclosure**	**None**	**Ballyshane**	**0m**	**N/A**	**Direct**	**Negative**	**Very High**	**Potentially Significant**
L139-186	**Archaeology**	**Field system**	**None**	**Ballymackesy**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.12: Route Corridor Option I Cultural Heritage Impact Assessment

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AH003	Architecture	Country house (1800–1805)	NIAH	Killeline	80m	N/A	None	Neutral	N/A	N/A
AH004	Architecture	Country house (1840–1880)	RPS & NIAH	Ballymackesy	60m	N/A	None	Neutral	N/A	N/A
AH005	Architecture	Bridge (1850–1860)	RPS & NIAH	Cloonyscrehane	40m	N/A	None	Neutral	N/A	N/A
AH006	**Architecture**	**Historic garden/demesne (Killeline House)**	**NIAH**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Moderate**
AH010	Architecture	Vernacular buildings	None	Dromin	10m	N/A	Potential Direct	Negative	Medium	Slight
AH011	Architecture	Vernacular building	None	Ballingowan	5m	N/A	Potential Direct	Negative	Medium	Slight
AY019	Archaeology	Ringfort – rath	RMP	Ballingowan	112m	75m	None	Neutral	N/A	N/A
AY021	Archaeology	Ringfort – rath	RMP	Gortroe	6m	2m	Potential Direct	Negative	Low	Slight
AY029	Archaeology	Ringfort – rath	RMP	Killaghteen	20m	0m	None	Neutral	N/A	N/A
AY030	Archaeology	Ringfort – rath	RMP	Shangarry	150m	130m	None	Neutral	N/A	N/A
AY031	Archaeology	Ritual site – holy well	RMP	Shangarry	175m	130m	None	Neutral	N/A	N/A
AY032	**Archaeology**	**Ringfort – rath**	**RMP**	**Shangarry**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Significant**
AY033	Archaeology	Ringfort – rath	RMP	Knockane	155m	151m	None	Neutral	N/A	N/A
AY034	Archaeology	Ringfort – rath	RMP	Ballymackesy	160m	142m	None	Neutral	N/A	N/A
AY035	Archaeology	Ringfort – rath	RMP	Ballymackesy	152m	103m	None	Neutral	N/A	N/A
AY036	Archaeology	Ringfort – rath	RMP	Ballymackesy	46m	13m	None	Neutral	N/A	N/A
AY037	Archaeology	Ringfort – rath	RMP	Killeline	185m	128m	None	Neutral	N/A	N/A
AY039	**Archaeology**	**Ringfort – rath**	**RMP**	**Cloonyscrehane**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Significant**
AY041	Archaeology	Enclosure	RMP	Dromin	110m	100m	None	Neutral	N/A	N/A
AY047	**Archaeology**	**Ringfort – rath**	**RMP**	**Ballintubbrid**	**7m**	**0m**	**Potential Direct**	**Negative**	**Medium**	**Moderate**

Asset Ref.	Category	Site Type	Designation	Townland	Distance to Site	Distance to ZoN	Type of Impact	Quality of Impact	Magnitude of Impact	Significance of Effect
AY050	**Archaeology**	**Mound**	**RMP**	**Ballinvallig**	**0m**	**0m**	**Direct**	**Negative**	**High**	**Significant**
AY051	Archaeology	Ringfort – rath	RMP	Ballinvallig	17m	0m	None	Neutral	N/A	N/A
AY054	Archaeology	Enclosure	SMR	Shangarry	57m	43m	None	Neutral	N/A	N/A
AY060	**Archaeology**	**Enclosure**	**SMR**	**Cloonyscrehane**	**0m**	**0m**	**Direct**	**Negative**	**Very High**	**Significant**
AY061	Archaeology	Enclosure	SMR	Ballymackesy	60m	N/A	None	Neutral	N/A	N/A
AY062	**Archaeology**	**Enclosure**	**SMR**	**Killeline**	**0m**	**N/A**	**Direct**	**Negative**	**High**	**Significant**
CH008	Archaeology	Field system	None	Cloonyscrehane	0m	N/A	Direct	Negative	Medium	Unknown
CH013	Archaeology	Area of potential (Dooally River)	None	Cloonyscrehane	0m	N/A	Direct	Negative	Very High	Unknown
CH014	Archaeology	Area of potential (River Deel)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
CH015	Archaeology	Area of potential (River Daar)	None	Various	0m	N/A	Direct	Negative	Very High	Unknown
L139-186	**Archaeology**	**Field system**	**None**	**Ballymackesy**	**0m**	**N/A**	**Direct**	**Negative**	**Medium**	**Potentially Moderate**

Table 9.13: Route Corridor Options Appraisal Table

Impact Significance Level	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Profound	None	None	None	None	None	None	None	None	None
Significant Negative	**1 Sites** Bridge AH014 (direct)	None	**4 Sites** Ringforts AY039 (LI036-080) & AY048 (LI036-134) (direct) Enclosures AY060 (LI036-215 & AY062 (LI036-217) (direct)	**3 Sites** Ringfort AY032 (LI036-061) (direct) Mound AY050 (LI036-140) (direct) Enclosure AY062 (LI036-217) (direct)	**1 Site** Bridge AH014 (direct)	**1 Site** Bridge AH014 (direct)	**1 Site** Bridge AH014 (direct)	**2 Sites** Ringfort AY048 (LI036-134) (direct) Enclosure AY062 (LI036-217) (direct)	**5 Sites** Ringforts AY032 (LI036-061) & AY039 (LI036-080) (direct) Mound AY050 (LI036-140) (direct) Enclosures AY060 (LI036-215 & AY062 (LI036-217) (direct)
Potentially Significant Negative	**1 Site** Mound L121-162 (direct)	**2 Sites** Field system L128-156 (direct) Mound L134-178 (direct)	**1 Site** Enclosure L131-168 (direct)	None	**1 Site** Mound L121-162 (direct)	None	None	**1 Site** Enclosure L131-168 (direct)	None
Moderate Negative	**4 Sites** Vernacular buildings AH013 & AH015 (direct) Ringfort AY014 (LI036-022) (direct) Ringfort AY017 (LI036-026) (potential direct)	**5 Sites** Vernacular building AH008 (direct) Ringforts AY001 (LI028-132), AY004 (LI028-142) & AY027 (LI036-056) (potential direct) Moated site AY028 (LI036-058) (potential direct)	**2 Sites** Holy well AY046 (LI036-131) (direct) Historic garden/ demesne AH006 (NIAH Ref. 1373) (direct)	**2 Sites** Ringfort AY047 (LI036-132) (potential direct) Historic garden/ demesne AH006 (NIAH Ref. 1373) (direct)	**5 Sites** Vernacular buildings AH013 & AH015 (direct) Ringforts AY014 (LI036-022) & AY017 (LI036-026) (direct) Enclosure AY056 (LI036-206) (potential direct)	**6 Sites** Vernacular buildings AH013 & AH015 (direct) Ringforts AY008 (LI036-013), AY011 (LI036-016) & AY017 (LI036-026) (potential direct) Ringfort AY014 (LI036-022) (direct)	**6 Sites** Vernacular buildings AH013 & AH015 (direct) Ringfort AY008 (LI036-013) (potential direct) Ringforts AY014 (LI036-022) & AY017 (LI036-026) (direct) Enclosure AY056 (LI036-206) (potential direct)	**1 Site** Historic garden/ demesne AH006 (NIAH Ref. 1373) (direct)	**2 Sites** Ringfort AY047 (LI036-132) (potential direct) Historic garden/ demesne AH006 (NIAH Ref. 1373) (direct)

Impact Significance Level	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Potentially Moderate Negative	**5 Sites** Road L120-159 (direct) Field systems L120-200, L128-174 & L135-182 (direct) Enclosure L135-181 (direct)	**1 Site** Enclosure L127-176 (direct)	**1 Site** Field system L139-186 (direct)	**1 Site** Field system L139-186 (direct)	**5 Sites** Road L120-159 (direct) Field systems L120-200, L128-174 & L135-182 (direct) Enclosure L135-181 (direct)	**3 Sites** Field systems L128-174 & L135-182 (direct) Enclosure L135-181 (direct)	**3 Sites** Field systems L128-174 & L135-182 (direct) Enclosure L135-181 (direct)	**1 Site** Field system L139-186 (direct)	**1 Site** Field system L139-186 (direct)
Slight Negative	**2 Sites** Railway lines (site of) AH007 & AH012 (direct)	**1 Site** Railway line (site of) AH007 (direct)	**4 Sites** Vernacular buildings AH009, AH010 & AH011 (potential direct) Ringfort AY021 (LI036-033) (potential direct)	None	**2 Sites** Railway lines (site of) AH007 & AH012 (direct)	**2 Sites** Railway lines (site of) AH007 & AH012 (direct)	**2 Sites** Railway lines (site of) AH007 & AH012 (direct)	**1 Site** Vernacular building AH009 (potential direct)	**3 Sites** Vernacular buildings AH010 & AH011 (potential direct) Ringfort AY021 (LI036-033) (potential direct)
Imperceptible	None	None	None	None	None	None	None	None	None

Impact Significance Level	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Unknown	**8 Sites** Circular cropmarks CH001 & CH004 (direct) Oval cropmark CH002 (direct) Oval enclosure CH003 (direct) Possible barrow CH007 (direct) Crosses Ballyfraley Stream (CH012), Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**4 Sites** Sub-square cropmark CH005 (direct) Crosses Ballyfraley Stream (CH012), Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**5 Sites** Field system CH008 (direct) Crosses Ehernagh Stream (CH011), Dooally River (CH013), River Deel (CH014) & River Daar (CH015) (areas of archaeological potential)	**4 Sites** Circular cropmarks CH009 & CH010 (direct) Crosses Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**6 Sites** Oval enclosure CH003 (direct) Circular cropmark CH004 (direct) Possible barrow CH007 (direct) Crosses Ballyfraley Stream (CH012), Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**8 Sites** Circular cropmarks CH001 & CH006 (direct) Oval cropmark CH002 (direct) Oval enclosure CH003 (direct) Possible barrow CH007 (direct) Crosses Ballyfraley Stream (CH012), Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**4 Sites** Oval enclosure CH003 (direct) Crosses Ballyfraley Stream (CH012), Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**4 Sites** Circular cropmarks CH009 & CH010 (direct) Crosses Dooally River (CH013) & River Daar (CH015) (areas of archaeological potential)	**4 Sites** Field system CH008 (direct) Crosses Dooally River (CH013), River Deel (CH014) & River Daar (CH015) (areas of archaeological potential)
Significance Level	**Moderate Negative**	**Moderate Negative**	**Major Negative**	**Major Negative**	**Moderate Negative**	**Moderate Negative**	**Moderate Negative**	**Moderate Negative**	**Major Negative**
Preference	**Preferred**	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Intermediate**	**Least Preferred**

9.4.2 Assessment of the Effects of Route Corridor Options

Below is a summary of the main predicted effects on cultural heritage for each of the nine Route Corridor Options based on current information on recorded and potential archaeological and architectural heritage features.

All of the Route Corridor Options would have a net negative effect on cultural heritage to a greater or lesser degree, although no profound impacts are predicted on archaeological or architectural heritage sites because no National Monuments or architectural heritage assets of national or international importance would be impacted by any of the Route Options. It is also noteworthy that the nature and importance of LiDAR features are currently unknown, especially given most of the Potentially Significant effects above relate to these cultural heritage receptors.

Furthermore, all of the Route Corridor Options would require the removal of roadside features and enclosing elements of fields such as drystone walls, earthen boundaries and gates, as well as cutting through townland boundaries.

The Preferred Option will be assessed in more detail during the next project phase (i.e. Phase 3 Design and Environmental Evaluation). This will include further investigations, including a full walkover of the Preferred Option and targeted geophysical surveys. Archaeological test excavations may be undertaken at selected locations, if required. A more detailed assessment of potential direct and indirect impacts on individual assets, including visual intrusion and setting impacts, will also be undertaken at the next stage.

9.4.2.1 Route Corridor Option A

Route Corridor Option A is predicted to have quantifiable direct or indirect impacts on twenty-one (no. 21) cultural heritage receptors. The Route Corridor Option directly impacts one (no.1) Recorded Monument, comprising a ringfort AY014 (LI036-022) in the townland of Churchtown. The impact to the site is rated as Moderate Negative; LiDAR analysis has shown this site to survive as a low relief feature. The Route Corridor Option also presents a potential direct impact to another ringfort, AY017 (LI036-026), which is also rated as Moderate Negative; LiDAR analysis suggests this to be a bivallate ringfort. Depending on the design, there could be one (no. 1) Potentially Significant direct impact on potential archaeological sites identified through the LiDAR analysis (mound L121-162), as well as five (no. 5) Potentially Moderate direct impacts on LiDAR sites (road L120-159, field systems L120-200, L128-174 & L135-182, and enclosure L135-181). Impacts of unknown significance could also occur in relation to five (no. 5) features identified on aerial photography and satellite imagery that would be directly impacted; two (no. 2) circular cropmarks (CH001 & CH004), one (no. 1) oval cropmark (CH002), one (no. 1) oval enclosure (CH003) and a possible barrow (CH007). Route Corridor Option A also crosses three (no. 3) areas of high archaeological potential; Ballyfraley Stream (CH012), Dooally River (CH013) and the River Daar (CH015).

No direct impacts are predicted for any Protected Structures or structures listed on the NIAH, although Daar Bridge (AH014) would be directly impacted, which would result in a Significant Negative effect. Moderate Negative effects are predicted for two (no. 2) undesignated architectural heritage sites, comprising two (no. 2) clusters of vernacular buildings (AH013 & AH015), while Slight Impacts are anticipated for the impacts to the former rail lines (AH007 & AH012).

Overall, Route Corridor Option A is rated as **Moderate Negative** because just one Significant impact is predicted on a structure which is not afforded statutory protection, and the impact could be reduced by mitigation.

9.4.2.2 Route Corridor Option B

Route Corridor Option B is predicted to have quantifiable direct or indirect impacts on thirteen (no. 13) cultural heritage receptors. The Route Corridor Option may result in potential direct impacts to four (no. 4) Recorded Monuments: ringforts AY001 (LI028-132), AY004 (LI028-142) and AY027 (LI036-056), and moated site AY028 (LI036-058); these impacts have been rated as Moderate Negative. Depending on the design, there could be two (no. 2) Potentially Significant direct impacts on potential archaeological sites identified during the LiDAR assessment (field system L128-156 and mound L134-178), in addition to one (no. 1) Potentially Moderate direct impact on enclosure L127-176. Impacts of unknown significance could also occur in relation to one (no. 1) feature identified on aerial photography, comprising a sub-square cropmark (CH005). Route Corridor Option B also

crosses three (no. 3) areas of high archaeological potential; Ballyfraley Stream (CH012), Dooally River (CH013) and the River Daar (CH015).

No direct impacts are predicted for any Protected Structures or structures listed on the NIAH, though Moderate Negative direct impacts are predicted for vernacular buildings in Coolacokery (AH008) and Slight Negative for the former W&LR Limerick to Tralee Line (AH007).

Overall, Route Corridor Option B is rated as **Moderate Negative**.

9.4.2.3 Route Corridor Option C

Route Corridor Option C is predicted to have quantifiable direct or indirect impacts on seventeen (no. 17) cultural heritage receptors. These include direct impacts to five (no. 5) Recorded Monuments: ringforts AY039 (LI036-080) and AY048 (LI036-134; clearly identified as a large enclosed area in LiDAR analysis), enclosures AY060 (LI036-215) and AY062 (LI036-217), which are rated as Significant Negative. The direct impact predicted for holy well AY046 (LI036-132), is rated as Moderate Negative. No evidence to support the presence of a well was noted in LiDAR analysis; but LiDAR analysis has shown AY060 to be a possible bivallate ringfort. Furthermore, the Route Corridor Option may result in a potential direct impact to ringfort AY021 (LI036-033; slight evidence for a bank associated with this monument was identified in LiDAR analysis), which is rated as Slight Negative. One (no. 1) Potentially Significant direct impact is predicted for enclosure L131-168 and a Potentially Moderate direct impact for field system L139-186. Option C would also result in a direct negative impact to one (no. 1) undesignated cultural heritage site, field system CH008; however, the significance of the impact is unknown. Route Corridor Option C also crosses four (no. 4) areas of high archaeological potential: Ehernagh Stream (CH011), the Dooally River (CH013), River Deel (CH014) and the River Daar (CH015).

One (no. 1) direct impact is predicted for the historic garden/demesne associated with Killeline House (AH006), which is listed in the NIAH Garden Survey (Ref. 1373), and will result in a Moderate Negative effect. Slight Negative potential direct impacts are predicted for vernacular buildings AH009, AH010 and AH011.

Route Corridor Option C is rated as **Major Negative**.

9.4.2.4 Route Corridor Option D

Route Corridor Option D is predicted to have quantifiable direct or indirect impacts on ten (no. 10) cultural heritage receptors. It would directly impact three (no. 3) Recorded Monuments, ringfort AY032 (LI036-061), enclosure AY062 (LI036-217) and mound AY050 (LI036-140; put forward as a possible barrow site in LiDAR analysis), which are rated as Significant Negative. Depending on the design, it also has the potential to impact ringfort AY047 (LI036-132; put forward to be a bivallate ringfort from LiDAR analysis), resulting in a Moderate Negative impact, while a Potentially Moderate negative impact is predicted for field system L139-186. Option D would result in direct negative impacts to two (no. 2) undesignated cultural heritage sites, circular cropmarks CH009 and CH010; the significance of these impacts is unknown. Route Corridor Option D also crosses two (no. 2) areas of high archaeological potential: the Dooally River (CH013) and the River Daar (CH015).

A direct impact is predicted for AH006, Killeline House historic garden/demesne (Ref. 1373), which will result in a Moderate Negative effect.

Route Corridor Option D is rated as **Major Negative**.

9.4.2.5 Route Corridor Option E

Route Corridor Option E is predicted to have quantifiable direct or indirect impacts on twenty (no. 20) cultural heritage receptors. The Route Corridor Option would directly impact two (no. 2) Recorded Monuments, ringforts AY014 (LI036-022) and AY017 (LI036-026). The impacts are rated as Moderate Negative; LiDAR analysis has shown AY014 to survive as a low relief feature and AY017 as a bivallate ringfort. The Route Corridor Option also presents a potential direct impact to enclosure AY056 (LI036-206), which is also rated as Moderate Negative. Depending on the design, there could be one (no. 1) Potentially Significant direct impact (mound L121-162) and

five (no. 5) Potential Moderate direct impacts (road L120-159, field systems L120-200, L128-174 & L135-182 and enclosure L135-181), on potential archaeological sites identified during the LiDAR assessment. Impacts of unknown significance could also occur in relation to three (no. 3) features identified on aerial photography that would be directly impacted, comprising circular cropmark CH004, oval enclosure CH003 and possible barrow CH007. Route Corridor Option E also crosses three (no. 3) areas of high archaeological potential; Ballyfraley Stream (CH012), Dooally River (CH013) and the River Daar (CH015).

No direct impacts are predicted for any Protected Structures or structures listed on the NIAH. However, Daar Bridge (AH014) would be directly impacted, resulting in a Significant Negative effect. Moderate Negative effects are predicted for two (no. 2) undesignated architectural heritage sites, vernacular buildings (AH013 & AH015), with Slight Negative effects predicted for the former railway lines (AH007 & AH012).

Overall, Route Corridor Option E is rated as **Moderate Negative**.

9.4.2.6 Route Corridor Option F

Route Corridor Option F is predicted to have quantifiable direct or indirect impacts on twenty (no. 20) cultural heritage receptors. The Route Corridor Option would directly impact one (no. 1) Recorded Monument, ringfort AY014 (LI036-022), which is rated as Moderate Negative; LiDAR analysis has shown this site to survive as a low relief feature. The Route Corridor Option also presents potential direct impacts to another three (no. 3) ringforts, AY008 (LI036-013), AY011 (LI036-016) and AY017 (LI036-026), which are also rated Moderate Negative. Depending on the design, there could be three (no. 3) Potentially Moderate direct impacts on potential archaeological sites identified during the LiDAR assessment (field systems L128-174 & L135-182 and enclosure L135-181). Impacts of unknown significance could also occur in relation to five (no. 5) features identified on aerial photography and satellite imagery that would be directly impacted, comprising circular cropmarks CH001 & CH006, oval cropmark CH002, oval enclosure CH003, and possible barrow CH007. Route Corridor Option F also crosses three (no. 3) areas of high archaeological potential: Ballyfraley Stream (CH012), Dooally River (CH013) and the River Daar (CH015).

No direct impacts are predicted for any Protected Structures or structures listed on the NIAH, although Daar Bridge (AH014) would be directly impacted, resulting in a Significant Negative effect. Moderate Negative effects are predicted for two (no. 2) undesignated architectural heritage sites, comprising two (no. 2) clusters of vernacular buildings (AH013 & AH015). Slight Negative effects are predicted for direct impacts to the sites of former railway lines AH007 and AH012.

Overall, Route Corridor Option F is rated as **Moderate Negative**.

9.4.2.7 Route Corridor Option G

Route Corridor Option G is predicted to have quantifiable direct or indirect impacts on sixteen (no. 16) cultural heritage receptors. The Route Corridor Option would directly impact two (no. 2) Recorded Monuments, ringfort AY014 (LI036-022) and AY017 (Li036-026), which are rated as Moderate Negative. LiDAR analysis has shown AY014 to survive as a low relief feature and AY017 as a bivallate ringfort. The Route Corridor Option also presents potential direct impacts to another ringfort, AY008 (LI036-013), as well as to enclosure AY056 (LI036-206), which are also rated Moderate Negative. Depending on the design, there could be three (no. 3) Potentially Moderate direct impacts on potential archaeological sites identified during the LiDAR assessment (field systems L128-174 & L135-182 and enclosure L135-181). A direct impact of unknown significance could also occur in relation to one (no. 1) feature identified on aerial photography, comprising oval enclosure CH003. Route Corridor Option G also crosses three (no. 3) areas of high archaeological potential: Ballyfraley Stream (CH012), Dooally River (CH013) and the River Daar (CH015).

No direct impacts are predicted for any Protected Structures or structures listed on the NIAH, although Daar Bridge (AH014) would be directly impacted, resulting in a Significant Negative effect. Moderate Negative effects are predicted for two (no. 2) undesignated architectural heritage sites, comprising clusters of vernacular buildings (AH013 & AH015) and Slight Negative effects are predicted for the sites of former railways (AH007 & AH012).

Overall, Route Corridor Option G is rated as **Moderate Negative**.

9.4.2.8 Route Corridor Option H

Route Corridor Option H is predicted to have quantifiable direct or indirect impacts on ten (no. 10) cultural heritage receptors. These include direct impacts to two (no. 2) Recorded Monuments, ringfort AY048 (LI036-134; clearly identified as a large enclosed area in LiDAR analysis) and enclosure AY062 (LI036-217), which are rated as Significant Negative. Two (no. 2) Potentially Significant direct impacts are predicted for enclosure L131-168 and Potential Moderate direct impacts for field system L139-186, which were identified in the LiDAR assessment. Option H will also result in direct negative impacts to two (no. 2) undesignated cultural heritage sites: circular cropmarks CH009 and CH010; however, the significance of these impacts is unknown. Route Corridor Option H also crosses two (no. 2) areas of high archaeological potential: the Dooally River (CH013) and the River Daar (CH015).

A direct impact is predicted for AH006, Killeline House historic garden/demesne (Ref. 1373), which will result in a Moderate Negative effect. A potential direct impact is predicted for undesignated vernacular building AH009, resulting in a Slight Negative effect.

Route Corridor Option H is rated as **Moderate Negative**.

9.4.2.9 Route Corridor Option I

Route Corridor Option I is predicted to have quantifiable direct or indirect impacts on fifteen (no. 15) cultural heritage receptors. It would directly impact five (no. 5) Recorded Monuments: ringforts AY032 (LI036-061) and AY039 (LI036-080), mound AY050 (LI036-140; put forward as a possible barrow site in LiDAR analysis) and enclosures AY060 (LI036-215) and AY062 (LI036-217), which are all rated as Significant Negative. LiDAR analysis has shown AY060 to be a possible bivallate ringfort. Depending on the design, it also has the potential to impact ringfort AY047 (LI036-132; put forward to be a bivallate ringfort from LiDAR analysis), resulting in a Moderate Negative impact, and ringfort AY021 (slight evidence for a bank associated with this monument was identified in LiDAR analysis), which would result in a Slight Negative impact. A Potentially Moderate negative impact is predicted for field system L139-186, while an impact of unknown significance is predicted for field system CH008. Route Corridor Option I also crosses three (no. 3) areas of high archaeological potential: the Dooally River (CH013), River Deel (CH014) and the River Daar (CH015).

One (no. 1) direct impact is predicted for the historic garden/demesne associated with Killeline House (AH006), which is listed in the NIAH Garden Survey (Ref. 1373), and will result in a Moderate Negative effect. Slight Negative potential direct impacts are predicted for vernacular buildings AH010 and AH011.

Route Corridor Option I is rated as **Major Negative** because the significance of effect predicted for impacts at four Recorded Monuments are considered to be Significant; in quantitative terms this Option poses the greatest number of such potential impacts, with one of those being a direct impact on the site of a possible burial mound (AY050).

Table 9.14: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Impact Level/ Significance of Effect	PAG Unit 7.0 Score
Option A	Moderate Negative	**2**
Option B	Moderate Negative	**2**
Option C	Major Negative	**1**
Option D	Major Negative	**1**
Option E	Moderate Negative	**2**

Route Corridor Option	PAG Unit 7.0 Impact Level/ Significance of Effect	PAG Unit 7.0 Score
Option F	Moderate Negative	**2**
Option G	Moderate Negative	**2**
Option H	Moderate Negative	**2**
Option I	Major Negative	**1**

9.5 Conclusions

During the identification of the Route Corridor Options, every effort was made to avoid known archaeological and architectural heritage sites wherever possible. However, all Route Corridor Options are likely to have a net adverse effect on cultural heritage to a moderate or major degree. In addition, all Route Corridor Options have the potential to encounter currently unrecorded archaeological sites and other cultural heritage features. The likely impact of the selected preferred option will be assessed in more detail during next project phase (i.e. Phase 3 Design and Environmental Evaluation).

The assessment found that Route Corridor Option A, B, E, F, G and H would have a Moderate adverse impact and Route Corridor Options C, D and I would have a Major adverse impact, for the reasons outlined in Section 9.4.2 above.

9.6 References

Anon 1980. The story of Limerick's railways. *Limerick Weekly Echo* (December 6), 9. Available at: rail003.pdf (limerickcity.ie) [Online]. Accessed 12.07.21.

Bayliss, A. & Woodman, P.C. 2009. A new Bayesian chronology for Mesolithic occupation at Mount Sandel, Northern Ireland. *Proceedings of the Prehistoric Society* **75**, 101–23.

Bonsall, J. 2021. Report for N21 Newcastle West Road Scheme – Phase 2 LiDAR Archaeological Assessments. Unpublished report prepared by Archaeological Management Solutions for Limerick City and County Council.

Caulfield, S., O'Donnell, R.G. and Mitchell, P.I. 1998. ^{14}C dating of a Neolithic field system at Céide Fields, County Mayo, Ireland. *Radiocarbon* **40**, 429–40.

Cody, E. 1981. A hill-fort at Ballylin, County Limerick, with a note on Mooghaun, County Clare. *The Journal of the Royal Society of Antiquaries of Ireland*, Vol. **111**, 70–80.

Collins, T. 2009. Hermitage, Ireland: life and death on the western edge of Europe. In S.B. McCartan, R.J. Schulting, G. Warren & P.C. Woodman (eds), *Mesolithic Horizons: papers presented at the seventh international conference on the Mesolithic in Europe, Belfast 2005*, 876–9. Oxbow Books: Oxford.

Collins, T. and Coyne, F. 2003. Fire and Water: Early Mesolithic Cremations at Castleconnell, Co. Limerick. *Archaeology Ireland* **64**, 24–7.

Cooney, G. 2000. *Landscapes of Neolithic Ireland*. Routledge: Abingdon.

DAHG. 2011. *Architectural Heritage Protection Guidelines for Planning Authorities.* The Stationery Office: Dublin.

DAHGI 1999. *Framework and Principles for the Protection of the Archaeological Heritage.* The Stationary Office: Dublin.

Delaney, S. 2014. Burnt mounds, roundhouse, charcoal-production kiln and vernacular cottage. *North Munster Antiquarian Journa*l **54**, 43–59.

DHLGH 2021. *NIAH Handbook*. Available for download at: https://www.buildingsofireland.ie/app/uploads/2021/03/NIAH-Handbook-Edition-March-2021.pdf

Duffy, P. 2004. Townlands: territorial signatures of landholding and identity. In B.S. Turner (ed.), *The Heart's Townland: marking boundaries in Ulster*, 18–38. Ulster Local History Trust & the Cavan-Monaghan Rural Development Co-operative Society.

Edwards, N. 1996. *The Archaeology of Early Medieval Ireland*. Routledge: London.

EPA 2002. *Guidelines on the information to be contained in Environmental Impact Statements.* Environmental Protection Agency: Dublin.

EPA 2003. *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).* Environmental Protection Agency: Dublin.

EPA 2015. *Advice Notes for Preparing Environmental Impact Statements DRAFT September 2015*. Environmental Protection Agency: Dublin.

EPA 2017. *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.* Environmental Protection Agency: Dublin.

Fitzpatrick, E. 2009. Native enclosed settlement and the problem of the Irish 'ring-fort', *Medieval Archaeology* **53**, 271–307.

Hawkes, A. 2015. *Fulachtaí fia* and Bronze Age cooking in Ireland: reappraising the evidence, *Proceedings of the Royal Irish Academy* **115C**, 47–77.

Lewis, S. 1837. *A Topographical Dictionary of Ireland. Vols. 1 & 2*. S. Lewis & Co: London. Available for download at: Newcastle (Limerick) - Topographical Dictionary of Ireland (1837) (libraryireland.com)

LCCC 2014. *Newcastle West Local Area Plan 2014–2020* (Extended Until August 2024). Available for download at: https://www.limerick.ie/council/services/planning-and-property/development-plans/local-area-plan-newcastle-west

Lynch, A. 2014. *Poulnabrone: an Early Neolithic portal tomb in Ireland*. Department of Arts, Heritage and the Gaeltacht, Archaeological Monograph Series 9: Dublin.

McCormack, A.M. 2005. *The Earldom of Desmond, 1463–1583: the decline and crisis of a feudal lordship*. Four Courts Press: Dublin.

McErlean, T. 1983. The Irish townland system of landscape organisation. In T. Reeves-Smyth & F. Hamond (eds.), *Landscape Archaeology in Ireland*, 315–39. BAR British Series **116**. Archaeopress: Oxford: BAR.

Ní Ghabhláin, S. 1996. The Origin of Medieval Parishes in Gaelic Ireland: the evidence from Kilfenora. *Journal of the Royal Society of Antiquaries of Ireland*, Vol. **126**, 37–61.

NRA 2005a. *Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes*. Available at: https://www.tiipublications.ie/downloads/SRM/12-Archaeology-Planning-Guidelines-2005.pdf

NRA 2005b. *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

NRA 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

Nugent, P. 2007. *The Gaelic Clans of County Clare and their Territories 1100–1700 A.D.* Geography Publications: Dublin.

O'Brien, W. and O'Driscoll, J. 2017. *Hillforts, Warfare and Society in Bronze Age Ireland*. Archaeopress: Oxford.

O'Connor, P.J. 1987. *Exploring Limerick's Past: An Historical Geography of Urban Development in County and City*. Orieacht na Mumhan Books: Newcastle West.

O'Conor, K. 1998. *The Archaeology of Medieval Rural Settlement in Ireland*. Discovery Programme Monograph **3**: Dublin.

Ó Danachair, C. 1955. The holy wells of Co. Limerick. *Journal of the Royal Society of Antiquaries of Ireland* **LXXXV**, 193–217.

O'Donovan, J. 1839–40. *Field Name Books of the County and City of Limerick with the Place-Names, English and Irish as explained and fixed by John O'Donovan. Ordnance Survey of Ireland 1839–40* (unpublished). Available at: http://www.limerickcity.ie/Library/LocalStudies/FieldNameBooksofLimerick/

O'Sullivan, A., McCormick, F., Kerr, T.R. & Harney, L. 2013. *Early Medieval Ireland AD 400-1100. The Evidence from Archaeological Excavations.* Royal Irish Academy: Dublin.

Ruddy, V.P. 2015. Dublin 1843: O'Connell's Repeal Meetings. *Dublin Historical Record*, Vol. **68** (**1**), 60–70.

Schulting, R.J., Murphy, E., Jones, C. & Warren, G. 2012. New dates from the north and a proposed chronology for Irish Court Tombs. *Proceedings of the Royal Irish Academy* **112C**, 1–60.

Smyth, W.J. 2012a. The Roles of Cities and Towns During the Great Irish Famine. In J. Crowley, W.J. Smyth & M. Murphy (eds) *Atlas of the Great Irish Famine, 1845–52*, 240–54. Cork University Press: Cork.

Smyth, W.J. 2012b. The Province of Munster and the Great Irish Famine. In J. Crowley, W.J. Smyth & M. Murphy (eds.) *Atlas of the Great Irish Famine, 1845–52*, 358–70. Cork University Press: Cork.

Smyth, W.J. 2012c. Exodus from Ireland – Patterns of Emigration. In J. Crowley, W.J. Smyth & M. Murphy (eds.) *Atlas of the Great Irish Famine, 1845–52*, 492–503. Cork University Press: Cork.

Stout, M. 1997. *The Irish Ringfort*. Dublin. Four Courts Press: Dublin.

Stout, M. 2015. Early Medieval Settlement on Lough Ree, in B. Cunningham & H. Murtagh (eds.), *Lough Ree Historic Lakeland Settlement*, 70–82. Four Courts Press: Dublin.

TII. 2016. *Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis* (PE-PAG-02031). Available at: https://www.tiipublications.ie/library/PE-PAG-02031-01.pdf

Waddell, J. 2000. *The Prehistoric Archaeology of Ireland*. Wordwell: Bray.

Westropp, T.J. 1904–5. A survey of the ancient churches of the County of Limerick, *Proceedings of the Royal Irish Academy* **XXV**, 327–480.

Whittle, A., Healy, F. & Bayliss, A. 2011. *Gathering Time: dating the Early Neolithic enclosures of southern Britain and Ireland*. Oxbow Books: Oxford.

Woodman, P.C. 2011. Making yourself at home on an island: the first 1000 years (+?) of the Irish Mesolithic. *Proceedings of the Prehistoric Society* **78**, 1–34.

Woodman, P.C., Dowd, M., Fibiger, L., Carden, R.F. & O'Shaughnessy, J. 2018. Archaeological excavations at Killuragh Cave, co. Limerick: a persistent place in the landscape from the Early Mesolithic to the Late Bronze Age. *The Journal of Irish Archaeology* **26**, 1–32.

10. Material Assets/Non-Agricultural Properties

10.1 Introduction

This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options. These corridors are made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment. This assessment has been completed by Jacobs.

TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis (2016) requires the assessment of Non-Agricultural Properties.

The TII Guidelines noted above specifically defines Non-Agricultural Properties as

> "*affected properties and types of land classed as commercial, recreational, open space, minerals and public facilities (hospitals, schools, and religious institutions) which are not of an agricultural nature are considered under the heading of Non-Agricultural Properties*".

This definition is similar to the definition of Community Assets within the DMRB Sustainability and Environmental Appraisal, LA112 Population and human health guidelines (2020) for Population and Human Health which includes 'village halls, healthcare facilities, education facilities, religious facilities, village greens, open green space, allotments, sports pitches etc'. Therefore, in the absence of specific TII guidance for the assessment of Non-Agricultural Properties or Material assets, this assessment will be conducted in line with these DMRB guidelines. For consistency throughout Stage 1 and 2 of this process and onwards to Phase 3, Environmental Impact Assessment, this chapter is to be referred to as Material Assets (Non-Agricultural). Material Assets can be defined as resources that are valued and that are intrinsic to specific places. They may be of either human or natural origin and the value may arise for either economic or cultural reasons. (EPA, 2003)

10.2 Methodology

In line with the TII Guidelines and the DMRB guidelines identified above, the receptor types *included* in the assessment comprise the following:

- Community properties – hospitals, schools, religious institutions, public parks, open spaces or lands that are used for recreation amenity, etc (as shown in Volume 2, Figure 10.1);
- Commercial properties (i.e. businesses) (as shown in Volume 2, Figure 10.1); and
- Development land – lands or sites zoned for development within the County Development Plan. Lands zoned for development within the County Development Plan are shown on Volume 2, Figure 10.2.

Commercial properties (businesses) will be considered in terms of a "community asset" / amenity in line with the DMRB guidelines. This assessment does not consider the impact on a business in terms of impact on trading; although it is noted that positive or negative impacts on businesses could occur as a result of changes to passing trade. The information *relating* to how this might affect different businesses is not available at this stage of the assessment and would be considered as part of a socio-economic assessment at Phase 3: EIAR. This assessment, therefore, focuses on the impact to businesses as an amenity to the wider community and considers the potential for impacts which are directly measurable, including loss of land, impacts to existing access, and changes in traffic, noise and disruption compared to the existing baseline.

All businesses are considered to be key assets to the local community as they are an important source of employment and services. However, at this phase of the assessment, all local businesses in the Study Area have not been individually mapped. The location of properties and businesses have been taken into account as far as possible in the routing of the Route Corridor Options. These include but are not limited to Ashgrove Meats, Pallas Foods and Ballyconway Transport Ltd. Any direct impacts to businesses will be avoided as far as possible, ensuring access to these key employment sources are not impeded. Any direct impacts to businesses will be fully assessed at Phase 3 as part of the Environmental Impact Assessment.

Material Assets assessments often includes an assessment of impacts on key infrastructure such as transport, waste *management* and utilities such as energy and water. These are not included in this assessment as they have been assessed elsewhere:

- Transport infrastructure in relation to the road network has been assessed as part of the engineering assessment (See Volume 1 of this Option Selection Report) and infrastructure relevant to active travel has been assessed as part of the Physical Activity Appraisal (See Volume 1 Section 9.9);
- Waste has been assessed within Section 6 of this report; and
- Utilities have been assessed as part of the Stage 1 Assessment and the locations of key utilities are shown in Figures 13.1, 13.2 and 13.3, Volume 2 of this Option Selection Report.

Residential properties are not included in this section. The proximity of properties to the route corridor has been considered within the Air Quality and Noise assessments, therefore, to avoid double counting, properties have not been included in this section. *Additionally*, it is not possible at this Phase of the project to reasonably assess the potential acquisitions of properties. The acquisition of properties is dependent on a number of factors including the detail of the proposed alignment within the 400m corridor, which will be designed at the next Phase (Phase 3 – EIA) of the project. Impacts to access to properties have been avoided as far as possible in the identification of Route Corridor Options and will be assessed in detail at the next Phase of the project. Similarly, any changes as a result of amendments to the road network (e.g., road closures) will be assessed at the next Phase.

10.2.1 Data, Information and Sources

The following data sources *have* been used in this chapter:

- Aerial photography and mapping of Study Area (GSI, OSI and online sources);
- Surveys from publicly accessible lands;
- Limerick County Development Plan 2010-2016 (https://www.limerick.ie/council/services/planning-and-property/development-plans/county-development-plan);
- Newcastle-West Local Area Plan 2014-2020 (extended to 2024) https://www.limerick.ie/sites/default/files/media/documents/2019-05/Newcastle-West-Local-Area-Plan-Extended-until-2024.pdf);
- IPCC licensed facilities - EPA Historic landfill sites – Limerick County Council;
- Schools/colleges - Department of Education and Skills;
- Industrial estates and places of worship - online sources;
- Sports clubs, community centres and scenic routes - county council data;
- Nursing homes - Health Service Executive;
- Hotel spas and golf clubs - Fáilte Ireland; and
- Trails - Sport Ireland.

10.2.2 Assessment Methodology

The methodology for *assessing* the impact of the proposed Route Corridor Options on Non-Agricultural Material Assets comprised of the following:

- A desktop survey and a survey from publicly accessible land to identify any community assets of value. Community Assets within the Route Corridor Option and as far as 300m equating to a total width of 1km were identified;

- Using the Stage 2 Project Appraisal Matrix in Step 4 of the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis[68] and the DMRB guidelines on Population and Human Health[69] the assessment was undertaken on each option to include:
- quantitative (no. of receptors impacted); and
- qualitative (sensitivity of the receptor and magnitude of the impact) assessment.
- The sensitivity of each asset was determined based on the nature and setting of the property;
- The magnitude of the impact on each asset was considered to determine the overall impact. The windscreen survey allowed a greater understanding of the magnitude of impacts on certain receptor; and
- The significance of the overall impact of each Route Corridor Option was then determined based on professional judgement on the sensitivity and magnitude of the impacts on each receptor in combination along that Route Corridor Option.

10.2.3 Assessment Criteria

The comparative evaluation of Route Corridor Options was assisted by scoring the level of impacts of each Route Corridor Option using the Stage 2 Project Appraisal Matrix in Step 4 of the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. Each Route Corridor Option is assigned a level of significance in terms of its overall effects and is scored based on a seven-point scale ranging from 1 (Major Negative) to 7 (Major Positive). As discussed in Section 10.2.2, in order to determine the potential overall effect, sensitivity of each individual receptor and magnitude of each impact must be determined first.

10.2.3.1 Determining individual impacts to receptors

The sensitivity of each *receptor* was determined using the criteria detailed in Table 10.1.

Table 10.1: Criteria for determining sensitivity of receptors (informed by DMRB guidelines)

Receptor Sensitivity	Description
High	Receptors which are the following: • there is little or no capacity to experience changes without resulting in disruption to its quality and integrity; and • there are no reasonable alternative facilities available, or they are only available in the wider local planning authority area; and • the level of use among the community is frequent (daily).
Medium	Receptors which are one or more of the following: • there is some limited or average capacity to experience changes without resulting in disruption to its quality and integrity; and • some limited reasonable alternative facilities are available at a local level within adjacent communities; and / or • the level of use among the community is reasonably frequent (weekly - monthly).
Low	Receptors which are one or more of the following: • there is a suitable capacity to experience changes without resulting in disruption to its quality and integrity; or • there are reasonable alternative facilities available within the same community or at a local level within the wider community; or • the level of use among the community is infrequent (monthly or less frequent).

[68] TII. 2016. Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.
[69] Highways England, Transport Scotland, Llywodraeth Cymru, Department for Infrastructure, January 2020. Design Manual for Roads and Bridges, Sustainability and Environmental Appraisal, LA 112 Population and Human Health.

In combination with the sensitivity of the receptor to change, the magnitude of the impact will help determine the level or significance of *impact* on the receptor and as a result of the Route Corridor Option. The magnitude of impacts on individual receptors was determined using the criteria detailed in Table 10.2.

Table 10.2: Criteria for determining magnitude of impacts (informed by DMRB guidelines)

Magnitude of Impact	Criteria
High Negative	Loss of the entire receptor due to permanent closure or to loss of the receptor/site or a significant area of land vital to the functioning of the receptor leaving it unusable for its intended purpose; or Permanent and significant disruption to quality and integrity of receptor preventing it from continuing to provide its function or serve its' purpose for the community.
Medium Negative	Loss of part of receptor or some lands associated with the receptor changing the way in which the receptor to provide its intended purpose for the community; and / or Permanent disruption to the quality and integrity of receptor changing the way in which the receptor performs its intended purpose for the community.
Low Negative	Loss of a small area of land which is unessential to the functioning of the receptor; and / or Minor or temporary disruption to the quality and integrity of receptor however its function for the community continues in the same manner.
Negligible / Slight	Results in an impact on receptor but of insufficient magnitude to affect either use or integrity.
Low Beneficial	Results in minor improvement of receptor quality and integrity such as small decreases in noise, disturbance and traffic or increased business/trade as a result of a small increase in through traffic.
Medium Beneficial	Results in moderate improvement of receptor quality and integrity such as moderate decreases in noise, disturbance and traffic or an increase in business/trade as a result of a moderate increase in through traffic.
High Beneficial	Results in major improvement of receptor quality and integrity such as significant decreases in noise, disturbance and traffic or an increase in business/trade as a result of a significant increase in through traffic.

10.2.3.2 Determining Significance of Effect of Each Route Corridor Option

The Significance of *Effect* of each Route Corridor Option was determined based on the combination of impacts on receptors along the entire Route Corridor Option. Each Route Corridor Option will be assigned a score based on the PAG Guidelines.

The criteria for the *seven*-point scale as shown in Table 10.3 and a number was assigned according to the significance of the effect.

Table 10.3: Key for Scoring Effects

Score	Significance of Effect	Criteria
7	Major Positive	High magnitude positive impacts on multiple High sensitivity receptors within the Route Corridor Option and no Negligible or Negative Impacts any receptors
6	Moderate Positive	Medium magnitude positive impacts on more than one High or Medium sensitivity receptor and no Negligible or Negative Impacts
5	Minor or Slightly Positive	Low magnitude positive impacts on at least one receptor and no Negligible or Negative Impacts
4	Not Significant or Neutral	No impacts / A small number of Negligible Magnitude Impacts on Medium or Low sensitivity receptors
3	Minor or Slightly Negative	Mostly Low Magnitude Impacts on High – Low sensitivity receptor or Medium Magnitude impacts on no more than one High sensitivity receptors and no more than two Medium sensitivity receptors.
2	Moderate Negative	Medium Magnitude Impacts on more than one High sensitivity receptors within the Route Corridor Option.
1	Major Negative	High Magnitude Impacts on one or more than one High sensitivity receptors within the Route Corridor Option.

Positive impacts are not considered because only receptors within the Route Corridor Options and 300m beyond are scoped into the assessment and there is potential for positive impacts beyond this scope. At Stage 3 (EIAR) the assessment will consider impacts to all *relevant* receptors within the Study Area.

10.3 Existing Environment

The constraints in the Study *Area have* been mapped are presented in Volume 2, Figures 10.1 of this Option Selection Report.

10.3.1 Key Communities

The Study Area is rural in nature *and* the largest key community is the town of Newcastle West. There are a number of other smaller settlements within the Study Area which include Ballyconway, Ballymackessy, Killaready, Killoughteen, Ballylahiff and Ballingowan.

10.3.2 Key Receptors

Identified community assets collated from the desktop and surveys from publicly accessible lands are mapped in Volume 2, Figures 10.1 of this Option Selection Report. Receptors within each Route Corridor Option are detailed in the Table 10.4 below and have been assigned a sensitivity rating in accordance with Table 10.1 above. It is important to note that this sensitivity to change rating does not necessarily reflect or correlate to the importance of the business to the community. It is a measure of the receptors ability to experience change without affecting its ability to keep performing its *purpose* for the community. It is a measure of the receptors' ability to experience change without affecting its *ability* to keep performing its purpose for the community.

There are no High sensitivity receptors in the Study Area, however, there are five Medium sensitivity receptors impacted by the proposed *Route* Corridor Options.

- Three of these medium sensitivity receptors are B&B's; Ballingowan House B&B, The Orchard B&B and Shanagarry B&B. All have low or negligible magnitude impacts from Route Corridor Options C, D, H and I as a result of increased noise or disturbance to the properties.

- Pallas Foods is considered to be medium sensitivity as it is considered a key employment hub within the town and is a key food supplier locally and regionally. Pallas Foods is within the 400m corridor of Route Corridor Option A, B, E, F and G, therefore there is potential for some loss of land. This loss of land however is highly unlikely; therefore, impacts are deemed to be low.

- St. Bridget's Holy Well is considered to be medium sensitivity receptor due to its religious setting. It is 35m from the edge of Route Corridor Options D and I, therefore there is some potential for increased noise and disturbance to the setting of this receptor. All other receptors are of low sensitivity.

Table 10.4: Receptors within 1km buffer of a Route Corridor Centreline and Sensitivity

Community Assets	Receptor Category	Sensitivity to change Rating	Rationale
Ballingowan House B&B	Local Commercial / Tourism	Medium	This business may rely somewhat but not solely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is Medium because its operation would be more sensitive to a new road scheme which could impact on setting and tranquillity of the accommodation.
The Orchard B&B	Local Commercial	Medium	This business does rely somewhat but not solely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is Medium because its operation would be more sensitive to a new road scheme which could impact on setting and tranquillity of the accommodation.
Shanagarry B&B	Local Commercial	Medium	This business does rely somewhat but not solely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is Medium because its operation would be more sensitive to a new road scheme which could impact on setting and tranquillity of the accommodation.
St. Brigid's Holy Well	Place of Worship	Medium	This amenity may benefit somewhat but not solely on passers-by. Access to the amenity will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is medium because its operation would be more sensitive to a new road scheme which could impact on setting and tranquillity of the amenity.
Pallas Foods	Local Commercial	Medium	This business does not necessarily rely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is medium because its employs a larger number of people than other business in the area therefore it's operation would be more sensitive to a new road scheme or the construction of a new road scheme.
Limerick Greenway	Local Recreational / Community	Low	Regional recreational amenity. Users would have a capacity to experience a reasonable degree of change without resulting in significant disruption to

			the quality and integrity of the receptor due to existing nature of the greenway by roadsides.
Ashgrove Meats	Local Commercial	Low	This business does not heavily rely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Aileen Downey Chiropodist	Local Community	Low	This business does not heavily rely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Tyres and Auto Services	Local Commercial	Low	This business does rely somewhat but not solely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Ballyconway Transport Ltd	Local Commercial	Low	This business does not heavily rely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Cahills Farm Cheeses Ltd	Local Commercial	Low	This business does not heavily rely on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Gary Brogan Tractor Sales	Local Commercial	Low	This business does not rely heavily on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Dolmen Guitars	Local Commercial	Low	This business does not rely heavily on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.
Perfect Paws	Local Community	Low	This business does not rely heavily on passing trade. Access to the business will be maintained regardless of which Route Corridor Option is selected. The sensitivity to change is low because its operation would be less sensitive to a new road scheme.

10.4 Assessment of Route Corridor Options

10.4.1 Assessment of Potential Impacts

10.4.1.1 Types of Impacts likely to occur

The impacts which are likely to occur as a result of the Project range from loss of the receptor or loss of lands associated with the receptor to more general disruption and disturbance which may impact the quality and integrity of a receptor.

Land Loss

Some receptors will be more sensitive to land loss such as historic or heritage sites such as churches which are irreplaceable in terms of their historic setting. Depending on individual receptors and the location and size of an area of land lost, the impact on receptors will vary. The magnitude of impacts will be determined based on whether the receptor can continue to perform its intended purpose for the community. It is unlikely that there would be any positive impacts from any land loss.

Disruption and Disturbance

The impacts on the integrity and quality of receptors will also vary depending on the receptor type. For example, the integrity and quality of some community receptors such as schools, churches and care homes may be negatively impacted by increased disruption and disturbance as a result of increased noise and/or traffic whereas other community receptors such as sports and recreational facilities will be less vulnerable to such changes. There is also potential for positive impacts with regards to disruption and disturbance; a receptor which is sensitive to noise for example a school or church, may be affected in a positive way if they are close to or on the existing N21 and the level of traffic passing by decreased by being directed away from the existing N21 to a re-aligned or proposed new route. Some businesses may be less vulnerable to increases in noise with the exception of businesses which have gardens that are critical to their successful operation, for example pubs and hotels or B&B's which have gardens popular with visitors.

Access and Severance

Businesses may be positively or negatively impacted if they have an increased or decreased level of through traffic or changed accessibility as result of the Project. Direct impacts to businesses will be assessed in more detail at Phase 3 as part of the Environmental Impact Assessment as part of the socio-economic assessment.

Community Severance will be assessed in Phase 3 of the Project; however, it has been considered as part of this Phase 2 Stage 2 assessment and Route Corridor Options have been identified which avoid causing severance of communities as far as possible. However, the Project will involve offline development which may impact rural communities. This will be considered in more detail within the next phase of the project (Phase 3: Environmental Impact Assessment). The potential locations of junctions were not included in the environmental assessment and will be assessed at the next phase of the project.

10.4.1.2 Summary of impacts on key receptors within the Study Area

Table 10.5 illustrates the results of the full impact assessment of all receptors within the 400m wide Route Corridor Options and 300m either side of the Route Corridor Options.

As illustrated in Table 10.5, most receptors will not be impacted at all by any of the Route Corridor Options due to being further than 300m from the Route Corridor Option boundary and are marked (N/A). Receptors with potential to be impacted from the Route Corridor Options are anticipated to experience either low or negligible impacts.

A number of Route Corridor Options (C, D, H and I) intersect with lands zoned for development within the Newcastle West Area Plan. These lands are zoned for Agriculture, Existing and Proposed Residential, Education and Community Facilities, Enterprise and Employment, Town Centre, Mixed-Use, Open Space and Recreation, Utilities. It is not anticipated that these Route Corridor Options will result in significant enough land take to result in any more than a low magnitude impact on zoned areas.

Table 10.5: Assessment of impacts on receptors within the 1km of the centreline of a Route Corridor Option

Community Assets	Magnitude of Impact by Route Corridor Options								
	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
High Sensitivity									
None									
Medium Sensitivity									
Ballingowan House B&B	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	Low
The Orchard B&B	N/A	N/A	N/A	Low	N/A	N/A	N/A	Low	N/A
Shanagarry B&B	N/A	N/A	N/A	Negligible	N/A	N/A	N/A	N/A	Negligible
Pallas Foods	Low	Low	N/A	N/A	Low	Low	Low	N/A	N/A
St. Brigids Holy Well	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A	Low
Low Sensitivity									
Limerick Greenway	Low	N/A	N/A	N/A	Low	Low	Low	N/A	N/A
Ashgrove Meats	Low	N/A	N/A	N/A	Low	Low	Low	N/A	N/A
Aileen Downey Chiropodist	Low	Negligible	N/A	N/A	Low	Low	Low	N/A	N/A
Tyres and Auto Services	Low	N/A	N/A	N/A	Low	Low	Low	N/A	N/A
Perfect Paws	N/A	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ballyconway Transport Ltd	N/A	Negligible	Low	N/A	N/A	Negligible	Negligible	Low	N/A
Cahills Farm Cheeses Ltd	N/A	N/A	Low	Negligible	N/A	N/A	N/A	Negligible	Low
Gary Brogan Tractor Sales	N/A	Negligible	N/A	Negligible	N/A	Negligible	Negligible	N/A	Negligible
Dolmen Guitars	N/A	N/A	Negligible	N/A	N/A	N/A	N/A	Negligible	N/A
Zoned Land									

Community Assets	Magnitude of Impact by Route Corridor Options								
	Option A	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I
Limerick: Urban and Rural Settlement Strategy, Residential, Economic Development, Community and Recreation, Environment and Heritage, Transport and Infrastructure, The Shannon Estuary	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Newcastle West: Agriculture, Existing and Proposed Residential, Education and Community Facilities, Enterprise and Employment, Town Centre, Mixed-Use, Open Space and Recreation, Utilities	N/A	N/A	Low	Low	N/A	N/A	N/A	Low	Low
Overall Significance Effect	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative

10.4.2 Assessment of Effects of Route Corridor Options

All Route Corridor Options are considered to have Minor Negative impacts overall due to a combination of negligible and low magnitude impacts on a number of receptors. Despite having similar impact ratings there are minor differentiations between Route Corridor Options.

10.4.2.1 Route Corridor Option A

Route Corridor Option A has Low magnitude impacts on a number of Low sensitivity receptors including the Limerick Greenway, Ashgrove Meats, Aileen Downey Chiropodist and Tyres and Auto Services. The Limerick Greenway is a regional recreational amenity which would have capacity to experience a reasonable degree of change without resulting in significant disruption to the quality and integrity of the receptor due to existing nature of the greenway by roadsides. The Route Corridor Option crosses the greenway on two occasions, however considering existing crossings and location alongside roadsides, it is determined that this Route Corridor Option only has a Low magnitude impacts on this receptor. Ashgrove Meats and Aileen Downey Chiropodist and Tyres and Auto Services do not rely heavily on passing trade and access to the businesses will be maintained therefore the impacts on these receptors are deemed to be low due to the location of these businesses to the Route Corridor Option and their sensitivity to change.

The indicative R521 link road which was assessed in association with Route Corridor Option A (Blue) has potential to have a Low magnitude impacts to the Medium sensitivity receptor, Pallas Foods. This amenity may benefit somewhat but not solely on passers-by. The sensitivity to change is Medium because its operation would be more sensitive to the construction of new road as it is one of the largest employment hubs in the Study Area. However, access to the site will be maintained therefore impacts will be temporary during construction and of low magnitude. Therefore, the overall effect will be Minor Negative.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.2 Route Corridor Option B

Route Corridor Option B impacts the lowest number of receptors. It has Low magnitude impacts to the Medium sensitivity receptor, Pallas Foods. This amenity may benefit somewhat but not solely on passers-by. The sensitivity to change is Medium because its operation would be more sensitive to the construction of new road as it is one of the largest employment hubs in the Study Area. A small proportion of the site is located within the 400m corridor; however, it is considered that direct impacts to the lands will be unlikely due to a number of other constraints in the area.

The Route Corridor Option also results in low magnitude impacts on one other low sensitivity receptor which may be vulnerable to noise, Perfect Paws Kennels. The receptor is also within the Route Corridor, however, similarly, loss of land is unlikely due to a number of other constraints in the area.

All other receptors have negligible impacts. Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.3 Route Corridor Option C

Route Corridor Option C has potential to impact on the Medium sensitivity Ballingowan House B&B. The receptor is on the edge of the 400m corridor and has potential to be impacted from noise and disturbance, particularly the gardens of the property as a result of the new road to the south and south east of the property. However, the receptor is located on the existing N21, therefore this will not be a significant change to the existing environment and impacts are expected to be of low magnitude.

Two Low sensitivity receptors, Ballyconway Transport Ltd and Cahills Farm Cheeses Ltd are within the 400m corridor of Option C. Both sites are fully within the 400m corridor, however it is assumed that with the constraints within the area, it is unlikely that there will be significant loss of land impacting the businesses, therefore impacts are considered to be Low magnitude.

The Route Corridor Option intersects lands zoned for development. including Proposed Residential Development and Existing Residential. However, these intersections are very minor and should not significantly impact the

development of these areas in line with the zoning, therefore it is anticipated that there would be a Low magnitude impact.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.4 Route Corridor Option D

Route Corridor Option D has potential to impact on the Medium sensitivity The Orchard B&B. The receptor is within the 400m corridor and has potential to be impacted from noise and disturbance to the property as a result of the new road to the south and south east of the property. The receptor is on the existing N21 and the proposed Route Corridor ties in on the other side of the road, therefore this will not be a significant change to the existing environment and impacts are expected to be of Low magnitude.

Route Corridor Option D has Negligible impacts on Shanagarry B&B as it is approximately 280m from the Route Corridor Option boundary. The bypassing of the B&B will not be considered in determining impact of Route Corridor Options as all proposed Route Corridor Options will result in bypassing of Shanagarry B&B.

Route Corridor Option D has a low magnitude of impact to a Medium sensitivity receptor, St. Brigid's Holy Well. This amenity would have some capacity to experience changes without resulting in significant disruption to the quality and integrity of the receptor due to existing location of the site by the roadside. However, this option would result in additional disturbance from noise and traffic to the south and south west of the site in addition to the existing N21 to the north of the site, therefore this Route Corridor Option would have a Low magnitude impact on this receptor.

The Route Corridor Option intersect a slightly larger area of lands zoned for development than other Route Corridor Options, including Proposed Residential Development and Existing Residential and Open Space, Utilities, Enterprise and Employment and Agriculture. However, these intersections are very minor and should not significantly impact the development of these areas in line with the zoning, therefore it is anticipated that there would be a Low magnitude of impact.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.5 Route Corridor Option E

Route Corridor Option E (Blue Alt) has Low magnitude impacts on a number of Low sensitivity receptors including the Limerick Greenway, Ashgrove Meats, Aileen Downey Chiropodist and Tyres and Auto Services. The Limerick Greenway is a regional recreational amenity, which would have capacity to experience a reasonable degree of change without resulting in significant disruption to the quality and integrity of the receptor due to existing nature of the greenway by roadsides. The Route Corridor Option crosses the greenway on two occasions, however considering existing crossings and location alongside roadsides, it is determined that this Route Corridor Option only has a Low magnitude impacts on this receptor. Ashgrove Meats and Aileen Downey Chiropodist and Tyres and Auto Services do not rely heavily on passing trade and access to the businesses will be maintained therefore the impacts on these receptors are deemed to be Low in magnitude due to the location of these businesses to the Route Corridor Option and their sensitivity to change.

The indicative R521 link road which was assessed in association with Option E (Blue Alt) has potential to have a Low magnitude impacts to the Medium sensitivity receptor, Pallas Foods. This amenity may benefit somewhat but not solely on passers-by. The sensitivity to change is medium because its operation would be more sensitive to the construction of new road as it is one of the largest employment hubs in the Study Area. However, access to the amenity will be maintained therefore impacts will be temporary during construction and of low magnitude. A small proportion of the site is located within the Route Corridor; however, it is considered that direct impacts to the lands will be unlikely. Therefore, the overall effect will be Low magnitude.

The Route Corridor Option also results in Negligible magnitude impacts on two low sensitivity receptors, Cahill Cheeses and Gary Brogan Tractor Sales.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.6 Route Corridor Option F

Route Corridor Option F has Low magnitude impacts on a number of Low sensitivity receptors including the Limerick Greenway, Ashgrove Meats, Aileen Downey Chiropodist and Tyres and Auto Services. The Limerick Greenway is a regional recreational amenity, which would have capacity to experience a reasonable degree of change without resulting in significant disruption to the quality and integrity of the receptor due to existing nature of the greenway by roadsides. The Route Corridor Option crosses the greenway on two occasions, however considering existing crossings and location alongside roadsides, it is determined that this Route Corridor Option only has a low magnitude impact on this receptor. Ashgrove Meats and Aileen Downey Chiropodist and Tyres and Auto Services do not rely heavily on passing trade and access to the businesses will be maintained therefore the impacts on these receptors are deemed to be low due to the location of these businesses to the Route Corridor Option and their sensitivity to change.

The indicative R521 link road which was assessed in association with Option F has potential to have a Low magnitude impacts to the Medium sensitivity receptor, Pallas Foods.

The Route Corridor Option also results in Negligible magnitude impacts on two low sensitivity receptors, Ballyconway Transport and Gary Brogan Tractor Sales.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.7 Route Corridor Option G

Route Corridor Option G has Low magnitude impacts on a number of Low sensitivity receptors including the Limerick Greenway, Ashgrove Meats, Aileen Downey Chiropodist and Tyres and Auto Services. The Limerick Greenway is a regional recreational amenity, which would have capacity to experience a reasonable degree of change without resulting in significant disruption to the quality and integrity of the receptor due to existing nature of the greenway by roadsides. The Route Corridor Option crosses the greenway on two occasions, however considering existing crossings and location alongside roadsides, it is determined that this Route Corridor Option only has a low magnitude impacts on this receptor. Ashgrove Meats and Aileen Downey Chiropodist and Tyres and Auto Services do not rely heavily on passing trade and access to the businesses will be maintained therefore the impacts on these receptors are deemed to be low due to the location of these businesses to the Route Corridor Option and their sensitivity to change.

The indicative R521 link road which was assessed in association with Option G has potential to have a Low magnitude impacts to the Medium sensitivity receptor, Pallas Foods. The Route Corridor Option also results in Negligible magnitude impacts on two low sensitivity receptors, Ballyconway Transport and Gary Brogan Tractor Sales.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.8 Route Corridor Option H

Route Corridor Option H has potential to impact on the Medium sensitivity The Orchard B&B. The receptor is within the 400m corridor and has potential to be impacted from noise and disturbance to the property as a result of the new road to the south and south east of the property. The receptor is on the existing N21 and the proposed Route Corridor ties in on the other side of the road, therefore this will not be a significant change to the existing environment and impacts are expected to be of low magnitude.

The Route Corridor Option also results in Negligible magnitude impacts on two low sensitivity receptors, Cahill Cheeses and Dolman Guitars.

The Route Corridor Option intersect lands zoned for development. including Proposed Residential Development and Existing Residential. However, these intersections are very minor and should not significantly impact the development of these areas in line with the zoning, therefore it is anticipated that there would be a low magnitude of impact.

Since all receptors have low or negligible magnitude impacts the overall effect will be Minor Negative.

10.4.2.9 Route Corridor Option I

Route Corridor Option I has potential to impact on one Medium sensitivity receptor, Ballingowan House B&B. The receptor is on the edge of the Route Corridor Option boundary and has potential to be impacted from noise and disturbance the gardens of the property as a result of the new road to the south and south east of the property. The receptor is on the existing N21 therefore this will not be a significant change to the existing environment and impacts are expected to be of low magnitude. Option I also has Negligible impacts on Shanagarry B&B as it is approximately 280m from the Route Corridor Option boundary. The bypassing of the B&B is not be considered in determining impact of Route Corridor Options as all proposed Route Corridor Options will result in bypassing of Shanagarry B&B.

Route Corridor Option I has a low magnitude of impact to a Medium sensitivity receptor; St. Brigid's Holy Well. This amenity would have some capacity to experience changes without resulting in significant disruption to the quality and integrity of the receptor due to existing location of the site by the roadside. However, this Route Corridor Option would result in additional disturbance from noise and traffic to the south and south west of the site in addition to the existing N21 to the north of the site, therefore this Route Corridor Option would have a low impact on this receptor.

Two Low sensitivity receptors, Ballyconway Transport Ltd and Cahills Farm Cheeses Ltd are within the corridor of Route Corridor Option I. Both sites are fully within the 400m corridor, however it is assumed that with the constraints within the area, it is unlikely that there will be significant loss of land impacting the businesses, therefore impacts are considered to be Minor negative.

The Route Corridor Option also results in Negligible magnitude impacts on the low sensitivity receptor, Gary Brogan Tractor Sales.

The Route Corridor Option intersect lands zoned for development. including Proposed Residential Development and Existing Residential. However, these intersections are very minor and should not significantly impact the development of these areas in line with the zoning, therefore it is anticipated that there would be a low magnitude of impact.

Table 10.6: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Minor Negative	3
Option B	Minor Negative	3
Option C	Minor Negative	3
Option D	Minor Negative	3
Option E	Minor Negative	3
Option F	Minor Negative	3
Option G	Minor Negative	3
Option H	Minor Negative	3
Option I	Minor Negative	3

10.4.3 Conclusion

Negligible impacts are not considered to be differentiators between Route Corridor Options. None of the Route Corridor Options results in Medium or High magnitude impacts on any receptors.

All Route Corridor Options have Minor effect on Material Assets in the Study Area, as there are no Medium magnitude impacts on receptors within the Study Area. There are minor differentiations between Route Corridor Options, however these differentiations were balanced and did not result in differentiations in scores. Route Corridor Options D and I have the greatest number of potentially low magnitude impacts on Medium or High sensitivity receptors (two), both with potential to result in low magnitude impacts to St. Bridget's Holy Well, The Orchard B&B and Ballingowan House B&B respectively. Both have potential impacts on a lower number of Low sensitivity receptors compared to other Route Corridor Options. Route Corridor Options B, C and H have the lowest level of effect overall with potentially low magnitude impacts on the fewest number of receptors, with Route Corridor Options C and H potentially impacting only one High sensitivity receptor. Route Corridor Option B impacts the fewest number of receptors overall.

Option A, E, F and G also have the potential to impact only one High sensitivity receptor, Pallas Foods. These options do have the potential to impact a greater number of Low sensitivity receptors (five) compared to other Route Corridor Options. All four options have the potential to result in Low magnitude impacts to the Limerick Greenway. Limerick Greenway is a low sensitivity receptor as it is considered to have reasonable "capacity to experience changes without resulting in disruption to its quality and integrity" in line with DMRB guidelines on Population and Human Health. As all impacts are considered to be low magnitude the overall effect of these Route Corridor Options on Material Assets (Non-Agricultural) is considered to be minor.

11. Agriculture

11.1 Introduction

Con Curtin of Curtin Agricultural Consultants Ltd was commissioned to conduct the agricultural impact assessment for the Route Corridor Options proposed for the N21 Newcastle West Road Scheme. This assessment involves the end-to-end assessment of nine 400m wide Route Corridor Options made up of four key Route Corridor Options, a number of sectional alternatives and an indicative R521 link road for the purposes of assessment.

This chapter assesses the various Route Corridor Options in-line with;

- European Union (2018) (Planning and Development) (Environmental Impact Assessment) Regulations. (SI 296 of 2018);
- Environmental Protection Agency (EPA) (August 2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports[70]; and
- Transport Infrastructure Ireland (TII) (2016) Project Appraisal Guidelines Unit 7.0 - Multi Criteria Analysis, PE-PAG-02031[71].

11.2 Methodology

11.2.1 Assessment Criteria

This assessment is a combination of a desktop assessment of available data sources combined with surveys from publicly accessible lands conducted in January 2020 and May 2021. The desktop study considered the following sources of information;

- Aerial mapping / photography (Google and Bing) was used to examine current land use [72];
- OS Discovery mapping;
- Corine 2018 Land Cover Data (downloaded in January 2020);
- Department of Agriculture, Food and the Marine Forestry viewer[73] ;
- Soil mapping data from the Teagasc Irish Soil Information System[74] was used to identify the soil types within the Study Area. The soil quality and type varies within a small area and the mapping data used is consistent over large areas, thus the information is indicative only;
- Land registry boundary data was used to determine the folio boundaries of high sensitivity enterprises;
- Property Registration Authority of Ireland (PRAI)[75] database;
- Data regarding agriculture in County Limerick from the Central Statistics Office (CSO)[76]; and
- Limerick County Council planning permission database in relation to planning applications in farmyards for milking parlours and poultry developments.

The surveys noted the locations of herds of dairy cows, horses, milking parlours, equine facilities and poultry farms and general observations were made in relation to land quality.

The impact on agriculture is one of the most significant impacts of road schemes due to the largely rural nature of green field schemes. In line with TII PE-PAG-02031[71] the degree to which a new road affects an agricultural property depends on a number of criteria such as:

1. The type of farm enterprises carried out;

[70]Environmental Protection Agency (EPA) (August 2017) Guidelines on the Information to be contained in Environmental Impact Assessment Report. Available from: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed 09 April 2020]
[71] 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 [Accessed: 09 April 2020]
[72] Google Aerial Mapping (2021). Available from: https://www.google.com/maps [Accessed: June 2021]
[73] https://publicapps.agriculture.gov.ie/gispublic/rpfms/pages/workspace/public.jsp
[74] Teagasc (2019), Irish Soil Information System. Available from http://gis.teagasc.ie/soils/ [Accessed on 13/01/2020]
[75]Property Registration Authority (2021). Available from https://www.landdirect.ie/index [Accessed in 2020 and 2021]
[76] Farm enterprise data for Co Limerick derived from Table 2 of 2010 Census of Agriculture;

(The significance of impact is higher when high highly sensitivity farms are affected and therefore impacts on low and medium sensitivity farms will not be as significant.)

2. Farm size;
3. Land take and removal of buildings and / or facilities.
4. The degree of severance with mitigation; and
5. Viability.

11.2.1.1 The type of farm enterprises

A high-level desktop review of the Route Corridor Options using the ortho-photography, PRAI land parcel data, Limerick County Council planning data combined with surveys from publicly accessible lands in January 2020 and May 2020 assessed the number of high sensitivity farm enterprises (as outlined in Table 11.1) such as dairy farms, equine farms and poultry enterprises.

- Dairy farms are high sensitivity because movement of the milking cows between the milking parlour and the grazing platform may be severed. Also, dairy farms tend to have a specialised farm infrastructure such as paddocks, roadways, water systems etc. which is sensitive to disruption.
- Equine enterprises are high sensitivity because horses are generally more valuable than other farm livestock and tend to be sensitive to construction traffic and construction noise. The layout of stud farms can be very specialised with expensive infrastructure such as training tracks, lounging areas and specially laid-out paddocks.
- Pig/Poultry/ Horticultural operations are high sensitivity because they have extensive buildings with large numbers of livestock or plant-stock which cannot be easily reorganised or replaced on the same site and are usually operated very intensively. Biosecurity would be a big concern for these enterprises.

The significance of impact is higher when high highly sensitivity farms are affected and therefore impacts on low and medium sensitivity farms will not be as significant.

Table 11.1 Farm Enterprise Sensitivity

Farm Enterprise Type	Intensity / Scale	Sensitivity
Stud farms, farm shops / open farms are generally high or very high sensitivity. Intensive horticulture is generally high or very high sensitivity.	High	Very High
	Medium	High
	Low	Medium
Dairy farms and intensive equine enterprises.	High	High
	Medium	High
	Low	Medium
Pig and Poultry enterprises	High	Very High
	Medium	High
Non-dairy grazing livestock enterprises (including beef, sheep, and small non intensive equine) and grass cropping enterprise.	High	Medium
	Medium	Low or medium
	Low	Low
Tillage	High	Medium
	Medium	Low or medium
Rough Grazing, Bog, Forestry, Woodland	Low	Low or very low

11.2.1.2 Farm size

The farm size along the Route Corridor Options is based on the CSO data available from twelve relevant Electoral Divisions relevant to the Study Area around Newcastle West – as presented in Table 11.3. Based on this CSO data the average size of farms in the Study Area is 32.3ha, which is the same as the County average. In the absence of individual landowner consultations, the area of farms is assumed to be the same along all the Route Corridor Options. In general, land-take and severance impacts will tend to have a higher impact on smaller holdings

because a higher proportion of the farm is taken or severed. Therefore, when assessing this criterion, impacts on larger farms will not be as significant.

11.2.1.3 Land take and removal of buildings and / or facilities

Agricultural land[77] was identified from Corine Landcover 2018 shape file data, examination of aerial photography and examination of DAFM Forestry Viewer. The land-take of agricultural land within the 400m wide Route Corridor Options was calculated using GIS software. The following sub-criteria were examined to determine the land-take impact;

i. **Area of agricultural land**. The mainland uses within the Study Area are pastures (93%), forestry (2%) and urban (4%). The area of agricultural land within each of the nine Route Corridor Option (400m corridor) was calculated. This was based on assessing the CORINE landcover data 2018, aerial photography and the Department of Agriculture, Food and the Marine Forestry viewer. Route Corridor Options with lowest land-takes of agricultural land will not be as significant;

ii. **Percentage of agricultural land**. Having excluded forestry and urban land the percentage of land which is agricultural is measured - as identified from the CORINE landcover data 2018 and also with reference to aerial photography and the Department of Agriculture, Food and the Marine forestry viewer. Route Corridor Options with a lower percentage of agricultural land will not be as significant because agricultural impacts are less likely;

iii. **Potential impacts on farm buildings / facilities**. This assessment involved a count of the number of farm buildings / yards / animal handling facilities within the footprint of each Route Corridor Option using the ortho-photography mapping and referring to the site surveys. Route Corridor Options which affect the lowest number of farm buildings / facilities will not be as significant. Consideration has also been given to the location of the farmyard / building / facility. For example, an impact is far more likely if the building is located at the centre of the 400m corridor rather than at the edge; and

iv. **Potential impacts on farm buildings / facilities on high sensitivity farms**. This assessment involved a count of the number of farm buildings / yards / animal handling facilities within the footprint of each Route Corridor Option and within high sensitivity folios using the ortho-photography mapping, PRAI data and referring to the site surveys.

11.2.1.4 Severance (The degree of severance with mitigation)

The degree to which land parcels are severed by a Route Corridor Option will be mainly determined by the length of the Route Corridor Option through agricultural land. Route Corridor Options with the lowest predicted severance impacts will not be as significant.

11.2.1.5 Viability

The viability of the agriculture within this Study Area is examined by measuring the following sub-criteria.

i. **Land quality.** Viability is related to many factors, including land quality. Low viability is where land is dominated by scrub, woodland, natural vegetation or poor-quality land such that the agricultural potential of that land is restricted. Route Corridor Options which cross free draining mineral soils are likely to have higher viability than Route Corridor Options that cross poor quality or poorly drained land. Within this Study Area Howardstown Series (*0760c*) and the alluvial soil *(5RIV)* are generally poorer quality and will not be as significant over the free draining Elton (*1000x*) and Ashgrove Series (*1160a*).

ii. **Agricultural areas of significant natural vegetation and forestry/woodland.** Based on Corine 2018 data, the Forestry Map Viewer on DAFM website and aerial photography, areas of '*Land principally occupied by agriculture, with significant areas of natural vegetation'* and forestry / woodland were mapped to indicate viability along the individual Route Corridor Options. These areas are considered to have low agricultural viability. Route Corridor Options with high areas of low viability land will not be as significant.

[77] Excluding forestry, urban, mining, dense scrub

The number of high sensitivity enterprises is also considered here because high sensitivity enterprises are generally more viable than low sensitivity enterprises.

The assessment of Route Corridor Options was assisted by scoring of impacts to sensitive receptors using the Stage 2 Project Appraisal Matrix put forward in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis[71]. The assessment undertaken on each Route Corridor Option included both quantitative and qualitative assessment. The overall effect of each Route Corridor Option was scored based on the seven-point scale in line with the Scores detailed within the PAG Unit 7.0, as shown in Table 11.2 and a number was assigned according to the level of significance of the effect.

Table 11.2: Key for Scoring Effects

PAG Unit 7.0 Score	PAG Unit 7.0 Impact Level / Significance of Effect
7	Major Positive
6	Moderate Positive
5	Minor Positive
4	Neutral
3	Minor Negative
2	Moderate Negative
1	Major Negative

11.3 Existing Environment

11.3.1 Study Area

The Study Area around Newcastle West extends from Ardagh in the north, Knockaderry in the east, Castlemahon / Mahoonagh and Ballyquirk in the South and Ballypierce and Dromin in the west. The Study Area is approximately 9.5 km from north to south and approximately 10 km from east to west and consists of approximately 7650 hectares.

11.3.1.1 Land Use

The land use in the Newcastle West Study Area is as follows;

- Urban - 4%
- Pasture / agricultural land – 93%
- Forestry (non-agricultural) - 2%

Agriculture is dominant land use (93%). Improved grassland accounts for the majority of the agricultural land.

11.3.1.2 Farm Size

The average farm size in the Newcastle West Study Area is likely to be approximately 32.3 hectares which is similar to the national average of approximately 32.7 hectares and slightly less than the average for County Limerick (34.5 ha) – see Table 11.3.

Table 11.3: 2010 CSO agricultural statistics for 12 relevant Electoral Divisions

District Electoral Division	Average Size (ha)
21079_Ardagh	30.5
21084_Caher	23.1
21087_Danganbeg	34.7

District Electoral Division	Average Size (ha)
21091_Garryduff	38.2
21096_Knockaderry	30.0
21097_Mahoonagh	32.1
21098_Monagay	31.6
21101_Newcastle Rural	27.8
21105_Rooskagh	30.6
21110_Ballyinan	42.3
21121_Kilscannell	34.2
Average for all EDs	32.3
Limerick	34.5
National	32.7

11.3.1.3 Farm Type

169 farmyards and agricultural buildings have been identified in the Newcastle West Study Area (see Volume 2, Figure 11.2). Of these there are

- There are 35 (21%) medium – high sensitivity dairy farmyards and adjoining milking platforms;
- There is one (0.5%) high sensitivity dog training track in Gortroe 1 km north east of Newcastle West;
- There are 22 (13%) high sensitivity poultry farmyards. It is worth noting that there is a tradition of poultry production in West Limerick dating back to when Castlemahon Chickens and Kantogher Coop were significant poultry processors in the area;
- There is one high sensitivity beef abattoir in Dooally 1 km west of Newcastle West;
- There are 7 (4%) equine enterprises and adjoining folios. These are categorised as high sensitivity;
- 104 (61.5%) are medium sensitivity livestock enterprises (mainly beef and or sheep or grass sold as hay or silage).

In County Limerick approximately 24% of farmers were dairy farmers in 2010. The CSO June 2018 Crops and Livestock survey shows that the total number of dairy cows in County Limerick has increased by 26.5% since 2010[78] and the 2016 CSO Farm Survey shows that in the Mid-West Region the average herd size has increased by 31.5% to 71 cows[79] . Within the Study Area the density of livestock and dairy cows (livestock units per 100 hectares) is similar to the County Limerick average (see Table 11.4). Thirty-five dairy enterprises[80] were noted from examination of aerial photography, planning searches and survey from publicly accessible lands. These enterprises will range from medium – high sensitivity and the folio land parcels attached to these farmyards are presented as high sensitivity constraints.

Table 11.4: 2010 CSO agricultural statistics for 12 relevant Electoral Divisions

District Electoral Division	Average Size (ha)	Labour (AWU[81]) / Farm	Livestock units[82] / 100 ha	Dairy Cows / 100ha	Horses / 100ha
21079_Ardagh	30.5	2.4	146.8	46.0	2.19

[78] Table 8A of 2010 Census = 94,066 dairy cows: Table 4 of June 2018 Crops and Livestock Survey = 118,900.
[79] For Mid-West Region - Table 8A of 2010 Census 167,490 ÷ 3,111 = 54; Table 4.1 of 2016 Farm Survey = 213,000 ÷ 3,000 = 71.
[80] These enterprises were not confirmed by landowner meetings and therefore represent the best estimation of dairy farm numbers based on available data and author's experience.
[81] As defined in CSO statistics; Annual Working Unit = 1800 hours per annum or more.
[82] Dairy cows, other cattle, horses and sheep are assumed to be 1.0, 0.65, 0.65 and 0.15 livestock units respectively.

District Electoral Division	Average Size (ha)	Labour (AWU[81]) / Farm	Livestock units[82] / 100 ha	Dairy Cows / 100ha	Horses / 100ha
21084_Caher	23.1	2.0	107.5	36.8	1.32
21087_Danganbeg	34.7	1.7	151.4*	54.0*	0.85
21091_Garryduff	38.2	0.6	109.8	37.5	1.79
21096_Knockaderry	30.0	1.4	168.3*	64.8*	0.35
21097_Mahoonagh	32.1	1.2	149.1	34.9	0.92
21098_Monagay	31.6	3.6	141.2	47.1	0.45
21101_Newcastle Rural	27.8	2.9	121.3	45.6	5.89*
21105_Rooskagh	30.6	1.0	95.6	24.7	0.82
21110_Ballyinan	42.3	1.7	163.3*	61.6*	1.98
21121_Kilscannell	34.2	1.3	155.3*	54.5*	1.80
Average for all DEDs	32.3	1.8	137.2	46.1	1.7
Limerick	34.5	205.6	140.9	45.5	2.00

*These DEDs have relatively high values

The concentration of horses is lower than the County Limerick average, however the density of horses in Newcastle West rural DED is high. There is one stud farm near Dooally Bridge and one equestrian centre in Ballingowan. Within the Study Area around Newcastle West the DEDs with the highest concentrations of livestock and dairy cows are 21087_Danganbeg, 21096_Knockaderry, Balliyinan_21110 and 21121_Kilscannell. 21097_Mahoonagh and 21079_Ardagh also have reasonably high densities of livestock and dairy cows (see Table 1.2). Therefore, the highest density of high sensitivity livestock enterprises is towards the east and north of the Study Area.

11.3.1.4 Viability

Land Quality / Soil Types

The topography in the Study Area is generally flat. The western part of this area drains to the eastwards with the Arra and Dooally Rivers being the main drainage artery for surface drainage from hills to the west of the Study Area. The Arra River joins the Deale River east of Newcastle West. The River Deale drains the eastern part of the Study Area towards the north. The soils around Newcastle West are shown in Volume 2, Figure 11.2.

- The dominant soil is the Elton (1000x). This is a deep well drained soil, a loam with limestones and makes up approximately 40% of the Study Area. It is suitable for arable and grassland and is located mainly in the east and north of the Study Area.
- The Howardstown series (0760c) is a heavy soil type, a clay or clay loam with limestones which is Moderate well drained. It occurs mainly in the south of the Study Area and in the north along the N21. This soil accounts for approximately 33% of the Study Area.
- The Ashgrove series (1160a) in the east and north accounts for approximately 17% of the Study Area. This is a well-drained deep fine loamy soil generally suited to grassland production.

- The Boyne series (05RIV) is an alluvial soil. This is generally associated with river valleys and low-lying areas and therefore its agricultural potential is dependent on how well it is drained. There are flood plains along the Deale towards the north east of the Study Area. There are well drained fertile soils in Mahoonagh and Knockaderry. It is suited mainly for grassland production and accounts for approx. 10% of the Study Area.

11.4 Assessment of Route Corridor Options

11.4.1 Assessment of Potential Impacts

11.4.1.1 Farm Types

Within the area affected by the nine assessed Route Corridor Options there are;

- 179 farmyards and farmyard facilities have been identified in the Newcastle West Study Area (see Volume 2, Figure 11.2). Of these 30 occur within the nine 400m wide Route Corridor Options assessed within the Study Area;
    - There are five (17%) high sensitivity dairy farmyards;
    - There is one (3%) high sensitivity dog training track in Gortroe 1 km north east of Newcastle West;
    - There are three (10%) high sensitivity poultry farmyards;
    - There is one (3%) high sensitivity beef abattoir in Dooally 1 km west of Newcastle West;
    - There is one (3%) equine enterprise categorised as high sensitivity;
    - Nineteen (64%) are medium sensitivity livestock enterprises (mainly beef and or sheep or grass sold as hay or silage).
- In County Limerick approximately 24% of farmers were dairy farmers in 2010. The CSO June 2018 Crops and Livestock survey shows that the total number of dairy cows in County Limerick has increased by 32% from 2010 to 2020[83] and the 2016 CSO Farm Survey shows that in the Mid-West Region the average herd size has increased by 31.5% to 71 cows[84] and total dairy cow numbers data from CSO indicates that this has risen further since 2016. Along the nine 400m wide Route Corridor Options assessed there were 23 high sensitivity enterprises: 18 dairy enterprises, one dairy and poultry farm, three poultry enterprises and one equine enterprises. These were noted from examination of aerial photography, planning searches and site surveys. These enterprises are generally high sensitivity, and their folio land parcels are presented as high sensitivity constraints;

11.4.1.2 Farm size

The average size of farms in the Study Area is 32.3ha which is similar to the County Limerick average of 34.5ha (and similar to the national average of 32.7ha). All Route Corridor Options are therefore said to have neutral impact for these criteria because farms are a similar size to the national average.

11.4.1.3 Land take and removal of buildings and / or facilities[85]

The land-take of agricultural land along each of the Route Corridor Options is presented in Appendix A – the range is from 212ha (Route Corridor Option D) to 374ha (Route Corridor Option E). Within the assessed Route Corridor Options, the percentage of agricultural land ranged from 94% to 100% (see Appendix A). The number of farmyards / farm facilities within all the nine assessed Route Corridor Options is 30, of which eleven are high

[83] Table 8A of 2010 Census = 94,066 dairy cows: Table 4 of June 2020 Crops and Livestock Survey = 124,200.
[84] For Mid-West Region - Table 8A of 2010 Census 167,490 dairy cows ÷ 3,111 = 54; Table 4.1 of 2016 Farm Survey = 213,000 ÷ 3,000 = 71.
[85] The agricultural assessment assumes a length of 1.2km for the indicative R521 link road in terms of land take. This is an assumed length to quantify land take for the purposes of assessment and is subject to change.

sensitivity. The number of farmyards / farm facilities within each of the assessed Route Corridor Options ranges from 8 (Route Corridor Options B & D) to 12 (Route Corridor Option C).

11.4.1.4 Severance (The degree of severance with mitigation)

The length of the assessed Route Corridor Options ranges from 5.2km (Route Corridor Option D) to 9.4km (Route Corridor Option E).

11.4.1.5 Viability/Land quality

Soil types within the Study Area are described in Section 11.3.1.4. In general, the deep free draining soils (Elton - *1000x* and Ashgrove Series -*1160a*) are located in the East, North and Western parts of the Study Area – these are classed as good and very good quality soils. The heavy poorly drained Howardstown Series (*0760c*) is located mainly in the southern part – this is classed as a medium to good quality soil. Much of the alluvial soil *(5RIV)* is low-lying, flat and poorly drained – particularly in the North Eastern part of the Study Area along the River Deel, and therefore this soil is classed as mainly medium quality. The percentage of this poorer quality land varies from 31% (Route Corridor Options A & B) to 82% (Route Corridor Option H) with the higher percentage poor quality soils located south of Newcastle West (which is a preference from an agricultural perspective).

Land principally occupied by agriculture, with significant areas of natural vegetation' and forestry / woodland was mapped from Corine 2018 data, examination of aerial photography, examination of DAFM Forestry Viewer and on-site surveys. The percentage of *Land principally occupied by agriculture, with significant areas of natural vegetation'* and forestry / woodland varies from 0.4-1% (Route Corridor Options B, D and I) to 20% (Route Corridor Option F).

11.4.2 Assessment of Effects of Route Corridor Options

The key impacts associated with each Route Corridor Option across the range of agricultural sub-criteria are summarised below. The quantitative analysis of the Route Corridor Options are presented in Appendix A to this report.

As discussed in Section 11.3.1.2 and illustrated in Table 11.3 the farm size for the Study Area is approx. 32.3ha and is assumed to be the same for all farms along all Route Corridor Options. All Route Corridor Options are therefore said to have neutral impact for these criteria because farms are a similar size to the national average.

The impacts for the assessed criteria (farm size, farm type, land-take, severance and viability) are summarised in Table 11.5 below. The overall score is arrived at after considering the quantitative scores for each criteria, combined with a qualitative assessment of key impacts along each Route Corridor Option.

The indicative R521 link road assessed in association with Route Corridor Options A, E, F and G was included in the consideration of land take in order to quantify the impact of this proposed link road. The land-take of agricultural land was assumed to be approx. 48ha and no high sensitivity farms are located within the study area for the potential R521 link road.

11.4.2.1 Route Corridor Option A

There are 10 farmyards/farm buildings within the Route Corridor Option - 4 of these yards are high sensitivity yards/buildings and the Route Corridor Option has a relatively high land-take (353ha including the indicative R521 link road). The land quality is generally good with 28% of the land-take categorised as medium or poor-quality land and 19% is categorised as natural vegetation and forestry, therefore the land-take impact is Moderate.

This Route Corridor Option will have a high impact on a cluster of dairy farms at the western tie-in with N21 and potentially impacts on an equine enterprise at the eastern tie-in with N21. There are 8 high sensitivity enterprises (dairy, equine and poultry) within the 400m corridor which is high relative to the baseline and therefore the impacts on Farm Types are Moderate. Crossing agricultural land for approx. 8.9km (including indicative R521 link road) it will have a Moderate severance impact relative to the baseline. Affecting 8 high sensitivity enterprises and crossing good quality land the impact on the viability of agricultural land is minor negative.

A qualitative assessment of this Route Corridor Option is that there will be a high degree of land-take and severance, there will be a high degree of impact on dairy farms towards the West of the Study Area and there will be a low impact on an equine enterprise at the Eastern tie in with the N21. The overall impact is Minor negative.

11.4.2.2 Route Corridor Option B

Route Corridor Option B has a high land-take (354ha) and there are 9 farmyards/farm buildings within the 400m corridor - 3 of which are high sensitivity yards/buildings. The land quality is generally good with 31% of the land-take categorised as medium or poor-quality land and 1% is categorised as natural vegetation and forestry. The Route Corridor Option has a Moderate impact on land-take. There are 9 high sensitivity enterprises (dairy, equine and poultry) within the 400m corridor which is high relative to the baseline and therefore will have a moderate impact on Farm Types. Crossing agricultural land for approx. 8.7km it will have a moderate severance impact relative to the baseline. Affecting 9 high sensitivity enterprises and crossing good quality land the impact on the viability of agricultural land score is minor negative.

This Route Corridor Option is a similar to the length to the other Northern Route Corridor Options which include the indicative R521 link road. However, it impacts a higher number of high sensitivity enterprises, therefore the impact is Moderate negative for this Route Corridor Option.

11.4.2.3 Route Corridor Option C

Route Corridor Option C has a high land-take (329ha) and there are 12 farmyards/farm buildings within the corridor - 2 of which are high sensitivity yards/buildings. It has the highest land-take of the Route Corridor Options to the south of Newcastle West. The land is medium quality with 68% of the land-take categorised as medium or poor-quality land and 4% is categorised as natural vegetation and forestry. The impact land-take as a result of this Route Corridor Option is therefore Moderate. There are 6 high sensitivity enterprises (dairy and poultry) within the 400m corridor which is high relative to the baseline and results in Moderate impact for the Farm Type sub-criteria. Crossing agricultural land for approx. 8.2km it will have a Moderate severance impact relative to the baseline. Affecting 6 high sensitivity enterprises and crossing medium quality land the viability impact score is Minor negative.

The qualitative assessment of this Route Corridor Option is that it is marginally preferable to any of the Route Corridor Options to the north of Newcastle West because the land quality is generally poorer, and the Route Corridor Option is less preferable compared to other Southern Route Corridor Options due to the higher land-take and severance impacts. Therefore, the impact is Minor negative for this Route Corridor Option.

11.4.2.4 Route Corridor Option D

Route Corridor Option D has the lowest land-take (212ha) of all the Route Corridor Options. There are 8 farmyards/farm buildings within the 400m corridor - 3 of which are high sensitivity yards/buildings. The land is medium quality with 76% of the land-take categorised as medium or poor-quality land and 1% is categorised as natural vegetation and forestry, therefore the impact on land-take is minor. This Route Corridor Option affects a high sensitivity dog training track in Gortroe and there are 4 high sensitivity enterprises (equine, dog track and poultry) within the 400m corridor which is low relative to the baseline and results in minor impacts for Farm Type sub-criteria. Crossing agricultural land for approx. 5.2km it will have a minor severance impact relative to the baseline – it is the shortest Route Corridor Option. Affecting 4 high sensitivity enterprises and crossing medium or poor-quality land the viability impact score is neutral.

The qualitative assessment of this Route Corridor Option is that it is the shortest, it has a high proportion of medium or poor-quality land and despite impacting of a high sensitivity dog training enterprise it is expected to have the lowest impact overall. The impact is Minor negative overall.

11.4.2.5 Route Corridor Option E

Route Corridor Option E has the highest land-take (374ha). There are 11 farmyards/farm buildings within the 400m corridor - 4 of which are high sensitivity yards/buildings. The land quality is generally good with 31% of the land-take categorised as medium or poor-quality land and 18% is categorised as natural vegetation and forestry. The impact on land-take is moderate. There are 7 high sensitivity enterprises (dairy and poultry) within the 400m

corridor which is high relative to the baseline and the overall impact on Farm Types is moderate. Crossing agricultural land for approx. 9.4km (including indicative R521 link road) it will have a moderate severance impact relative to the baseline. Affecting 7 high sensitivity enterprises and crossing good quality land the impact on land viability is minor negative.

A qualitative assessment of this Route Corridor Option is that there will be a high degree of land-take and severance and while avoiding an equine enterprise at the Eastern tie-in with the N21 there will be a high degree of impact on dairy farms at the Western tie-in with the N21. The overall impact is Minor negative.

11.4.2.6 Route Corridor Option F

Route Corridor Option F has the lowest land-take of the Northern Route Corridor Options. There are 9 farmyards/farm buildings within the 400m corridor - 2 of which are high sensitivity yards/buildings. The land quality is generally good with 36% of the land-take categorised as medium or poor-quality land and 20% is categorised as natural vegetation and forestry, therefore the impact on land-take is Moderate. There are 7 high sensitivity enterprises (dairy, equine and poultry) within the 400m corridor which is high relative to the baseline and the impact on Farm Types is moderate. Crossing agricultural land for approx. 8.5km (including indicative R521 link road) it will have a moderate severance impact relative to the baseline. Affecting seven high sensitivity enterprises and crossing good quality land the viability impact score is minor negative.

The qualitative assessment of this Route Corridor Option is that it will minimise impacts on a cluster of dairy enterprises at the Western tie-in with the N21 but will have a low impact on an equine enterprise at the Eastern tie-in with the N21. It will have high land-take and severance impacts (lowest of the Route Corridor Options to the north of Newcastle West but high compared to Route Corridor Options to the south). The overall impact is Minor negative.

11.4.2.7 Route Corridor Option G

Route Corridor Option G has a high land-take (362ha). There are 11 farmyards/farm buildings within the 400m corridor - 2 of which are high sensitivity yards/buildings. The land quality is generally good with 39% of the land-take categorised as medium or poor-quality land and 19% is categorised as natural vegetation and forestry, therefore the impact on land-take is moderate. There are 6 high sensitivity enterprises (dairy and poultry) within the 400m corridor which is high relative to the baseline and the impact on Farm Types is Moderate. Crossing agricultural land for approx. 9km (including indicative R521 link road) it will have a moderate severance impact relative to the baseline. Affecting 6 high sensitivity enterprises and crossing good quality land the impact on land viability is minor negative.

The qualitative assessment of this Route Corridor Option is that it will minimise impacts on a cluster of dairy enterprises at the Western tie-in with the N21 and avoids impacts on an equine enterprise at the Eastern tie- with the N21. It is a long Route Corridor Option, and it will have high land-take and severance impacts. The overall impact is Minor negative.

11.4.2.8 Route Corridor Option H

Route Corridor Option H has an intermediate land-take (271ha). There are 11 farmyards/farm buildings within the 400m corridor - 4 of which are highly sensitive yards/buildings. The land is medium quality with 82% of the land-take categorised as medium or poor-quality land and 4% is categorised as natural vegetation and forestry Therefore the impact on land-take is minor negative i.3. This Route Corridor Option affects a high sensitivity dog training track in Gortroe and there are 8 high sensitivity enterprises (dairy, equine, dog track and poultry) within the 400m corridor which is high relative to the baseline and the impact on Farm Types is moderate. Crossing agricultural land for approx. 6.9km it will have a minor severance impact relative to the baseline. Affecting 8 high sensitivity enterprises the impact on land viability is minor negative (despite relatively poor-quality land).

This is a short Route Corridor Option with a relatively low land-take. It has the highest proportion of medium or poor-quality land and despite impacting of a high sensitivity dog training enterprise is expected to have the low impact overall. The impact is minor negative.

11.4.2.9 Route Corridor Option I

Route Corridor Option I has an intermediate land-take (270ha). There are 9 farmyards/farm buildings within the 400m corridor - 1 of which is a highly sensitive yard/building. The land is medium quality with 60% of the land-take categorised as medium or poor-quality land and 1% is categorised as natural vegetation and forestry, therefore the impact on land-take is minor negative. There are 2 high sensitivity enterprises (dairy and poultry) within the 400m corridor which is low relative to the baseline and the impacts on Farm Types will be neutral. Crossing agricultural land for approx. 6.5km it will have a minor severance impact relative to the baseline. Affecting 2 high sensitivity enterprises the viability impact score is neutral.

This is a short Route Corridor Option with a relatively low land-take. It has a high proportion of medium quality land. It affects the lowest number of high sensitivity enterprises and avoids impacting of a high sensitivity dog training enterprise. It is expected to have the low impact overall. The impact is Minor negative overall

Table 11-5 below summarises the overall effect of each Route Corridor Option on Agriculture.

Table 11.5 Material Assets – Agricultural Performance Matrix

Route Corridor Options	Sub-Criteria Score					Qualitative statement	Overall Significance of Effect / PAG Score
	Farm size	Farm type	Land-take[1]	Severance	Viability		
Option A	4	2	2	2	3	This Route Corridor Option results in a high impact on a cluster of dairy farms at the Western N21 tie-in and a low impact on an equine enterprise at Eastern N21 tie-in. It has a high land-take.	**3**
Option B	4	2	2	2	3	This Route Corridor Option is the longest in length with high land-take and severance impacts. Although minimising impact on a cluster of dairy farms at the Western N21 tie-in it affects a high number of high sensitive enterprises.	**2**
Option C	4	2	2	2	3	This Route Corridor Option has the highest land-take of Southern Route Corridor Options.	**3**
Option D	4	3	3	3	4	This is the shortest Route Corridor Option and therefore has the lowest level impact, but it will still impact on a high sensitivity enterprise (dog training track) at Eastern N21 tie-in.	**3**
Option E	4	2	2	2	3	This Route Corridor Option results in impacts on a cluster of dairy farms at the Western N21 tie-in. It will have a high impact on high sensitivity enterprises, high land-take and high severance impacts.	**3**
Option F	4	2	2	2	3	This Route Corridor Option minimises impacts on dairy farms at the Western N21 tie-in. It will have the lowest land-take of the Northern Route Corridor Options. However, it will have	**3**

Route Corridor Options	Sub-Criteria Score					Qualitative statement	Overall Significance of Effect / PAG Score
	Farm size	Farm type	Land-take[1]	Severance	Viability		
						a low impact on equine enterprise at Eastern tie-in.	
Option G	4	2	2	2	3	This Route Corridor Option has high land-take and severance impacts but minimises impacts on a cluster of dairy farms at the Western N21 tie-in. It avoids equine enterprise at the Eastern N21 tie-in.	**3**
Option H	4	2	3	3	3	This Route Corridor Option is short with relatively poor-quality land. It will have a minor negative land-take and severance impacts.	**3**
Option I	4	4	3	3	4	This Route Corridor Option is short with relatively poor-quality land. It will have a minor negative land-take and severance impacts. It will have a neutral to minor negative effect on viability.	**3**

Table 11.6: Significance of Effects of Route Corridor Options

Route Corridor Option	PAG Unit 7.0 Significance of Effect	PAG Unit 7.0 Score
Option A	Minor negative	3
Option B	Moderate negative	2
Option C	Minor negative	3
Option D	Minor negative	3
Option E	Minor negative	3
Option F	Minor negative	3
Option G	Minor negative	3
Option H	Minor negative	3
Option I	Minor negative	3

11.4.3 Conclusion

The majority of Route Corridor Options have a Minor negative effect and the significance of impact of these Route Corridor Options is expected to be the same, with the exception of Route Corridor Option B which has Moderate negative effect. All Route Corridor Options are assumed to affect farms of similar size and the percentage of agricultural land is similarly high along all Route Corridor Options i.e. varies between 94 and 99%. The key differentiations between Route Corridor Options are as follows:

- Route Corridor Options north of Newcastle West (A, B, E, F, G) are longer and will tend to have the highest land-takes and highest proportion of good quality land;
- Route Corridor Option D is the shortest Route Corridor Option has a low impact score relative to other Route Corridor Options, however it may have a significant impact on a high sensitivity dog training track in Gortroe;
- Route Corridor Options H and I, followed by Route Corridor Options C have lower land-take and severance impacts than the Route Corridor Options to the north of Newcastle West;
- Route Corridor Options F and G have higher land-take than other northern Route Corridor Options, however they minimise the impact on a cluster of dairy farms at the Western N21 tie-in;
- Route Corridor Options A and E have a high land-take and severance impacts and high impacts on a cluster of dairy farms near the Western N21 tie-in; and
- Route Corridor Option B is the longest mainline and therefore has the highest land take and severance impacts. It affects the highest number of high sensitivity enterprises (albeit that it minimises impacts on a cluster of dairy farms at the Western N21 tie-in). Therefore, it has Moderate negative effect.

Appendix 9.1. Archaeological Heritage Inventory

Identification No.	N21/NCW-AY001
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	High
Reference No.	LI028-132
Townland	Ballylahiff
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527738, 636542
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Roughly circular area, 39m (NE–SW) by 43m (NW–SE), enclosed by two concentric earthen banks with an intervening fosse. Inner bank (int H 1.2m, ext H 1.9m) incorporated into linear field boundary E–SSE. Gap in bank (Wth 3.4m) at SSW. Fosse (Wth 4.6m) evident all round but best-defined NNW–ENE. Outer bank (int H 1.3m to base of fosse, ext H 1.1m) only evident NNW–NE. A linear field boundary extends southeast from northeast end of outer bank to form corner with field boundary which incorporates part of inner bank.
LiDAR Description	L134-126: a heavily denuded bivallate ringfort consisting of two pairs of banks and ditches with very little topographic expression in the LiDAR data; measuring 67m externally and 32m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY002
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI028-135
Townland	Killard
Civil Parish	Ardagh
Barony	Shanid
Site Type	Moated site
Coordinates (ITM)	528764, 636696

Identification No.	N21/NCW-AY002
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted on 1841 OS map as embanked trapezoidal enclosure measuring *c.*60m (NW–SE) by 50m (SW–NE), and as trapezoidal field on 1923 OS map. Has since been levelled. According to local information, the enclosure and surrounding field boundaries were removed in 1979, with enclosing bank on north side *c.*2m high with external fosse. Slight rise noted in area of site with scarp (H 0.55m) evident NNW–NE. Listed as a moated site by T.B. Barry.
LiDAR Description	L142-141: rectilinear enclosure with a 6m-wide ditch, and a 4m-wide outer bank. The site measures 86m (N–S) by 85m (E–W) externally. Signature in LiDAR partly obscured by cut grass.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY003
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	High
Reference No.	LI028-138
Civil Parish	Ardagh
Barony	Shanid
Townland	Coolacokery
Site Type	Ringfort – rath
Coordinates (ITM)	529425, 636418
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area with a diameter of *c.*30m enclosed by two concentric earthen banks with intervening fosse (Wth 1.6m). Enclosing element truncated E–SE by trackway travelling NE–SSW; enclosure depicted as complete circle on 1841 OS map. Trackway has now been removed apart from portion crossing enclosure. Inner bank covered by dense overgrowth and has been eroded by cattle in places. Outer bank (int H 0.7m, ext H, 0.6m) is mostly covered by dumps of rubble and earth,
LiDAR Description	L150-142: the earthwork perimeter is obscured in the LiDAR data by trees. Bivallate ringfort consisting of two pair of ditches and banks; measuring 52m externally and 12m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY004
Route Corridor Options	Options B, E and G

Identification No.	N21/NCW-AY004
Legal Status	Recorded Monument
Importance	High
Reference No.	LI028-142
Townland	Ballyfraley
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	530341, 636287
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area with a diameter of *c*.25m enclosed by earthen bank (int H 0.95m, ext H 1.8m) with external fosse (D 0.8m, Wth 1.9m). Bank best preserved WSW–NNW. Fosse evident all round though deepest and waterlogged E–S.
LiDAR Description	L158-152: the monument is obscured in the LiDAR data by trees. An outer ditch can be seen clearly enclosing a bank; measuring 45m externally and 20m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY005
Route Corridor Options	Options B, E and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI028-180
Townland	Ballyfraley
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	529765, 636161
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area with a diameter of *c*.30m enclosed by earthen bank (int. H 0.55m; ext. H 1.5m) with external fosse (D 1.05m; Wth 3m). Outer edge of fosse is truncated by field boundary and drain NNW->NE; drain feeds water into fosse at NE and fosse is waterlogged except W->NNW.
LiDAR Description	L150-143: the earthwork perimeter is obscured in the LiDAR data by trees. Bivallate ringfort consisting of a pair of banks and ditches, measuring 62m externally and 14m internally in diameter. The townland boundary curves along the northern edge of the ringfort.

Identification No.	N21/NCW-AY005
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY006
Route Corridor Options	Options B, F and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-011
Townland	Dromin (Macturlogh)
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	525985, 633876
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area with a diameter of *c*.30m defined by scarped edge with inner lip (int H 0.5m, ext H 1.3m) and external fosse (D 0.95m, Wth 2.2m). Gap (Wth 1.7m) across scarp at N.
LiDAR Description	L129-099: the earthwork perimeter is obscured in the LiDAR data by trees. Consisting of a bank and external ditch surrounded by an external bank. Measures 59m externally in and 30m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY007
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-012
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526196, 635190
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes

Identification No.	N21/NCW-AY007
	Circular area, 27.5m N–S by 26.9m E–W, defined by scarped edge (H 1.2m, Wth 1.1m) with external fosse (D 0.6m, Wth 2.3m). Gap (Wth 2m) across scarped edge at ESE. Field boundary runs along outer line of fosse SW–NNW.
LiDAR Description	L127-121: the earthwork perimeter is partly obscured in the LiDAR data by trees. Consisting of a bank and external ditch measuring 42m externally and 21m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY008
Route Corridor Options	Options A, E, F and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-013
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526381, 634866
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 28m (N–S) by 29m (E–W), enclosed by earthen bank NNE–WNW (int H 0.9m, ext H 1.2m) and defined by scarped edge (H 1.2m, Wth 2.1m) WNW–NNW, with external fosse (D 0.4m, Wth 2.35m) NNE-SE. Gap in bank (Wth 1.5m) at west. Stream runs E–W along base of scarped edge on N side. Fosse infilled with rubble SE–NW; farm trackway runs along line of infilled fosse NW–S.
LiDAR Description	L128-119: the earthwork perimeter is obscured in the LiDAR data by trees. Bank with internal and external ditches; the external ditch is intercepted by a stream on its northern edge. The ringfort measures 49m externally and 20m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY009
Route Corridor Options	Options A, E, F and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-014

Identification No.	N21/NCW-AY009
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526402, 635018
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Roughly circular area, 25.5m N–S by 25m E–W, enclosed by earthen bank NNE–SSW (int H 0.3m, ext H 1m), with external fosse (D 0.3m, Wth 1.8m) NNE–SSW. Bank has been reconstructed SSW–NW, 1m inside original line, to form part of a field boundary. Gaps in bank at north (Wth 3.5m), west (Wth 1m) and south-southwest (Wth 1m).
LiDAR Description	L127-120: the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 41m externally and 23m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY010
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-015
Townland	Doocatteen
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526538, 636080
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 19.2m (N–S) by 21.3m (E–W), defined by scarped edge (H 1.25m, Wth 1.45m). The interior is level, under marshy pasture and heavily poached by cattle, with some overgrowth along edges.
LiDAR Description	L126-125: bank and an external ditch measuring 31m externally and 17m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY011
Route Corridor Options	Options A, E, F and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-016
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526659, 635296
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 29.3m N–S by 28.4m E–W, defined by scarped edge (H 0.7m, Wth 3m), with external fosse (D 0.3m, Wth 2.15m) NNE–SW and W–NW.
LiDAR Description	L127-122: bank and an external ditch measuring 47m externally and 27m internally in diameter. An arcing ditch, 80m in length, is located immediately to the southwest, which terminates against, or is cut by, a field boundary.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY012
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-018
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526935, 635750
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 29.9m (N–S) by 27.4m (E–W), defined by scarped edge (H 0.7m, Wth 1.1m), with external fosse (D 0.4m, Wth 1.9m) NW–SW. Enclosing element is partially levelled SW–NW. Debris from this levelling event is dumped on scarp to northwest and southwest. Field boundary runs along top of scarp NW–SW, while other field boundaries abut it to northwest, northeast, southeast and southwest.
LiDAR Description	L127-124: the earthwork perimeter is partly obscured in the LiDAR data by trees. Bank and external ditch measuring 47m externally and 30m internally in diameter.

Identification No.	N21/NCW-AY012
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY013
Route Corridor Options	Indicative R521 Link Road
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-021
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527352, 635895
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 26.9m (N–S) by 26.4m (E–W), enclosed by two concentric earthen banks with an intermediate fosse (Wth 2-3m) SSE–E. An internal bank (int H 0.55m, ext H 2m) encloses the entire site and has gap (Wth 2m) at southeast. External bank (int H 2m, ext H 1.7m) survives SSE–E. Field boundary encircles enclosure, 1m from base of external bank, from NNE–NNW.
LiDAR Description	L135-128: the earthwork perimeter is partly obscured in the LiDAR data by trees. Bivallate ringfort comprising a pair of banks and ditches measuring 78m externally and 38m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY014
Route Corridor Options	Indicative R521 Link Road
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-022
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527372, 635108
LiDAR Description	**Scheduled for inclusion in the next revision of the RMP**: Yes

	Depicted on 1924 OS map as embanked circular enclosure with a diameter of *c*.35m, now levelled. No trace evident, though area has many irregular undulations. Former railway track truncates line of fosse to south. Field boundaries in vicinity of site are removed.
LiDAR Feature No.	L135-130: bank and external ditch measuring 72m externally and 48m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY015
Route Corridor Options	Indicative R521 Link Road
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-023
Townland	Doocatteen
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527471, 636160
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 35m (N–S) by 37.2m (E–W), enclosed by two concentric earthen banks with intervening fosse (Wth 3.25m). Internal bank (int H 0.3m, ext H 1.35m) completes full circuit. The external bank (int H 0.95m, ext H 0.55m) is only extant SSE–W, though probably incorporated into field boundary that skirts site NW–E. Gap (Wth 2.5m) in internal bank at north. Gap (Wth 2m) in both banks to south.
LiDAR Description	L134-127: the earthwork perimeter is partly obscured in the LiDAR data by trees. Bivallate ringfort comprising two pairs of banks and ditches; the external ditch is barely perceptible as a shallow scoop around the east, west and north sides, but pronounced on the south side. The ringfort, which is located on the edge of the townland boundary and a stream, measures 71m externally and 29m internally in diameter. The site includes a central mound that rises to a height of 1m above the surrounding ground level. The mound includes a linear depression that is suggestive of a possible souterrain.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY016
Route Corridor Options	Options A, E, F, G and Link Rd
Legal Status	Recorded Monument
Importance	High

Identification No.	N21/NCW-AY016
Reference No.	LI036-025
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527590, 635604
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 24.2m (N–S) by 24.5m (E–W), defined by scarped edge (H 1.15m, Wth 1.7m) with external fosse (D 0.4m, Wth 4.75m). Causeway entrance (Wth 1.7m) at north Intermittent stone revetting at base of scarped edge on western side.
LiDAR Description	L135-129: bank and external ditch, measuring 41m externally and 14m internally in diameter; surrounded by a tree ring.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY017
Route Corridor Options	Options A, E, F and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-026
Townland	Garranekeevan
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	528334, 635577
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area with a diameter of *c.*45m, defined by scarped edge (H 1.7m, Wth 2.2m), with external fosse (D 1.4m, Wth 4m) SW–SE. Interior and much of enclosing element covered by impenetrable overgrowth. Local information says there is a "tunnel" here, which suggests the possible presence of a souterrain.
LiDAR Description	L143-140: the monument is obscured in the LiDAR data by trees. Bivallate ringfort consisting of two pairs of ditches and banks, measuring 65m externally and 7m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY018
Route Corridor Options	Option A
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-030
Townland	Ballingowan
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	529712, 635334
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 34m (N–S) by 35.3m (E–W), defined by scarped edge (H 0.95m, Wth 1.8m). Entrance (Wth 4m) via ramp across scarp at east. Drain cut along base of scarped edge NW–NNW leads north to pond. Field boundary abuts base of scarp S–SSW. A wooden fence runs along top of scarp SSW–WNW, and is replaced by a post-and-wire fence WNW–NE. The interior is level, dry and clear of overgrowth.
LiDAR Description	Not included in LiDAR assessment.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY019
Route Corridor Options	Options C and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-031
Townland	Ballingowan
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	529871, 635054
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Subcircular area, 24.5m (N–S) by 21m (E–W), enclosed by earthen bank (int H 0.4m, ext H 1.95m) SW–NE, and defined by scarped edge (H 1.5m, Wth 2m) NE-SW. External fosse (D 1.4m, Wth 3.6m) SE–WSW; recut as drain ENE–SE and WSW–NNE. Entrance (Wth 1.9m) at northwest. Field boundary abuts outer edge of fosse at south-southwest.
LiDAR Description	L151-145: the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 37m externally and 18m internally in diameter.

Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY020
Route Corridor Options	Options A and F
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-032
Townland	Ballyfraley
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	530215, 631427
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 42.6m (N–S) by 43m (E–W), defined by scarped edge (H 1.25m, Wth 2.3m). Scarp most pronounced SE–NE, but slight from NE–SE. Entrance (Wth 8m) via ramp at west. Interior level and under pasture. Field boundaries removed to west.
LiDAR Description	L159-150: bank and external ditch measuring 62m externally and 38m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY021
Route Corridor Options	Options C and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-033
Townland	Gortroe
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	530444, 634219
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as embanked circular enclosure with a diameter of *c.*60m on 1841 OS map, has since been levelled. No visible surface expression; field boundaries removed to east.

Identification No.	N21/NCW-AY021
LiDAR Description	L160-094: bank of enclosure was partially visualised, with slight expression in the LiDAR data.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY022
Route Corridor Options	Options B, E and G
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-039
Townland	Coolanoran
Civil Parish	Kilscannell
Barony	Connello Lower
Site Type	Ringfort – rath
Coordinates (ITM)	530876, 636075
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes In pasture on gentle south-facing slope. Depicted as embanked circular enclosure with a diameter of *c.*30m on 1841 OS map. Has since been levelled, with no surface expression.
LiDAR Description	L158-093: no expression in the LiDAR data; the data suggests widespread ground disturbance.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY023
Route Corridor Options	Options A and E
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-051
Townland	Garryduff
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	524325, 632359
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes

Identification No.	N21/NCW-AY023
	Circular area, 32.5m (N–S) by 32.6m (E–W), enclosed by earthen bank (int H 0.35m, ext H 1.3m) with external fosse (D 0.2m, Wth 3.2m). Causeway entrance (Wth 5.3m) at west-northwest.
LiDAR Description	L114-096: defined by external bank and ditch and internal bank and ditch. Displays an external diameter of 53m and internal diameter of 20m; includes a slightly raised interior.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY024
Route Corridor Options	Options A, C, E and H
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-053
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	524641, 632317
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted on 1924 OS map as circular embanked enclosure with diameter of *c.*30m, has since been levelled. Slight undulations in area of site only indication of its presence. Location of site indicated by kink in field boundary SE–NW; other field boundaries have been removed.
LiDAR Description	L114-097: consisting of an external bank and ditch and an internal bank that have been substantially removed and/or incorporated into adjacent field boundaries to west and south. It measures 53m externally and 29m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY025
Route Corridor Options	Options A and E
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-054
Townland	Killaghteen
Civil Parish	Ardagh

Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	524808, 633259
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as embanked circular enclosure with a diameter of *c*.30m on the 1841 OS map, and as an oval platform, *c*.30m (N–S) by 35m (E–W), on 1924 OS map. It is now largely inaccessible due to dense overgrowth and dumped soil, which covers much of the site. Enclosing element appears to be a scarped edge. Centre of interior is clear and covered by grass.
LiDAR Description	L113-098: The earthwork perimeter is obscured in the LiDAR data by trees. The ringfort comprises an external ditch and internal bank, measuring 38m externally in diameter; no internal estimate available due to tree cover.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY026
Route Corridor Options	Options A, B, E, F and G
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-055
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	525028, 632706
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted on 1924 OS map as embanked circular enclosure with a diameter of *c*.25m, has since been levelled with no surface expression. Surrounding field boundaries have been removed. Aerial photo (ASIAP) taken in 2002 shows the cropmark of a bivallate circular enclosure.
LiDAR Description	L122-102: bank and external ditch measuring 52m externally and 15m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY027
Route Corridor Options	Options B, F and G
Legal Status	Recorded Monument

Identification No.	N21/NCW-AY027
Importance	High
Reference No.	LI036-056
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	525194, 632347
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 26.7m N–S by 25.2m E–W, defined by scarped edge (H 0.45m, Wth 6.3m). No fosse. Low profile site that is barely discernible. Local man said site was not interfered with and always had this low profile. Aerial photo: GSI, photo R555. Not marked on any edition of OS maps.
LiDAR Description	L122-103: the eastern half of the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 45m externally and 27m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY028
Route Corridor Options	Options B, F and G
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-058
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Moated site
Coordinates (ITM)	525850, 632931
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Sub-rectangular area, 29.8m (N–S) by 24m (E–W), defined by an earthen bank (int H 0.5m, ext H 1.85m) with an external fosse (D 0.7m). Entrance (Wth 3.2m) at southwest with causeway across fosse. Field boundary running E–W crosses fosse to meet bank at west. The interior is level, dry and clear of overgrowth.
LiDAR Description	L122-101: represented in the LiDAR data as a rectilinear enclosure, the perimeter of which is obscured by trees. The site appears on the OS first-edition 6-inch map as a circular ringfort-style enclosure surrounded by rectilinear field systems and on the OS 6-inch Cassini map as a rectilinear scarped earthwork on its western and southern sides only. The LiDAR data indicates that it consists of a 4–5m wide ditch,

Identification No.	N21/NCW-AY028
	without an outer bank, measuring 45m (WSW–ENE) by 53m (NNW–SSE), externally.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY029
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-059
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526234, 632685
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes On level ground in garden of private dwelling. Depicted as embanked circular enclosure with a diameter of *c* 30m on 1924 OS map. Has been severely altered by incorporation into garden. Defining scarped edge (H 0.75m, Wth 0.9m) with external fosse (D 0.6m, Wth 1.8m) survives SW–E, but otherwise is levelled. This shows site was circular in plan with an E–W diameter of 30m. Field boundary runs along outer line of fosse WSW–NW.
LiDAR Description	L130-117: the earthwork perimeter is partly obscured in the LiDAR data by trees. Bank with internal and external ditches measuring 42m externally and 21m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY030
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-060001
Townland	Shangarry
Civil Parish	Monagay
Barony	Glenquin

Identification No.	N21/NCW-AY030
Site Type	Ringfort – rath
Coordinates (ITM)	526532, 632723
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as embanked circular enclosure with a diameter of *c*.50m on 1924 OS map. Has since been truncated on north and east sides so that enclosing element is now only evident SE–WNW. This is truncated on east side by N–S field boundary and on north side by enclosure surrounding holy well AY031 (LI036-06002). Surviving section of enclosing element consists of earthen bank (int H 0.65m, ext H 1.35m) with external fosse (D 1.1m, Wth 0.65m) SE–WNW.
LiDAR Description	L130-115: the earthwork perimeter is obscured in the LiDAR data by trees. Oval-shaped bank with external ditch that measures 72m (NW–SE) by 57m (SW–NE) externally and 51m (NW–SE) by 22m (SW–NE). Contains an internal subcircular enclosed area at the south side of the ringfort defined by a ditch and internal bank, measuring 26m in external and 14m in internal diameter. The monument encloses holy well AY031 (LI036-060002).
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY031
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-060002
Townland	Shangarry
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ritual site – holy well
Coordinates (ITM)	526509, 632729
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Indicated as "St Bridget's Well" on 1924 OS map. In enclosed landscaped area in northeast quadrant of ringfort AY030 (LI036-06001). Circular modern stone wall with a diameter of 1.05m encloses the head of the well with outflow on eastern side. Also includes a paved area and grotto.
LiDAR Description	L130-116: no surface expression for the site, which is defined by a circular modern stone wall, not visible in the LiDAR data.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY032
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-061
Townland	Shangarry
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526602, 632383
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area measuring 32.2m (N–S) by 31.9m (E–W) defined by scarped edge (H 0.6m, Wth 2.1m).
LiDAR Description	L130-114: pair of banks flanking a ditch. The site measures 70m externally and 21m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY033
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-063
Townland	Knockane
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526976, 632229
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as embanked circular enclosure with a diameter of *c.*25m) on 1924 OS map. Has since been levelled with no surface expression. Aerial photo (ASIAP) taken in 2002 shows cropmark of univallate circular enclosure.
LiDAR Description	L130-113: heavily denuded pair of banks flanking a ditch. The site measures 71m externally and 19m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY034
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-065
Townland	Ballymackesy
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527272, 632131
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Subcircular area that measures 22.6m (N–S) by 26.3m (E–W) and is defined by scarped edge (H 0.85m, Wth 1.4m), with external fosse (D 0.45m, Wth 2.6m) NE-W. The interior is level, dry and covered by overgrowth.
LiDAR Description	L138-133: the monument is obscured in the LiDAR data by trees and very little can be discerned. Consisting of a bank and an external ditch; the townland boundary passes along the edge of the monument, while the west and south sides are truncated by field boundaries. The site measures 49m externally and 34m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY035
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-066
Townland	Ballymackesy
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527490, 631741
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area with a diameter of *c*.28m defined by scarped edge (H c.0.5m), with slight trace of external fosse (D 0.1m) SSE–NNE. Drain cut along base of scarped edge NNE–SSE where field boundary skirts enclosure. Interior level and covered by dense overgrowth.

Identification No.	N21/NCW-AY035
LiDAR Description	L139-137: the townland boundary runs along the eastern edge of the monument, which is obscured in the LiDAR data by trees. A clear external ditch is visible beyond the edge of the tree canopy that measures 40m externally in diameter. The interior is obscured.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY036
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-071
Townland	Ballymackesy
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527834, 631992
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as embanked circular enclosure with a diameter of *c*.50m on the 1841 OS map. Has since been truncated on eastern and southern sides by field boundaries. However, enclosing element survives SW–ENE as an earthen bank (int H 0.55m, ext H 0.4m) and defined by scarped edge SSE–SW. Entrance (Wth 2.6m) through bank at north.
LiDAR Description	L139-134: the earthwork perimeter is obscured in the LiDAR data by trees, while its southern edge is located on a townland boundary. Consists of a bank with internal and external ditches; it measures 70m externally and 31m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY037
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-073
Townland	Killeline
Civil Parish	Monagay

Identification No.	N21/NCW-AY037
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	528111, 631982
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 27.8m (N–S) by 26.7m (E–W), enclosed by earthen bank (int H 0.3m, ext H 1.15m) W–NW, and defined by scarped edge (H 1.15m, Wth 3.2m) with external fosse (D 0.25m, Wth 1.8m) E-NW. Enclosing element overlain by field boundary NW–E.
LiDAR Description	L147-138: the earthwork perimeter is obscured in the LiDAR data by trees, compromising most measurements. External ditch is visible measuring 44m externally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY038
Route Corridor Options	Options D and H
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-077
Townland	Killeline
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	528641, 632687
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Roughly circular area, 26.75m (N–S) by 24.9m (E–W), enclosed by earthen bank (int H 0.6m; ext H 0.95m), with external fosse (D 0.1m, Wth 1.4m) NW–SW. Causeway entrance (Wth 4.15m) at east. A drain has been cut along the line of fosse SW–NW. The fosse, which has a shallow profile, appears to have been largely infilled.
LiDAR Description	L146-139: the earthwork perimeter is obscured in the LiDAR data by trees, compromising most measurements. An external ditch is visible that measures 56m externally in diameter. The townland boundary runs along the western edge of the ringfort.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY039
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-080
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	529399, 632592
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 27m (N–S) by 29m (E–W), enclosed by earthen bank (int H 1.9m, ext H 1.65m) NW–NE and E–SSW, with external fosse (D 0.3m, Wth 3m) NW–NE and E–SSE. Enclosing element has been levelled from NE–E and SSW–NW. Most of interior is covered by shallow quarries and dumps of quarried material.
LiDAR Description	L154-147: the earthwork perimeter is obscured in the LiDAR data by trees. Two concentric ditches are visible in the LiDAR data that measure 96m externally and 18m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY040
Route Corridor Options	Options D and H
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-081
Townland	Dromin
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	529425, 633611
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area (46.6m N–S) defined by scarped edge (H 0.75m, Wth 6m). However, scarp and part of interior have been removed NE–SE (interior now 35.2m E–W). A small N–S running drainage channel cuts across scarp at southeast. An E–W field boundary runs along base of scarp SSE–SSW. An ESB pole stands 1m from top of scarp at west-northwest.

Identification No.	N21/NCW-AY040
LiDAR Description	L153-146: the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch that measures 43m externally and 22m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY041
Route Corridor Options	Options C and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-084
Townland	Dromin
Civil Parish	Grange
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	530583, 633948
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Site depicted on 1841 OS map as embanked circular enclosure with a diameter of *c.*110m, has since been levelled. Only evident trace is arc of fosse, possibly V-shaped (D 0.45m, Wth 1.25m, *c.*46m) S–SW, truncated at either end by N–S field boundary. No trace of fosse in adjoining fields to east or west.
LiDAR Description	L161-149: circular enclosure that straddles field boundaries and a townland boundary. The enclosure is recorded on the OS first-edition 6-inch map as a circular enclosure. The LiDAR data have identified the southern edge of a curving bank and external ditch that measures 120m in length, the remainder of the enclosure cannot be seen in the LiDAR data.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY042
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-120
Townland	Ballintubbrid
Civil Parish	Monagay
Barony	Glenquin

Identification No.	N21/NCW-AY042
Site Type	Ringfort – rath
Coordinates (ITM)	525670, 631299
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area measuring 18m E–W, enclosed by earthen bank (int H 0.3m, ext H 0.85m), except from NNW–E where enclosing element has been removed by farm trackway. The interior, which slopes down slightly to north, is covered by overgrowth.
LiDAR Description	L123-106: the earthwork perimeter is obscured in the LiDAR data by trees and the northwest edge is truncated by a trackway; a slight bank was visualised beneath the tree canopy. Consisting of bank and internal ditch that measure 38m externally and 13m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY043
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-123
Townland	Ballintubbrid
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	525824, 631489
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 33.2m (N–S) by 35m (E–W), enclosed by earthen bank (int H 0.95m, ext H 1.5m) S–NW, and defined by scarped edge (H 1.5m, Wth 3.3m) NW–S. External fosse (D0.8m, Wth 2.1m) encloses entire site. Fosse barely traceable from 40–220°. Gaps in bank (Wth 1.5m) at east and west. Interior level, dry and clear of overgrowth.
LiDAR Description	L123-105: the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 51m externally and 33m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY044
Route Corridor Options	Options C and H

Identification No.	N21/NCW-AY044
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-126
Townland	Ballintubbrid
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526139, 631145
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 30m (N–S) by 33.2m (E–W), enclosed by earthen bank (int H 0.5m, ext H 1.65m) with external fosse (D 0.25m, Wth 1.7m); enclosing element overgrown. Possible entrance where bank lowers WNW–W. Gaps in bank (Wth 2-2.5m) at east, east-southeast, southeast, south and northwest. Field boundary runs N–S along outer line of fosse WSW–WNW.
LiDAR Description	L131-107: the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 62m externally and 22m internally in diameter. Includes a significant depression, 3m in width, running E–W across the centre of the site, which is suggestive of a possible souterrain or another internal feature.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY045
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-128
Townland	Ballyshane
Civil Parish	Killeedy
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526389, 631261
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 28.1m (N–S) by 28.5m (E–W), enclosed by earthen bank (int H 0.35m, ext H 1.25m) with external fosse (D 0.65m, Wth 2.75m). Gap (Wth 2.15m) across scarped edge at south. Fosse partially infilled SW–WNW. A field boundary abuts outer edge of fosse at northeast. Interior slopes down slightly to west, and is under pasture.

Identification No.	N21/NCW-AY045
LiDAR Description	L131-108: the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 45m externally and 26m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY046
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-131
Townland	Ballyshane
Civil Parish	Killeedy
Barony	Glenquin
Site Type	Ritual site – holy well
Coordinates (ITM)	526531, 631421
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Not marked on any edition of the OS maps. Well, comprising spring in earth-cut pool with a diameter of 2.3m and depth of 0.65m); outflow drain on north side. Outflow runs N–S joining stream running SW–NE, *c.*15m to west of the spring. No pilgrimage tokens visible.
LiDAR Description	L131-198: well, defined by an earth-cut pool, not visible in the LiDAR data.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY047
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-132
Townland	Ballintubbrid
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526731, 632055
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes

Identification No.	N21/NCW-AY047
	Depicted as embanked circular enclosure with a diameter of *c.*40m on 1924 OS map. Has since been levelled, with no surface expression. Aerial photo (ASIAP) taken in 2002 shows cropmark of a univallate circular enclosure.
LiDAR Description	L130-111: bisected by a field boundary, the site is heavily denuded and appears as a very low contrast surface expression in the LiDAR data. Bivallate ringfort with two very low-profile concentric ditches and clear banks, measuring 60m externally and 22m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY048
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-134
Townland	Ballinvallig
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526808, 631527
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as an embanked circular enclosure with a diameter of *c.*30m on 1924 OS map. Has since been levelled, with no surface expression.
LiDAR Description	L131-109: consisting of a ditch 7m in width; the enclosure measures 61m externally and 54m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY049
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-139
Townland	Ballinvallig
Civil Parish	Monagay
Barony	Glenquin
Site Type	Ringfort – rath

Identification No.	N21/NCW-AY049
Coordinates (ITM)	527003, 631568
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular raised area, 24.8m (N–S) by 26.3m (E–W), defined by scarped edge (H 0.6m, Wth 0.4m). A field boundary running E–W skirts base of scarp; shed built into scarp at north-northeast and pole stands inside top of scarp at north-northwest.
LiDAR Description	L139-110: consisting of an internal ditch, bank and external ditch, measuring 36m externally and 24m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY050
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-140
Townland	Ballinvallig
Civil Parish	Monagay
Barony	Glenquin
Site Type	Mound
Coordinates (ITM)	527073, 631889
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Depicted as oval mound, *c.*20m (E–W) by 15m (N–S) on 1924 OS map. It is now covered by vegetation. AY051, a ringfort (LI036-141) lies 40m to the southeast.
LiDAR Description	L139-135: possible barrow. The mound, which rises to 1m in height above the surrounding ground surface, is enclosed by a circular ditch and a low-profile external bank that measures 44m in external diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY051
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	High
Reference No.	LI036-141
Townland	Ballinvallig
Civil Parish	Monagay

Identification No.	N21/NCW-AY051
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	527101, 631847
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Circular area, 32.2m (N–S) by 34.1m (E–W), enclosed by earthen bank (int H 0.6m, ext H 0.45m). A field boundary running NW–SE abuts bank to southeast and runs along the inner face of bank at southwest. Another field boundary abuts bank to northwest.
LiDAR Description	L139-136: the monument is mostly obscured in the lidar data by tree. Pair of banks flanking a ditch, measuring 64m externally and 23m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY052
Route Corridor Options	Options B, F and G
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-197
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	526218, 633198
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Evident as cropmark of circular enclosure with a diameter of *c.*30m on aerial photograph (LAS). No visible surface expression.
LiDAR Description	L129-118: heavily denuded bank and external ditch, almost imperceptible other than the southern edge. The enclosure measures 47m externally and 29m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY053
Route Corridor Options	Options C and H
Legal Status	Recorded Monument
Importance	Medium

Identification No.	N21/NCW-AY053
Reference No.	LI036-201
Townland	Ballintubbrid
Civil Parish	Monagay
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	525651, 631632
Description	**Scheduled for inclusion in the next revision of the RMP**: No Recorded as Redundant Record in SMR. Record was created with reference to an aerial photograph but an extensive search failed to produce the photograph.
LiDAR Description	L123-104: LiDAR suggests the presence of a subcircular enclosure defined by a palaeochannel 8m in width on its western edge, as well as a 4m wide external ditch and 1–3m wide internal bank. Possibly associated with ringforts AY048 (LI036-134) and AY049 (LI036-139) to southwest.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY054
Route Corridor Options	Options D and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-202
Townland	Shangarry
Civil Parish	Monagay
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	526867, 632188
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes D-shaped area, straight side 30m (NNE–SSW) by 14m (WNW–ESE), defined on straight side by field boundary and stream. Enclosed SSW–NNE by fosse (Wth 4m; D 0.15m)
LiDAR Description	L130-112: D-shaped enclosure defined on its straight side by a townland boundary, field boundary and a stream. The site, which consists of a bank flanked on either side by a ditch, measures 60m (E–W) by 75m (N–S). The enclosure occurs beside four townland boundaries (Shangarry, Ballintubbrid, Ballinvallig and Knockane).
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY055
Route Corridor Options	Option B
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-204
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	526546, 635494
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes In flood plain of River Dooally. Circular area with a diameter of 12m enclosed by earthen bank (int. H 0.15m; ext. H 0.6m; Wth 4m) with external fosse (D 0.2m; Wth 6.9m).
LiDAR Description	L127-123: ditch flanked by internal and external banks that measures 30m externally and 8m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY056
Route Corridor Options	Options E and G
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-206
Townland	Ballyfraley
Civil Parish	Grange
Townland	Glenquin
Site Type	Enclosure
Coordinates (ITM)	529633, 635943
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Oval area, 16m (NE–SW) by 22m (NW–SE), defined by scarped edge (H 0.75m; Wth 3.35m) with external fosse (D 0.2m; Wth 8.35m). Earthen field boundary overlies top of scarped edge, except to northeast, east-southeast and southwest, where there are gaps in the boundary.
LiDAR Description	L155-144: curving ditch, 26m in length, that runs between two field boundaries to form a subcircular enclosure that measures 50m in external diameter.

Identification No.	N21/NCW-AY056
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY057
Route Corridor Options	Indicative R521 Link Road
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-207
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	527345, 634876
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes D-shaped area, 12m (N–S) by 14m (E–W), defined by scarped edge (H 0.4m; Wth 3.7m), that is more pronounced to south (H 0.9m; Wth 5.5m), and straightens along west. External fosse (D 0.4m; Wth 8.4m) evident NW–NE, ESE–SE and S–WSW, but crossed by shallow gulley SE–S. Possible causeway across scarp at northwest.
LiDAR Description	L136-131: circular enclosure comprising a bank and external ditch measuring 35m in external diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY058
Route Corridor Options	Options B, F and G
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-208
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	525943, 633283
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes

Identification No.	N21/NCW-AY058
	Roughly circular area, 14m (NNW–SSE) by 12m (WNW–ESE), defined by scarped edge (H 0.25m; Wth 4m), with faint trace of external fosse S-NE (D 0.25m; Wth 8.5m). Interior level except along edge from E–SE where there is a gentle indent in the ground.
LiDAR Description	L121-100: LiDAR feature may represent an entirely new monument entirely. Small oval-shaped enclosure with a slight raised interior defined by a ditch, 6m in width. The site measures 26m by 31m.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY059
Route Corridor Options	Options A and F
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-212
Townland	Ballyfraley
Civil Parish	Grange
Barony	Glenquin
Site Type	Ringfort – rath
Coordinates (ITM)	530235, 635513
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Levelled monument visible as circular-shaped cropmark, *c.*37m (N-S) by 42m (E–W), from SE–S–W–NW. Delimited from NW–N–E–SE by a curving field boundary running NW–SE. Evident on OSI orthophotograph taken between 2005–12 and on Google Earth orthoimages. A linear cropmark running N–S intersects the monument at southeast.
LiDAR Description	L159-151: the northeast quadrant of the earthwork perimeter is obscured in the LiDAR data by trees. Bank and external ditch measuring 59m externally and 29m internally in diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY060
Route Corridor Options	Options C and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-215

Identification No.	N21/NCW-AY060
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	529703, 632731
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Levelled monument visible as circular-shaped cropmark with a diameter of *c.*30m that is intersected by N–S linear cropmark to southeast. Evident on OSI orthophotograph taken between 2005–12 and on Google Earth orthoimages.
LiDAR Description	L154-148: possible bivallate ringfort comprising two pairs of heavily denuded concentric banks and ditches. The site measures 80m in external diameter.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY061
Route Corridor Options	Options C, D, H and I
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-218
Townland	Ballymackesy
Civil Parish	Monagay
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	527383, 631789
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes Cropmark of circular-shaped area with a diameter of *c.*26m. Visible on Digital Globe orthophoto taken 2011–13 and on Google Earth orthoimage taken 24/06/2018. Suggestive of the remains of a levelled ringfort.
LiDAR Description	L139-187: a very clear example of a possible ringfort. Consisting of external ditch with internal bank that measures 39m externally and 19m internally in diameter. Heavily denuded by plough furrows that cross the site from NE–SW.
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Identification No.	N21/NCW-AY062
Route Corridor Options	Options C, D, H and I

Identification No.	N21/NCW-AY062
Legal Status	Recorded Monument
Importance	Medium
Reference No.	LI036-217
Townland	Killeline
Civil Parish	Monagay
Barony	Glenquin
Site Type	Enclosure
Coordinates (ITM)	528316, 632311
Description	**Scheduled for inclusion in the next revision of the RMP**: Yes In reclaimed grassland, on demesne lands of Killeline House, which is located 110m to WNW. Outline of roughly-circular-shaped area with a diameter of c.32m, enclosed by low bank. Evident as circular shaped depression on OSI orthoimage (2005–12) and on Digital Globe orthophoto (2011–13). Outline of earthwork with rush-covered depression visible on Google Earth orthoimage dated 06/10/2010. Close proximity to Killeline House may suggest the earthwork is representative of a designed landscape feature, such as a tree-ring, as opposed to the remains of a ringfort.
LiDAR Description	Not included in LiDAR assessment
Source(s)	Historic Environment Viewer [online]. Available at: https://maps.archaeology.ie/HistoricEnvironment/

Appendix 9.2. Architectural Heritage Inventory

Identification No.	N21/NCW-AH001
Route Corridor Options	Options A, E, F, G and Indicative R521 Link Road
Legal Status	Listed on the NIAH
Rating	Regional
Reference No.	21903602 (NIAH Building Survey Reg.)
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Original Use	Country house (Churchtown House)
Date	1760–1800
Coordinates (ITM)	527522, 635664
Description	Detached L-plan three-bay two-storey house, built *c.*1780, with extension to rear (northwest). Hipped slate roof with rendered chimneystacks, cast-iron rainwater goods and oversailing eaves with timber brackets. Rendered walls throughout. Square-headed window opening with tooled limestone sills and six-over-six pane timber sliding sash windows. Elliptical-headed door opening to front (southeast) elevation, having double-leaf timber panelled doors flanked by timber pilasters and stained-glass sidelights having cut limestone sills, surmounted by petal fanlight, opening to cut limestone step. Multiple-bay two-storey outbuilding to rear with pitched slate roof and red brick chimneystack. Rubble stone walls. Square-headed and segmental-headed openings with red brick voussoirs and timber battened fittings to upper floor. Cast-iron piers to entrance to west of site with replacement steel gate. Set within own grounds. Located within its own grounds, this is a pleasing middle-sized house of balanced Georgian proportions, existing largely in its early form and retaining much of its original fabric. The façade of this house is enhanced by a decorative entrance with its timber surround, stained glass sidelights and fanlight, serving to enliven the underlying regular classical form. The outbuilding and modest gated entrance further complement the house forming a pleasant and interesting group in the landscape.
Source(s)	NIAH Building Survey [online]. Available at: https://www.buildingsofireland.ie/buildings-search/building/21903602/churchtown-house-churchtown-newcastle-west-limerick

Identification No.	N21/NCW-AH002
Route Corridor Options	Indicative R521 Link Road
Legal Status	Protected Structure; listed on the NIAH
Rating	Regional
Reference No.	1442 (RPS Ref.); 21903603 (NIAH Building Survey Reg.)

Identification No.	N21/NCW-AH002
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Original Use	Bridge
Date	1860–1870
Coordinates (ITM)	527573, 635008
Description	Single-arch road bridge, built *c.*1865, spanning the former Rathkeale to Newcastle West extension. Comprising round-headed arch having rusticated limestone voussoirs and dressed stone soffits springing from rusticated limestone piers with rusticated impost blocks. Snecked rusticated limestone spandrels surmounted by rusticated limestone parapet walls with coping and stringcourses. Splayed snecked rusticated limestone abutments projecting from sides (east, west) having rusticated limestone coping and capping. Tarmac road over bridge. Bridge forms part of the former Limerick to Tralee Railway line which now forms part of the Southern Trail. This is a fine example of a railway bridge that follows a standard design. Typical of many architectural features associated with nineteenth-century railways, the bridge features well executed walls constructed in rusticated limestone. Simple artistic details including rusticated voussoirs, stringcourses and coping greatly enhance the visual appeal of the bridge. Although no longer used as a railway, the track below this bridge has been recently converted into the Great Southern Trail (Limerick Greenway), an 85km trail through West Limerick and North Kerry.
Source(s)	NIAH Building Survey [online]. Available at: https://www.buildingsofireland.ie/buildings-search/building/21903603/churchtown-newcastle-west-limerick

Identification No.	N21/NCW-AH003
Route Corridor Options	Options C, D, H and I
Legal Status	Listed on the NIAH
Rating	Regional
Reference No.	21903606 (NIAH Building Survey Reg.)
Townland	Killeline
Civil Parish	Monagay
Barony	Glenquin
Original Use	Country house (Killeline House)
Date	1800–1805
Coordinates (ITM)	528170, 632423
Description	Freestanding three-bay two-storey country house, built in 1801, having porch to front (east), projecting gable-fronted end bays to rear (west) and lean-to conservatory to side (south). Three-bay single-storey lean-to extension with three-

Identification No.	N21/NCW-AH003
	bay single-storey gable-fronted porch to side (south) of projecting gable-fronted bay. Three-bay single-storey additional to rear (west) having central canopy. Hipped slate roof with red brick chimneystacks, timber clad eaves and uPVC rainwater goods. Double-pile slate roofs with rendered chimneystacks to projecting gable-fronted bays. Slate-lean-to roofs to extensions with pitched slate roofs to gable-fronted porch to side (south) elevation and rear elevation canopy. Flat roof to front porch having parapet with tooled limestone cornice surmounted by tooled stone capping with central inscribed limestone plaque with Latin motto. Concealed rainwater goods with uPVC downpipe. Carved timber bargeboards to rear elevation. Skylight to side (south) extension. Glazed roof to conservatory. Rendered walls throughout with plinth, quoins and platbands below eaves. Square-headed window openings having tooled limestone sills and internal timber panelled shutters, having six-over-six pane uPVC sliding sash windows throughout. Four-over-four pane uPVC sliding sash windows to first floor of side (north and south) elevations. Bipartite uPVC sliding sash windows to front elevation of porch. Render sills and timber casement windows to extension and gable-fronted porch to side (south) elevation. Timber casement windows to conservatory having camber-headed spandrels to side (south) elevation openings. Square-headed door openings throughout, having tooled limestone stepped approach and glazed timber doors to sides (north, south) elevations of front porch. Double-leaf glazed timber doors to side (south) elevation. Internal glazed timber door surmounted by single-pane overlight to side (south) elevation of conservatory. Timber panelled door to side (north) elevation surmounted by single-pane overlight. Glazed timber door to rear elevation. Enclosed farmyard complex attached to rear of house. Comprising eight-bay single-storey outbuilding forming southern range, four-bay two-storey former carriage house forming western range with integral porte-cochere and gable-fronted former loading bay. Eleven-bay single-storey outbuilding forming northern range. Pitched slate roofs throughout with red brick chimneystacks to north and south ranges. Decorative ceramic ridge tiles to southern range. Rendered and exposed rubble stone walls. Camber-headed porte-cochere having tooled limestone and rusticated stone voussoirs with central rusticated keystone. Rusticated keystones to south and west ranges above former entrances. Square-headed window openings having rendered and cut limestone sills with timber and uPVC casement windows. Camber-headed carriage arch to western range having rusticated keystone and double-leaf glazed timber doors. Square-headed door openings having timber battened and glazed timber doors. Exposed rubble stone enclosing walls forming eastern range with rubble stone coping and square-profile piers having roughly dressed rubble stone coping. Located on the crest of a low hillock, this building has extensive views to the east and south east. Having been burnt and rebuilt twice, this appealing building has been carefully restored to its former glory. Historically, the house was built as an agent's house by the British Government. A finely carved plaque depicting an arm in armour holding a sword with a Latin motto forms an attractive focal point to the façade. Currently undergoing renovation, its attractive outbuildings, accessed through an elegant porte-cochere around an enclosed courtyard, are integral to the historic character of this fine property.
Source(s)	NIAH Building Survey [online]. Available at: https://www.buildingsofireland.ie/buildings-search/building/21903606/killeline-house-killeline-newcastle-west-limerick

Identification No.	N21/NCW-AH004
Route Corridor Options	Options C, D, H and I
Legal Status	Protected Structure; listed on the NIAH
Rating	Regional
Reference No.	116 (RPS Ref.); 21903607 (NIAH Building Survey Reg.)
Townland	Ballymackesy
Civil Parish	Monagay
Barony	Glenquin
Original Use	Country house (Ballymackesy Cottage)
Date	1840–1880
Coordinates (ITM)	527958, 632112
Description	Detached three-bay two-storey former country house, built *c.*1860, having single-storey porch to front (east). Single-bay single-storey with dormer attic addition to rear (west) with lean-to extension and single-bay single-storey porch surmounted by later first-floor extension. Hipped slate roof having red brick chimneystacks, timber clad eaves course and cast-iron rainwater goods. Pitched slate roof to rear addition with red brick chimneystack. Slate-lean to roof to extension. Flat roof to porch with concealed rainwater goods behind rendered parapet with moulded stringcourse, cornice and coping. Roughcast rendered walls with plinth to front elevation, having line-and-ruled rendered walls to rear first floor extension, rendered walls with plinth to front porch. Recessed bays to front and side (north, south) elevations of porch having moulded reveals above recessed rusticated render panels to front and side (north) elevations. Cast-iron vent pipe to rear elevation. Square-headed window openings having tooled limestone sills and two-over-two pane timer sliding sash windows. Double and triple light arrangements to front porch, having rendered mullions, sills, moulded reveals and one-over-one pane timber sliding sash windows surmounted by single-pane overlights. One-over-one pane timber sliding sash window to gable of rear addition. Blocked square-headed window openings to first floor extension to rear. Square-headed door openings throughout, having tooled stone stepped approach, moulded rendered reveals to side (south) elevation of front porch, now blocked. Exposed rubbed red brick voussoirs to side (south) elevation of rear porch having blocked glazed timber door. Enclosed cobbled farmyard to south-west enclosed by various single and two-storey barn and stable blocks. Single-storey carriage house to west with brick chimneystack and integral carriage arch with rubbed brick voussoirs. Square-profile tooled limestone gate piers to north at site of original main entrance having chamfered corners and carved capping supporting single-leaf wrought-iron gate. Built in the mid-nineteenth century, this house maintains much of its historic appeal through the retention of key features including tooled limestone sills, a fine hipped slate roof, roughcast rendering, sash windows and cast-iron rainwater goods. It's well executed front porch displays some artistic detail within its design including moulded stringcourse, rusticated panels, cornice and an unusual arrangement of windows. The retention of original limestone gate piers and its

Identification No.	N21/NCW-AH004
	enclosed cobbled farmyard further complement the historic character of the property.
Source(s)	NIAH Building Survey [online]. Available at: https://www.buildingsofireland.ie/buildings-search/building/21903607/ballymackesy-cottage-ballymackesy-newcastle-west-limerick

Identification No.	N21/NCW-AH005
Route Corridor Options	Options C and I
Legal Status	Protected Structure; listed on the NIAH
Rating	Regional
Reference No.	1511 (RPS Ref.); 21903613 (NIAH Building Survey Reg.)
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Original Use	Bridge
Date	1850–1860
Coordinates (ITM)	529903, 632800
Description	Freestanding triple-arch road bridge, dated 1855. Comprising three camber-headed arches with tooled limestone voussoirs, keystones and dressed stone soffits springing from rusticated stone piers. Tooled stone corbels and stringcourse to piers, having dressed stone plinths with recent rendering and slightly curved V-cutwaters to northeast and southwest elevations. Tooled stone capping to cutwaters. Dressed stone spandrels surmounted by dressed limestone parapets with tooled limestone coping. Tooled limestone terminal piers flanking parapets. Recent cast-iron service pipe to south-west elevation mounted on cast-iron support beams. Recent freestanding rectangular tower to west end of south-west elevation having galvanised-steel platform. Tarmac road over bridge. This fine mid nineteenth-century bridge is an impressive engineering achievement, displaying throughout its fabric, the great skill and craftsmanship of its builders. Varying textures within the bridge including tooled, dressed and rusticated limestone greatly enhance its visual appeal. The inclusion of corbels within the design provide an interesting structural feature and insight into the construction methods of the arches. Carved on keystone 'EGF 1855'.
Source(s)	NIAH Building Survey [online]. Available at: https://www.buildingsofireland.ie/buildings-search/building/21903613/cloonyscrehane-newcastle-west-limerick

Identification No.	N21/NCW-AH006
Route Corridor Options	Options C, D, H and I

Identification No.	N21/NCW-AH006
Legal Status	Listed on the NIAH
Rating	Local
Reference No.	1373 (NIAH Garden Survey Reg.)
Townland	Killeline
Civil Parish	Monagay
Barony	Glenquin
Original Use	Historic garden/demesne (Killeline House)
Date	Nineteenth century
Coordinates (ITM)	528134, 632336
Description	Building indicated area labelled Killeline. Site Footprint Visible: Yes. Boundary Defined: Yes. Significant Development: No. General Comments: The parkland, comprising 40 acres, was utilised as a golf course from 1943 to 1988
Source(s)	NIAH Garden Survey [online]. Available at: https://www.buildingsofireland.ie/buildings-search/site/1373/killeline-house-monagay-co-limerick

Identification No.	N21/NCW-AH007
Route Corridor Options	Options A, B, E, F, G and Indicative R521 Link Road
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Churchtown and Dooally
Civil Parish	Newcastle
Barony	Glenquin
Original Use	W&LR Limerick Tralee Line: Railway line (site of)
Date	1880
Coordinates (ITM)	Various
Description	W&LR Limerick–Tralee Line (site of), opened in 1880; also known as the North Kerry Line. The WL&WR was bought by GS&WR in 1901 and was merged with three other companies to form the Great Southern Railways in 1925. The Transport Act of 1944 dissolved the GSR and its assets were transferred to CIE. The line was closed to passengers in 1963 and closed to freight in 1977. Track lifted, the former rail line now comprises the Limerick Greenway (formerly the Great Southern Trail), which is 42km in length.

Identification No.	N21/NCW-AH007
Source(s)	OS 25-inch map (1897–1903), Bing Aerial, Google Satellite, Survey from Accessible Lands 2021

Identification No.	N21/NCW-AH008
Route Corridor Options	Option B
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Coolacokery
Civil Parish	Ardagh
Barony	Shanid
Original Use	Vernacular buildings
Date	Nineteenth century
Coordinates (ITM)	529317, 636289
Description	Three (no. 3) structures and one (no. 1) pump shown on OS 25-inch map. Two (no. 2) structures extant and in use as sheds.
Source(s)	OS 25-inch map (1897–1903), OSI Aerial 1995, OSI Aerial 2000, OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13. OSI Aerial Premium 2013–18, Bing Aerial, Google Satellite

Identification No.	N21/NCW-AH009
Route Corridor Options	Options C and H
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Ballymackesy
Civil Parish	Monagay
Barony	Glenquin
Original Use	Vernacular building
Date	Nineteenth century
Coordinates (ITM)	527164, 631796
Description	Structure depicted on OS 6-inch and 25-inch maps. Extant, in use as shed.
Source(s)	OS 6-inch (1840–41), OS 25-inch map (1897–1903), OSI Aerial 1995, OSI Aerial 2000, OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13. OSI

Identification No.	N21/NCW-AH009
	Aerial Premium 2013–18, Bing Aerial, Google Satellite, Survey from Accessible Lands 2021

Identification No.	N21/NCW-AH010
Route Corridor Options	Options C and I
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Dromin
Civil Parish	Grange
Barony	Glenquin
Original Use	Vernacular building
Date	Nineteenth century
Coordinates (ITM)	530163, 633211
Description	Two (no. 2) structures depicted on the OS 6-inch map, three (no. 3) structures and pump are shown on 25-inch map. Extant, one (no. 1) in use as shed, others in ruins.
Source(s)	OS 6-inch (1840–41), OS 25-inch map (1897–1903), OSI Aerial 1995, OSI Aerial 2000, OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13. OSI Aerial Premium 2013–18, Bing Aerial, Google Satellite

Identification No.	N21/NCW-AH011
Route Corridor Options	Options C and I
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Ballingowan
Civil Parish	Grange
Barony	Glenquin
Original Use	Vernacular building
Date	Nineteenth century
Coordinates (ITM)	530002, 634995
Description	Structure evident on OS 6-inch and 25-inch maps, extant and in use as residential dwelling
Source(s)	OS 6-inch (1840–41), OS 25-inch map (1897–1903), OSI Aerial 1995, OSI Aerial 2000, OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13. OSI

Identification No.	N21/NCW-AH011
	Aerial Premium 2013–18, Bing Aerial, Google Satellite, Survey from Accessible Lands 2021

Identification No.	N21/NCW-AH012
Route Corridor Options	Option A, E, F and G
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Dungeeha
Civil Parish	Grange
Barony	Glenquin
Original Use	Rathkeale & Newcastle Junction Railway (R&NJR): Railway (site of)
Date	1867
Coordinates (ITM)	528169, 635463
Description	Rathkeale & Newcastle Junction Rail Line. Rathkeale & Newcastle Junction Railway (R&N.J.R.) (site of), opened in 1867. Final goods train in 1975, track lifted in late 1980s. The former rail line now comprises a section of the Limerick Greenway Trail (formerly the Great Southern Trail).
Source(s)	OS 25-inch map (1897–1903), Bing Aerial, Google Satellite, Survey from Accessible Lands 2021

Identification No.	N21/NCW-AH013
Route Corridor Options	Indicative R521 Link Road
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Original Use	Vernacular building
Date	Nineteenth century
Coordinates (ITM)	527498, 635960

Identification No.	N21/NCW-AH013
Description	Three (no. 3) structures evident on OS 6-inch map, with two (no. 2) structures on 25-inch map (one substantially enlarged). Elements of earlier building extant within present dwelling, while another extant as shed.
Source(s)	OS 6-inch (1840–41), OS 25-inch map (1897–1903), OSI Aerial 1995, OSI Aerial 2000, OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13. OSI Aerial Premium 2013–18, Bing Aerial, Google Satellite

Identification No.	N21/NCW-AH014
Route Corridor Options	Indicative R521 Link Road
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Original Use	Bridge
Date	Nineteenth century
Coordinates (ITM)	527522, 635996
Description	Daar Bridge, depicted on OS 6-inch map and 25-inch map, extant.
Source(s)	OS 6-inch (1840–41), OS 25-inch map (1897–1903), Bing Aerial & Google Satellite, Survey from Accessible Lands 2021

Identification No.	N21/NCW-AH015
Route Corridor Options	Indicative R521 Link Road
Legal Status	Undesignated
Rating	Local
Reference No.	N/A
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Original Use	Vernacular building
Date	Nineteenth century
Coordinates (ITM)	527484, 635939
Description	One (no. 1) structure depicted on OS 6-inch map, two (no. 2) shown on 25-inch map. Extant and in use as sheds.

Identification No.	N21/NCW-AH015
Source(s)	OS 6-inch (1840–41), OS 25-inch map (1897–1903), OSI Aerial Premium 2013–18, Bing Aerial, Google Satellite

Appendix 9.3. Inventory of other Cultural Heritage Assets

Identification No.	N21/NCW-CH001
Route Corridor Options	Options A and F
Legal Status	Undesignated
Importance	Unknown
Townland	Dungeeha
Civil Parish	Grange
Barony	Glenquin
Coordinates (ITM)	529077, 635635
Description	Possible circular enclosure visible as cropmark on aerial imagery, 19m in diameter
Source(s)	Bing Aerial, OSI Aerial 2005, OSI Aerial 2005–12

Identification No.	N21/NCW-CH002
Route Corridor Options	Options A and F
Legal Status	Undesignated
Importance	Unknown
Townland	Ballyfraley
Civil Parish	Grange
Barony	Glenquin
Coordinates (ITM)	529489, 635647
Description	Oval enclosure visible as cropmark on aerial imagery, 51m in diameter (N–S)
Source(s)	Bing Aerial, OSI Aerial 1995, OSI Aerial Premium 2005–12, OSI Aerial Premium 2013–18

Identification No.	N21/NCW-CH003
Route Corridor Options	Options A, E, F and G
Legal Status	Undesignated
Importance	Unknown
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Coordinates (ITM)	526407, 634768

Identification No.	N21/NCW-CH003
Description	Oval enclosure extant in field boundary, 137m in diameter. Possible remnants of enclosure that was incorporated into later field pattern. Also evident on OS 6-inch and 25-inch maps with quarry to south.
Source(s)	OS 6-inch map (1840–41), OS 25-inch map (1897–1903), OSI Aerial 1995, OSI Aerial 2000, OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13, OSI Aerial Premium 2013-18, Bing Aerial, Google Satellite

Identification No.	N21/NCW-CH004
Route Corridor Options	Options A and E
Legal Status	Undesignated
Importance	Unknown
Townland	Killaghteen
Civil Parish	Ardagh
Barony	Glenquin
Coordinates (ITM)	524932, 632753
Description	Circular enclosure evident as cropmark on aerial imagery, 28m in diameter, possible ring fort. Comparable expression as cropmark of levelled ringfort AY026 (LI036-55), *c.* 100m to southeast.
Source(s)	Bing Aerial, OSI Aerial 1995, OSI Digital Globe 2011–13, OSI Aerial Premium 2013–18

Identification No.	N21/NCW-CH005
Route Corridor Options	Option B
Legal Status	Undesignated
Importance	Unknown
Townland	Doocatteen
Civil Parish	Newcastle
Barony	Glenquin
Coordinates (ITM)	527330, 636406
Description	Sub-square enclosure, 65m (E–W) x 30m (N–S). Shown as field boundary associated with two former structures shown on OS 6-inch map and evident on aerial imagery.
Source(s)	Bing Aerial, Google Satellite, OS 6-inch map (1840–41), OSI Aerial 2005, OSI Aerial 2005–12, OSI Digital Globe 2011–13, Survey from Accessible Lands 2021

Identification No.	N21/NCW-CH006
Route Corridor Options	Option F
Legal Status	Undesignated
Importance	Unknown
Townland	Dooally
Civil Parish	Newcastle
Barony	Glenquin
Coordinates (ITM)	526599, 635191
Description	Circular enclosure evident as cropmark, 26m in diameter, visible on aerial imagery
Source(s)	Bing Aerial, HEV Aerial, OSI Aerial 2005–12, OSI Aerial Premium 2013–18

Identification No.	N21/NCW-CH007
Route Corridor Options	Option A
Legal Status	Undesignated
Importance	Unknown
Townland	Churchtown
Civil Parish	Newcastle
Barony	Glenquin
Coordinates (ITM)	527677, 635485
Description	Low mound with external ditch visible on aerial imagery, 19m in diameter, possible barrow
Source(s)	Bing Aerial, OSI Aerial 2005, OSI Digital Globe 2011–13

Identification No.	N21/NCW-CH008
Route Corridor Options	Option C
Legal Status	Undesignated
Importance	Unknown
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Coordinates (ITM)	529709, 632702
Description	Possible early medieval field system associated with enclosure AY060 (LI036-215). *c.*120m (NE–SW) x 85m (NW–SE), evident as cropmarks on aerial imagery
Source(s)	Bing Aerial, OSI Aerial 1995, OSI Aerial 2005–12, OSI Digital Globe 2011–13

Identification No.	N21/NCW-CH009
Route Corridor Options	Option D
Legal Status	Undesignated
Importance	Unknown
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Coordinates (ITM)	529264, 632749
Description	Circular feature evident as cropmark, 10m in diameter, visible on aerial imagery
Source(s)	Bing Aerial, Google Satellite

Identification No.	N21/NCW-CH010
Route Corridor Options	Option D
Legal Status	Undesignated
Importance	Unknown
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Coordinates (ITM)	529279, 632764
Description	Circular feature evident as cropmark, 4m in diameter, visible on aerial imagery
Source(s)	Bing Aerial, Google Satellite

Identification No.	N21/NCW-CH011
Route Corridor Options	Options C and I
Legal Status	Undesignated
Importance	Unknown
Townland	Cloonyscrehane
Civil Parish	Grange and Monagay
Barony	Glenquin
Coordinates (ITM)	N/A
Description	Ehernagh Stream (Area of Potential)
Source(s)	EPA Soils Database, County Limerick

Identification No.	N21/NCW-CH012
Route Corridor Options	Options A, B, E, F and G
Legal Status	Undesignated
Importance	Unknown
Townland	Ballingowan, Ballyfraley, Ballylahiff, Coolacokery, Dungeeha, Garranekeevan and Killard
Civil Parish	Ardagh, Grange and Newcastle
Barony	Glenquin and Shanid
Coordinates (ITM)	N/A
Description	Ballyfraley Stream (Area of Potential)
Source(s)	EPA Soils Database, County Limerick

Identification No.	N21/NCW-CH013
Route Corridor Options	Options A, B, C, D, E, F, G, H and I
Legal Status	Undesignated
Importance	Unknown
Townland	Churchtown, Cloonyscrehane, Dooally and Dromin
Civil Parish	Grange and Newcastle
Barony	Glenquin
Coordinates (ITM)	N/A
Description	Dooally River (Area of Potential)
Source(s)	EPA Soils Database, County Limerick

Identification No.	N21/NCW-CH014
Route Corridor Options	Options C and I
Legal Status	Undesignated
Importance	Unknown
Townland	Cloonyscrehane and Dromin
Civil Parish	Grange and Monagay
Barony	Glenquin
Coordinates (ITM)	N/A
Description	River Deel (Area of Potential)
Source(s)	EPA Soils Database, County Limerick

Identification No.	N21/NCW-CH015
Route Corridor Options	Options A, B, C, D, E, F, G, H, I and Indicative R521 Link Road
Legal Status	Undesignated
Importance	Unknown
Townland	Ballylahiff, Churchtown, Doocatteen, Dromin, Garranekeevan and Gortroe
Civil Parish	Grange and Newcastle
Barony	Glenquin
Coordinates (ITM)	N/A
Description	River Daar (Area of Potential)
Source(s)	EPA Soils Database, County Limerick

Appendix 9.4. Inventory of Previous Archaeological Investigations

Licence No.	07E0157
Route Corridor Options	Options C, D, H and I
Townland	Killeline
SMR/RMP Ref.	LI036-073 (AY037)
Coordinates (ITM)	528196, 632382
Excavations.ie Ref.	2007: 1118
Archaeological Consultant	John O'Connor
Summary of Findings	The proposed development involved the construction of a dwelling and associated services within the ZoN of an enclosure (AY037). Six trenches were excavated across the site. A stone-lined field drain was uncovered in two trenches, three sherds of 19th-century pottery were also recovered. Nothing of archaeological significance was noted.
Source(s)	Database of Irish Excavation Reports [online]. Available at: https://excavations.ie/report/2007/Limerick/0018095/

Licence No.	07E0180
Route Corridor Options	Options C, D, H and I
Townland	Killeline
SMR/RMP Ref.	N/A
Coordinates (ITM)	528197, 632404
Excavations.ie Ref.	2007: 1119
Archaeological Consultant	Jacinta Kiely, Eachtra Archaeological Projects
Summary of Findings	Twelve trenches were excavated within the footprint of the housing development. A ringfort (LI036-077) is located in proximity to the site. No testing was undertaken in the ringfort or associated ZoN. Nothing of archaeological significance was noted.
Source(s)	Database of Irish Excavation Reports [online]. Available at: https://excavations.ie/report/2007/Limerick/0018096/

Licence No.	09E0292
Route Corridor Options	Options D and I
Townland	Killaghteen

Licence No.	09E0292
SMR/RMP Ref.	LI036-059 (AY029)
Coordinates (ITM)	526259, 632690
Excavations.ie Ref.	2009: 532
Archaeological Consultant	Miriam Carroll, Tobar Archaeological Services
Summary of Findings	The initial phase of monitoring was carried out as a condition of planning. The proposed development consisted of the construction of a ground-floor extension and porch to a dwelling. The site is located within the ZoN of ringfort (LI036–059). The first phase of archaeological monitoring occurred in November 2009. Nothing of archaeological significance was noted.
Source(s)	Database of Irish Excavation Reports [online]. Available at: https://excavations.ie/report/2009/Limerick/0020879/

Route Corridor Options	Options D and I
Licence No.	09E0292
Townland	Killaghteen
SMR/RMP Ref.	LI036-059 (AY029)
Coordinates (ITM)	526259, 632690
Excavations.ie Ref.	2010: 445
Archaeological Consultant	Miriam Carroll, Tobar Archaeological Services
Summary of Findings	The second phase of archaeological monitoring at Killaghteen was carried out in 2010; nothing of archaeological significance was noted.
Source(s)	Database of Irish Excavation Reports [online]. Available at: https://excavations.ie/report/2010/Limerick/0021654/

Route Corridor Options	Options D and H
Licence No.	09E0438
Townland	Gortroe
SMR/RMP Ref.	N/A
Coordinates (ITM)	529561, 634264
Excavations.ie Ref.	2009: 531
Archaeological Consultant	Anette Quinn, Tobar Archaeological Services
Summary of Findings	Eight test-trenches were investigated at Gortroe, Newcastle West, in advance of the construction of a service station, restaurant and distributor road. Nothing of archaeological significance was noted.

Route Corridor Options	Options D and H
Licence No.	09E0438
Source(s)	Database of Irish Excavation Reports [online]. Available at: https://excavations.ie/report/2009/Limerick/0020878/

Licence No.	11E0349
Route Corridor Options	Options A and E
Townland	Garryduff
SMR/RMP Ref.	N/A
Coordinates (ITM)	524065, 632126
Excavations.ie Ref.	2011: 404
Archaeological Consultant	David Bayley, Irish Archaeological Consultancy
Summary of Findings	Testing was undertaken within the townlands of Glendarragh, Garryduff, Killaghteen and Ballintubbrid in October 2011, in advance of the construction of the N21 Killarney Pole to Barnagh Road Safety Scheme. The assessment was undertaken on behalf of Limerick County Council and the (then) National Roads Authority. A total of 6,164m of linear trenches were excavated in seven greenfield areas. Three archaeological sites were identified through the works, all of which were outside the Study Area. They were subsequently excavated in January 2012 (see Delaney 2014). Garryduff 1 (Licence No. 12E001), which was located 585m to the west-southwest of Options A and E, consisted of the remains of a small burnt spread that occurred in association with a centrally placed pit and flanking postholes that were interpreted as the remains of a spit or rack. Radiocarbon dates obtained from the central pit and a posthole indicated they derived from the Middle to Late Bronze Age. Four distinct phases of activity were identified at Garryduff 2 (Licence No. 12E002), which lay 475m to the west of Options A and E. The earliest consisted of a Middle Bronze Age roundhouse, which was characterised by a curvilinear slot trench, hearths, postholes, stakeholes and pits. A second Middle Bronze Age structure was identified to the east that was defined by stakeholes. A series of pits filled with heat shattered stone were located to the east of the roundhouse and were dated to the Middle to Late Bronze Age, while an Iron Age pit was uncovered to the west. The latest feature comprised the western end of a nineteenth-century vernacular dwelling that was depicted on the first-edition OS 6-inch map. Garryduff 3 (Licence No. 12E003) was located 110m west of Options A and E. It consisted of an early medieval charcoal-production kiln (2.2m by 0.7m by 0.22m), associated with four shallow sterile pits.
Source(s)	Database of Irish Excavation Reports [online]. Summary for 11E0349 available at: https://excavations.ie/report/2011/Limerick/0022477/ Summary for Garryduff 1 available at: https://excavations.ie/report/2012/Limerick/0023347/

Licence No.	11E0349
	Summary for Garryduff 2 available at: https://excavations.ie/report/2012/Limerick/0023348/ Summary for Garryduff 3 available at: https://excavations.ie/report/2012/Limerick/0023349/

Licence No.	18E0188
Route Corridor Options	Options D and H
Townland	Cloonyscrehane
SMR/RMP Ref.	N/A
Coordinates (ITM)	529306, 633113
Excavations.ie Ref.	2018: 261
Archaeological Consultant	Frank Coyne, Ægis Archaeology
Summary of Findings	Three trenches were investigated on the site of a regional athletics hub, to investigate the archaeological potential of a raised area partially surrounded by a ditch-like feature. The feature was natural in origin, possibly an old meander loop of the nearby River Arra.
Source(s)	Database of Irish Excavation Reports [online]. Available at: https://excavations.ie/report/2018/Limerick/0026966/

Appendix 9.5. Extracts from the Irish Folklore Commission Schools' Collection

Townland	Ballinvallig
Collector/Informant	Bridie Hough
Extract Detail	In the townland of Ballinvallig in the Parish of Monegea there is a fort one field in from the road not far from where I live. In the centre of this fort there is one white thorn bush standing alone. The people of long ago believed that there was a lot of money under this bush. The bush was very small at that time, so they said it would be very easy to root it up and dig out the money. Ten local men went together at nightfall with lanterns to search for the money. They had shovels and spades and were digging up the earth around the bush when they heard a dreadful sound in the bushes that encircled the fort. The men began to tremble and they hurriedly quenched their lanterns. Just then a great big light shone around the fort and a big black bull appeared with horns about three feet long, and chains hanging from his head. And his back seemed to be on fire. He chased the men for a while from the fort and then disappeared. Not long after the same thing happened to other men who ventured to look for the money. This fort belongs to Michael Foley of Ballinvalling. This is a true story and it was told to me by my Father. He heard it from his mother about 30 years ago. She was about 50 years at that time.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921974/4914559/4937480

Townland	Killaghteen
Collector/Informant	Mrs Hanly
Extract Detail	In the Famine years the people used to be dying by the road-side of cholera. There used be depots where maize meal was given out to the people to feed them.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921965/4914092

Townland	Killaghteen
Collector/Informant	Not listed
Extract Detail	In Quills land there are three forts quite close to each other. They are in the townland of *Dún na Cinc*. An underground passage is going south west to Tulaig where there are more.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921965/4914049

Townland	Coolcappa, Ballynamuddagh
Collector/Informant	Not listed

Townland	Coolcappa, Ballynamuddagh
Extract Detail	**Tobar Chiaráin** The pattern day is the 9th of September. Long ago there used be *cábáin* and sports there. Dancing etc. used be carried on that day. A woman washed clothes in it and it dried for three years. The parish priest of Ardagh brought the water back again there. It is in the townland of Coolcappa. Whitethorn trees grow near the well. It is a good piece in from the road. The water from the well is reputed to remain fresh for years. The well is circular in shape.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921965/4914044

Townland	Killaghteen
Collector/Informant	Seán O hAirnéide
Extract Detail	This holy well is in the parish of Ardagh. Very little is known of the well in the townland of Killaghteen. It is situated near the parish church. It is said that St Patrick cursed the well and whoever would drink its water would die. St Molua beseeched him to change the curse and he did. Now birds that drink the water of the well, they die beside it.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921965/4914037

Townland	Newcastle West
Collector/Informant	Saóirse MacSuibhlaigh
Extract Detail	Behind the workhouse of Newcastle West, they say that it is an airy place. There used be men and women seen there. The road there is called *Boithrin na Pla*. People used to be seen to drop with the hunger there in the bad times of 1847.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921965/4914030

Townland	Killaghteen
Collector/Informant	Not listed
Extract Detail	There are the ruins of an old church in the parish of Athea. It is said that it was the Franciscans who owned it at first. When Cromwell came to Ireland he came and burned this chapel while the people were inside hearing the holy Mass. The sign of fire is still to be seen on the stones. Some places in the ruins are of a blackish colour. He then killed a great number of people on a hill nearby and ever since the people of the parish have named it *Cnoc an Áin*, which means the hill of the destruction.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921965/4914024

Townland	Ballinena
Collector/Informant	Martin Creedon
Extract Detail	There is a fort situated about a mile and a half from Newcastle West in a place called Ballinena. It is a round fort with big white thorn bushes growing all round it. There is also a deep trench all around the outside of the ditch which was once full of water so as to protect the occupants of the fort from wild animals.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921964/4913994

Townland	Dungeeha
Collector/Informant	Patrick Burke
Extract Detail	There is a fort in my Locality by the name of Dungeehy. It is stated in local history that a man by the name of Roche dreamt that in this fort there was a great cask of gold hidden under a big flag. Roche only took this as a dream and thought no more of it. The next night Roche dreamt of the Gold again and the dream told him to take a lantern, pick-axe, spade, and shovel and go to the fort between twelve and one o'clock. He left this pass also, but the third night he dreamt the same thing. Then he made up his mind to go to the fort.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921964/4913986

Townland	Newcastle
Collector/Informant	Edward O'Sullivan
Extract Detail	Many years ago, there lived in Cullina about a quarter of a mile from Newcastle West on the Abbeyfeale road a chieftain who had a small army. One evening he heard that his enemies were entering the country near the coast of Kerry. His army was small and he knew they would beat him. At that time there lived in Killeedy a great saint by the name of St Ita. The chieftain heard of her and went and asked her help. The saint knew he was a catholic and told him the other army would reach Cullina at mid-day on next day. He got his little army together and was ready for battle. All day long he watched and waited. Next morning the battle began. When the saint kept her hands up the chieftain had the victory. When her hands fell down the other army had the victory.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921964/4913961

Townland	Newcastle West
Collector/Informant	John Somers
Extract Detail	Once, there lived in Temple Glantine a woman by the name of Mrs McGrath. She dreamt three nights of a pot of gold that was buried in a fort nearby. This fort is

Townland	Newcastle West
	now in the land of Mr Quill. There are the remains of eight or nine of these forts in one field, and it is one of these forts that the gold is supposed to be. One night however she went to unearth it. This gold was guarded by a wild cat. After a time, the cat attacked the woman, who ran for her life.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921964/4913939

Townland	Newcastle West
Collector/Informant	John Dalton
Extract Detail	In my locality there is a very large fort and it is said there is some treasure hidden there. Long ago a man by the name of Michael Welsh went in the night time to dig for the treasure. He took with him a spade and pickaxe. He reached the fort about eleven o'clock in the night. He began to dig and dig until about twelve o'clock. It was then that he saw the first of the crock of gold. He was about to lay his hand on the crock of gold when three great wolf-hounds attacked him. He ran for about five yards away, and the hounds went back again. After a short time, the man went back again and he found that the hole was closed. He then returned home safely. He never went to the fort since by night or neither did anyone else.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921964/4913924

Townland	Newcastle West
Collector/Informant	Patrick Aherne
Extract Detail	It is said, according to the old people of this district that there is treasure in Dungeehy Fort about a mile from the town on the Limerick road. No one seems to know how it got there but they say it is there for certain. Many years ago, a man by the name of Tom Roche had a dream three nights in succession that there was treasure of gold hidden in a certain spot in the fort. The fourth night he went to the fort carrying a spade and shovel and a lantern. He began to dig the fort as fast as he could in the place where he was told in his dreams.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921963/4913836

Townland	Newcastle West
Collector/Informant	Not listed
Extract Detail	**Killoughteen** Two miles outside the town of Newcastle West this townland is situated. It got its name from St Lactan because he built a church there in the olden times. The ruins of it are still to be seen. The real old Irish name for this place is *Cill Laichtín* "Lactan's Church". **Carraig an Easbuig**

Townland	Newcastle West
	This is a rock that is situated on a river in my parish. It got its name from the earliest times. Mass was celebrated there long ago when the Irish people were persecuted for their religion. The old people of the district say that it was a Bishop that used say the mass and the rock was called *Carraig an Easbuig* "the Bishop's Rock". **Ballineena** It is situated about two miles to the north west of Newcastle West. This place got its name from the great fairs that were held there long ago. They were great fairs for horses and the King of Munster used come there to buy them for his soldiers. The fair used last for a week and when the fair was over, sports were held. This is how that place got its name and its real old Irish name is *Baile an Aonaig*, the town of the fair. **Cluain Catha** Many hundred years ago a battle was fought at this place. This battle ended up in a big meadow. Many of the soldiers were slain, only a few fighters survived. That was how it got its name. In 1918 there was an *Aeridheacht* held there secretly. The English soldiers were looking for a meeting place but failed to locate it. **Bóithrín na Plagha** This place got its name from the famine days. The dead bodies of the district of Newcastle West were thrown into a big pit at this place. A big cart went around the town twice daily to bring the dead bodies to the pit. The Irish people then called it *Bóithrín na Plágha*, or the road of the plague. **Tournafulla** The tower of the blood. This name was given to it because there was a battle there long ago and the wall of the tower got splashed with the blood of the dead people. **Rathnanéan** This is a townland in the parish of Newcastle West. In the townland there is a fort and thousands of birds have built their nests in the fort. That is why it is called Rathnanéan or "the fort of the birds". **Bóthar Buidhe** This name was given to it because under the tar there is yellow mud and that is why it is called *Bóthar Buidhe* or the "yellow road". **Ballingarry** This name was given it because the land is very good for tillage and every person in the place used have a garden sat. That is why it is called *Baile an Garrdha*, or the town of the garden. **Killeedy** This place got its name from St Ita. She built a church here and the place was called *Cill Íde*, or the Church of Ita. **Monagea** This townland is situated about two miles to the south west of Newcastle West. Long ago this townland was all a bog and was a great place for wild geese, and that is why it was called *Món na Gé*, or "the bog of the geese". **Newcastle West** This place got its name from the castle that was built by the Knights Templars in the year 1184 and the town grew around it. There are two entrances to the castle. One entrance is in Bridge Street and the other is in the Square.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921963/4913824

Townland	Newcastle West
Collector/Informant	John Joseph Harnett
Extract Detail	On Shrove Tuesday night there is great sport. The people that don't get married during Shrove are sent to Skeilig Rock in the county Kerry. There is a big load put on their backs and the young people and children go around with ropes carrying them off to Skeilig. Shrove Tuesday night is called Pancake Night in my locality because all the people make pancakes on that night and they have a great feast. At the marriages long ago, there was always a race to and from the chapel. The most common way of travelling at that time was on horse-back and by car.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921963/4913800

Townland	Newcastle West
Collector/Informant	Denis Healy
Extract Detail	There is only one holy well in the parish of Newcastle West to my knowledge and it is called after St Brigid. People visit it every day but there do be a big crowd on the second of February. All the people pay rounds at the well. They say the Rosery while they are going around the well and every round of the beads is called a round. It is said that long-ago St Brigid was coming home from a visit from St Ita and it got dark just as she was at Shangarry. She went into the Chief's fort and he sheltered her that night. When morning came she told them about God and Jesus Christ and the Chief said that he would become a Catholic. Then St Brigid rooted up a few stones out of the ground and a well sprung up and she baptised them with the water. And that is the hour the well came there. The well is situated in Shanagarry in Mr Somers's land which is about one mile to the west of Newcastle West, on the Newcastle West Abbeyfeale road. The well is supposed to be able to cure sore eyes. The people come to the well and pray and when the prayers are said the people rub their eyes with the water of the well. In 1933 a statue of St Brigid was erected near the well. Mr Somers was going under an operation and he said that if he got over the operation he would erect a statue after the operation. The statue was erected. Some people take water out of the well home with them and keep it as a token.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921963/4913792

Townland	Newcastle West
Collector/Informant	Joseph McCarthy
Extract Detail	Long years ago, the fairs of this district were held at a place known as Ballymena. The right old name was *Baile An Aonaig*, or the town of the fair. Ballymena is situated about 2.5 miles outside the town of Newcastle West.

Townland	Newcastle West
	The people came from all parts of Munster to see those old fairs. All sorts of sports and merry-making were carried on there. All the chiefs of Munster were there. The fair at Ballymena is never held now. Since the towns of Newcastle West, Rathkeale and Abbeyfeale sprung up - the fairs at Ballymena died down. There is not a field in Newcastle West to hold fairs in. They are always held in the middle of the town.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921963/4913771

Townland	Newcastle West
Collector/Informant	Joseph Moore
Extract Detail	Near the Daar river which flows about a mile outside the town is a fort. In that fort was found, some years ago a golden pin and a huge pair of antlers. Those articles were found by Tom Moore and his brother Patrick when digging a drain through the fort which was then in their father's possession. On their way home with their treasures they broke off a ring which was attached to the pin and lost it as they did not realise its value. When they went to (school) next morning they gave it to the school master and we are not sure whether it is in the Courtenay school or not.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921962/4913740

Townland	Newcastle West
Collector/Informant	Patrick Healy
Extract Detail	Once upon a time there lived a man in Dunganvill. There was a fort near his house. One day he went into the fort and he began pulling weeds and sticks. All of a sudden, he saw a chalice he picked it up and looked at it. He ran home with it and showed it to his wife. His wife said to him "carry it in to Ardagh." So, the man went away. When he came to the village he showed it to the people and one of the people said "give it to the parish priest." The man gave it to the parish priest and the priest sent it to the National Museum. That chalice is seen there yet.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921962/4913731

Townland	Newcastle West
Collector/Informant	Not listed
Extract Detail	About 150 years ago flax was extensively grown in the district round Newcastle West. In various streams flowing near the town there are pools still locally known as "Flax Pools". In these pools the flax was steeped after being pulled. Gurrane was famous for its flax. It was supposed to grow the best crop in Co. Limerick. Up to 1830 there was "Bleaching Factory" in South Quay. It was owned by Mr Griffin. Owing to the district being so famous for its flax a number of weavers plied their trade in the town. Foremost of these were O'Grady, Murphy and Collins. James

	Murphy died about 35 years ago and was upward of 85 years of age at the time of his death.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921961/4913677

Townland	Newcastle West
Collector/Informant	Patrick Healy
Extract Detail	In Dungueeha a mile north of Newcastle West there is treasure hidden. One day a man went to look for it. he got a lantern and a rope and spade. Just as he was digging he saw a bull coming he ran home and told his wife. He went back again in the morning and he found his lantern, rope, and a spade and the hole covered. The fort is guarded by the bull.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921961/4913652

Townland	Killeline
Collector/Informant	Máire Bean Uí Eachtigheirn
Extract Detail	One night during the Civil War of 1922 as Daniel King, James Ambrose and Thomas Kierby were coming from Newcastle West to their home in Ballykenny driving in a horse and trap. They met with a few free State soldiers who called on them to halt. The men in the trap did not hear the command and they drove away. Then the soldiers raised their guns and fired on them. Daniel King and James Ambrose were shot dead but Tom Kierby escaped because he was sitting on the far side of the car. A small iron cross on the roadside at Killeline now marks the spot where the fatal shooting took place. This story was told to me by my father who knew those three men well.
Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921974/4914577/4938178

Townland	Dungeeha
Collector/Informant	George Ambrose
Extract Detail	There is a fort north of Newcastle West. It is called Dungeeha fort. Some people say there is a pot of gold hidden there. A great many years ago a man heard the story. He got an axe and a lantern. He went out to the fort at midnight. It was a very dark night. He did not know where to dig for the gold. At last he found the place. He was two hours digging for the gold. At last he found it. He was just going to take up the gold when he saw a big bull running towards him. He let down the lantern and ran home. When he came back next morning he found his axe and lantern but the pot of gold was covered up.

Source(s)	Dúchas Archive [online]. Available at: https://www.duchas.ie/en/cbes/4921962/4913736/4935263

Appendix 9.6. Townland Inventory

Townland Name	Ashgrove
Route Corridor Options	Option B
Gaelic Name	*Currach na Mallacht*
Suggested Meaning	The Wet Land of the Curses
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 455 acres. Townland the property of John Upton, Esq…There are two old forts in this townland, and a road passes through it, west of Ashgrove House" (O'Donovan 1939–40, 1383). "Ashgrove House…A large house, two stories high, with offices and a plantation. The residence of John Upton, Esq." (*ibid*., 1393). "Ashgrove Bridge…This bridge is situated 15 chains north of Ashgrove House" (*ibid*., 1395).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31632

Townland Name	Ballinena
Route Corridor Options	Option B
Gaelic Name	*Baile an Aonaigh*
Suggested Meaning	The Town of the Fair/Assembly
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 369 acres. Townland the property of Colonel Sanky…There are three ancient forts here" (O'Donovan 1939–40, 1384).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31633?s=Ballinena

Townland Name	Ballingowan
Route Corridor Options	Options A, C, E, F, G and I
Gaelic Name	*Baile an Ghabhann*
Suggested Meaning	The Town of the Smith
Civil Parish	Grange
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland contains 216 acres, and is the property of the Earl of Devon…There are four forts here" (O'Donovan 1939–40, 750–51).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31878

Townland Name	Ballintubbrid
Route Corridor Options	Options C, D, H and I
Gaelic Name	*Baile na Tiobraide*
Suggested Meaning	The Town of the Well
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 376 acres. Townland the property of the Earl of Devon…There are nine forts, one of which is in the west side of the townland, and on which stands a Trig, Station, called after the townland" (O'Donovan 1939–40, 1312). "Ballintubbrid House…A small thatched house of one storey, with plantation and a garden. The residency of Miss Bourke" (*ibid*., 1330).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31887

Townland Name	Ballinvallig
Route Corridor Options	Options C, D, H and I
Gaelic Name	*Baile an Bhealaigh*
Suggested Meaning	The Town of the Way
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 112 acres. Townland the property of the Earl of Devon…A large fort stands on the east boundary, on which is erected a Trig. Station. There are three other forts in the townland" (O'Donovan 1939–40, 1312). "Ballinvallig Fort…A large fort nearly surrounded by a double row of hawthorn bushes" (*ibid*., 1331).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31886?s=Ballinvallig

Townland Name	Ballyconway
Route Corridor Options	Options B, C, F, G and H
Gaelic Name	*Baile Uí Chonnmhaigh*
Suggested Meaning	The Town of Ó Connmhaigh
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 162 acres. Townland the property of the Earl of Devon" (O'Donovan 1939–40, 1312–13).

Townland Name	Ballyconway
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31852

Townland Name	Ballyfraley
Route Corridor Options	Options A, B, E, F and G
Gaelic Name	*Baile Uí Fhreáile*
Suggested Meaning	The Town of Ó Freáile
Civil Parish	Grange
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland contains 257 acres, and is the property of Michael C. Heffernan, Esq…the Mail Coach Road from Newcastle to Rathkeale passes through its eastern extremity, west of this road is a fort. There are also two other forts on its northern and western boundary" (O'Donovan 1939–40, 750). "Ballyfraley Bridge…A new bridge of one arch across Ballyfraley Stream, on the road from Rathkeale to Newcastle" (*ibid*., 756).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31631?s=BallyfraleyBaile

Townland Name	Ballylahiff
Route Corridor Options	Option B and Indicative R521 Link Road
Gaelic Name	*Baile Uí Fhlaithimh*
Suggested Meaning	The Town of Ó Flaithimh
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 147 acres. Townland the property of the Earl of Devon…There is an ancient fort close to its northwest boundary, and the Deel River forms its western boundary" (O'Donovan 1939–40, 1384).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31899

Townland Name	Ballymackesy
Route Corridor Options	Options C, D, H and I
Gaelic Name	*Baile Uí Mhacasa*
Suggested Meaning	The Town of Ó Macasa
Civil Parish	Monagay
Barony	Glenquin

Townland Name	Ballymackesy
Ordnance Survey Notes (1839–40)	"Contains 182 acres. Townland the property of the Earl of Devon…A fort and a Trig. Station stand at its west mearing. There are also two other forts, one near its northern boundary, the other on the mearing with Gortyknaveen" (O'Donovan 1939–40, 1313–14).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31889

Townland Name	Ballynahown
Route Corridor Options	Options C and H
Gaelic Name	*Baile na hAbhann*
Suggested Meaning	The Town of the River
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 131 acres. Townland the property of the Revd. Thos. Locke…near the southern boundary of the townland stands an old fort" (O'Donovan 1939–40, 1315).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31855

Townland Name	Ballypierce
Route Corridor Options	Option E
Gaelic Name	*Baile Phiaris*
Suggested Meaning	The Town of Piaras
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 333 acres. Townland the property of Major Maunsell. Agent, Thos. Worral, Esq., Limerick…There is an old fort in the southeast part of the townland" (O'Donovan 1939–40, 1383–84).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31783

Townland Name	Ballyshane
Route Corridor Options	Options C and H
Gaelic Name	*Baile Sheáin*
Suggested Meaning	The Town of Seán
Civil Parish	Killeedy

Townland Name	Ballyshane
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Townland the property of the Earl of Devon. All under tillage and pasture" (O'Donovan 1939–40, 1330).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31843

Townland Name	Castle Demesne
Route Corridor Options	Indicative R521 Link Road
Gaelic Name	*Fearann an Chaisleáin*
Suggested Meaning	Castle Demesne
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 96 acres. Townland the property of the Earl of Devon. The greater part is under pasture. The Castle, which gives name to this townland, is situated close to its southern boundary, the River Arra" (O'Donovan 1939–40, 1384–85).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31900

Townland Name	Churchtown
Route Corridor Options	Options A, B, E, F, G and Indicative R521 Link Road
Gaelic Name	*Baile an Teampaill*
Suggested Meaning	The Town of the Church
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 580 acres. Townland the property of the Earl of Devon. All under tillage and pasture…There are six ancient forts in it, one of which is called Churchtown fort. There is a very large limestone quarry in the southern part of the townland" (O'Donovan 1939–40, 1385). "Glebe of Churchtown No. 2…The property of Revd. Thos. Locke…The ruins of an old church and burial ground are near the centre of the townland" (*ibid*., 1390). "Churchtown fort…A large fort surrounded by two trenches. Money is said to be hidden in it" (*ibid*., 1394). "Daar Bridge…On the boundary between Ballylahiff and Churchtown townlands. An old bridge of two arches on the River Daar" (*ibid*., 1394).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31901

Townland Name	Cloonyscrehane
Route Corridor Options	Options C, D, H and I
Gaelic Name	*Cluain an Screatháin*
Suggested Meaning	The Pasture of the Shallow Sod
Civil Parish	Grange and Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 196 acres. Townland the property of the Earl of Devon…The Arra River forms its northern boundary. There are two forts in its western extremity and one near its northern boundary" (O'Donovan 1939–40, 1316).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31879?s=Cloonyscrehane

Townland Name	Coolacokery
Route Corridor Options	Options A, B, E, F and G
Gaelic Name	*Cúil an Chócaire*
Suggested Meaning	The Corner of the Cook
Civil Parish	Ardagh
Barony	Shanid
Ordnance Survey Notes (1839–40)	"Contains 440 acres…The property of De Courcy O'Grady Esq…There are three forts in this townland" (O'Donovan 1939–40, 90).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31643?s=Coolacokery

Townland Name	Coolanoran
Route Corridor Options	Options B, E and G
Gaelic Name	*Cúil an Fhuaráin*
Suggested Meaning	The Corner of the Spring
Civil Parish	Kilscannell
Barony	Connello Lower
Ordnance Survey Notes (1839–40)	"The property of De Courcy O'Grady, Esq., under the Earl of Devon. Contains 806 acres. The Mail Coach Road from Limerick to Tralee passes through this townland" (O'Donovan 1939–40, 1185).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/32158?s=Coolanoran

Townland Name	Cullenagh
Route Corridor Options	Options B, F and G

Townland Name	Cullenagh
Gaelic Name	*Cuileannach*
Suggested Meaning	Place of Holly
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 267 acres. Townland the property of the Earl of Devon…In its extreme east end are a neat cottage and a very large orchard. There are two forts, one in the north, and the other in the south extremity of the townland" (O'Donovan 1939–40, 1321).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31892

Townland Name	Dooally
Route Corridor Options	Options A, B, E, F and G
Gaelic Name	*Dumha Aille*
Suggested Meaning	Mound of the Cliff
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 400 acres. Townland the property of the Earl of Devon. All under tillage and pasture…the Dooally River forms its eastern boundary. There are two ancient forts in it…subject to flooding by the Dooally River in wet season" (O'Donovan 1939–40, 1386).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31902?s=Dooally

Townland Name	Doocatteen
Route Corridor Options	Option B and Indicative R521 Link Road
Gaelic Name	*Dumhach Chaitín*
Suggested Meaning	The Mound of Caitín
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 201 acres. Townland the property of Julius Delmege, Esq. The River Daar forms its eastern boundary. There are four ancient forts here" (O'Donovan 1939–40, 1287).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31634?s=Doocatteen

Townland Name	Dromin
Route Corridor Options	Options C, D, H and I
Gaelic Name	*An Dromainn*
Suggested Meaning	The Ridge
Civil Parish	Grange
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland contains 378 acres, all arable land. It is the property of the Earl of Devon…In the west end is Drummin House with gardens and orchard. The River Daar forms part of its south boundary and, running through this townland, joins the River Deel…There is a large fort on the southern boundary between Gortroe and Drummin Deel, and there are two smaller forts within it' (O'Donovan 1939–40, 752-53). "Drummin House…A large house, two storeys high, with offices and a plantation. The residence of Nicholas Meade, Esq." (*ibid*., 757).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31880

Townland Name	Dromin (Beesom)
Route Corridor Options	Option B
Gaelic Name	*An Dromainn (Beesom)*
Suggested Meaning	The Ridge
Civil Parish	Glenquin
Barony	Newcastle
Ordnance Survey Notes (1839–40)	"Contains 303 acres. Townland the property of the Earl of Devon…There are two roads through it" (O'Donovan 1939–40, 1385–86).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31903?s=Dromin+(Beesom)

Townland Name	Dromin (Macturlogh)
Route Corridor Options	Options A, B, E, F and G
Gaelic Name	*An Dromainn (Macturlough)*
Suggested Meaning	The Ridge
Civil Parish	Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 370 acres…Townland the property of the Earl of Devon. All under tillage and pasture…its eastern part is subject to flooding in winter" (O'Donovan 1939–40, 1385).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31904?s=Dromin+(Macturlogh)

Townland Name	Dungeeha
Route Corridor Options	Options A, D, E, F, G, H and Indicative R521 Link Road
Gaelic Name	*Dún Gaoithe*
Suggested Meaning	Fort of the Wind
Civil Parish	Grange
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland contains 207 acres, and is the property of the Earl of Devon…The Mail Coach Road forms its eastern boundary…about 30 links west of the road, is a large tree called Crannacrohy, or Gallows Tree, where some people are said to have been executed" (O'Donovan 1939–40, 752).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31881?s=Dungeeha

Townland Name	Garranekeevan
Route Corridor Options	Options A, B, E, F, G and Indicative R521 Link Road
Gaelic Name	*Garrán Uí Chiabháin*
Suggested Meaning	The Grove of Ó Ciabháin
Civil Parish	Newcastle
Barony	Glenquin
Text Records	"Contains 180 acres…Townland the property of the Earl of Devon…The Daar River forms its western boundary. There are two ancient forts in this townland" (O'Donovan 1939–40, 1388).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31905?s=Garranekeevan

Townland Name	Garryduff
Route Corridor Options	Options A, C, E and H
Gaelic Name	*An Garraí Dubh*
Suggested Meaning	The Black Garden
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 1,083 acres. Townland the property of Major Baunsell…near its centre is a Gentleman's seat, with plantation" (O'Donovan 1939–40, 1317–18).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31781

Townland Name	Glendarragh
Route Corridor Options	Options A, C, E and H
Gaelic Name	*Gleann Darach*
Suggested Meaning	Glen of Oak Trees
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 1.042 acres. Townland the property of the Earl of Devon; under tillage, the remainder is mountain ground and rough pasture… There are six forts, one gravel pit and two quarries" (O'Donovan 1939–40, 1318).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31858

Townland Name	Gortboy
Route Corridor Options	Options D and H
Gaelic Name	*An Gort Buí*
Suggested Meaning	The Yellow Field
Civil Parish	Grange and Newcastle
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland is the property of the Earl of Devon and contains 174 acres…There is a fort in its northeast extremity" (O'Donovan 1939–40, 754–55).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31908

Townland Name	Gortroe
Route Corridor Options	Options C, D, H and I
Gaelic Name	*An Gort Rua*
Suggested Meaning	The Red Field
Civil Parish	Grange
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland is the property of the Earl of Devon and contains 174 acres…The Mail Coach Road from Newcastle to Rathkeale forms its western boundary, and on it is a turnpike…There is a fort on its northeast extremity" (O'Donovan 1939–40, 754–55).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31882

Townland Name	Gortyknaveen
Route Corridor Options	Options C, D, H and I
Gaelic Name	*Gort Uí Chnáimhín*
Suggested Meaning	The Field of Ó Cnáimhín
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 70 acres. Townland the property of the Earl of Devon…an old fort stands on its west mearing" (O'Donovan 1939–40, 1333).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31893?s=Gortyknaveen

Townland Name	Killaghteen
Route Corridor Options	Options A, B, C, D, E, F, G, H and I
Gaelic Name	*Cill Laichtín*
Suggested Meaning	The Church of Laichtín
Civil Parish	Ardagh
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 626 acres…The whole of this townland is in tillage and pasture. The Mail Coach Road, leading from Limerick to Tralee, passes through the southern part of this townland…There are seven forts in the townland" (O'Donovan 1939–40, 99).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31780?s=Killaghteen

Townland Name	Killard
Route Corridor Options	Option B
Gaelic Name	*Cill Ard*
Suggested Meaning	High Church
Civil Parish	Ardagh
Barony	Shanid
Ordnance Survey Notes (1839–40)	"Contains 202 acres…The property of John Massey, Esq…There are two forts, one in the northwest and the other in the southeast extremity of the townland. There are also two wells adjacent to its eastern boundary" (O'Donovan 1939–40, 93–4).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31650

Townland Name	Killaready
Route Corridor Options	Options C and I

Townland Name	Killaready
Gaelic Name	*Cill an Riadaigh*
Suggested Meaning	The Church of An Riadach
Civil Parish	Mahoonagh
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"In the northern extremity of the parish, and contains 316 acres. Townland the property of John Maher…It contains two forts" (O'Donovan 1939–40, 1283).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31837?s=Killaready

Townland Name	Killeline
Route Corridor Options	Options C, D, H and I
Gaelic Name	*Cill Eithleann*
Suggested Meaning	The Church of Eithle
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 170 acres. Townland the property of the Earl of Devon…There are three forts, two on its western, and one on its southern boundary. The last-mentioned fort is within three chains of Killeline Bridge" (O'Donovan 1939–40, 1319). "Killeline Bridge…In the boundary between Killeline, Treanboy and Ballymackesy townlands. A small old bridge of one arch" (*ibid*., 1326).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31894?s=Killeline

Townland Name	Kilrodane
Route Corridor Options	Option B
Gaelic Name	*Cill Rodáin*
Suggested Meaning	The Church of Rodán
Civil Parish	Ardagh
Barony	Shanid
Ordnance Survey Notes (1839–40)	"Contains 141 acres…The property of the Earl of Devon" (O'Donovan 1939–40, 93). "Kilrodane Well…A small well so called" (*ibid*., 99). "Site of St Rodan's Church and graveyard" (*ibid*., 99).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31907?s=Kilrodane

Townland Name	Knockane
Route Corridor Options	Options D and I
Gaelic Name	*An Cnocán*
Suggested Meaning	The Hillock
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Townland the property of the Earl of Devon…Contains 166 acres…It contains a large fort in its centre" (O'Donovan 1939–40, 1319–20).
Explanatory Note	*Cnocán Uí Choileáin*, 'the hillock of Ó Coileáin', seems to have been the form in use in the 17th century (e.g. 1655 'Knockaneicullane' Civil Survey; 1659 'Cnockane Icallane' Census).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31895

Townland Name	Moveedy
Route Corridor Options	Options C and I
Gaelic Name	*Maigh Mhíde*
Suggested Meaning	The Plain of Míde
Civil Parish	Grange
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"This townland is the property of the Earl of Devon, and contains 121 acres…On this road is Grange Bridge over the River Deel, which forms the east boundary of this townland" (O'Donovan 1939–40, 755–56). "Moviddy Ford…On the River Deel, which is the boundary between Moviddy and Grange Upper townlands" (ibid., 758).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31883?s=Moveedy

Townland Name	Shangarry
Route Corridor Options	Options D and I
Gaelic Name	*An Seangharraí*
Suggested Meaning	The Old Garden
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 202 acres. Townland the property of the Earl of Devon…There are two forts, one near the south side of the townland, the other five chains east of the above-mentioned road" (O'Donovan 1939–40, 1322–23).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31896

Townland Name	Teermena
Route Corridor Options	Options C and I
Gaelic Name	*Tír Mhaonaigh*
Suggested Meaning	The Land of Maonach
Civil Parish	Monagay
Barony	Glenquin
Ordnance Survey Notes (1839–40)	"Contains 234 acres. Townland the property of the Earl of Devon…There are three forts, one of which, called Lisshwee, is situated near its southern boundary. There is a quarry near its southern boundary" (O'Donovan 1939–40, 1324–25).
Source(s)	Placenames Database of Ireland [online]. Available at: https://www.logainm.ie/en/31897?s=Teermena

Appendix 9.7. Phase 2 LiDAR Archaeological Assessments

Appendix 11.1 Material Assets – Agricultural Criteria and Sub-criteria analysis

Route Corridor Option	Farm type	Land-take			Severance			Viability			
	No of high sensitivity enterprises	Total Area (ha)	Land-take (ha) (including Link)	Agri-cultural land (% of total area)	No. of farmyards within corridor	No. of high sensitivity yards along corridor	Length (km) (including Link)	Poor or Moderate poorly drained soils (ha)	Poor or Moderate poorly drained soils (% of total area)	Area of agri-natural vegetation and forestry (ha)	Area of agri-natural vegetation and forestry (% of total area)
A	8	369	353	96%	10	4	8.9	102	28%	72	22%
B	9	361	354	99%	8	3	8.7	110	31%	4	<1%
C	6	341	329	96%	12	2	8.2	233	68%	12	4%
D	4	219	212	97%	8	3	5.2	166	76%	1	1%
E	7	389	374	96%	11	4	9.4	122	36%	70	18%
F	7	356	341	96%	9	2	8.5	123	41%	71	20%
G	6	373	362	97%	11	2	9.0	149	46%	70	19%
H	8	288	271	94%	11	4	6.9	235	82%	12	4%
I	2	271	270	100%	9	1	6.5	163	60%	1	1%