N4 Collooney to Castlebaldwin, *Proposed Road Development*

ADDENDUM TO ROUTE SELECTION REPORT

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1 Introduction and context

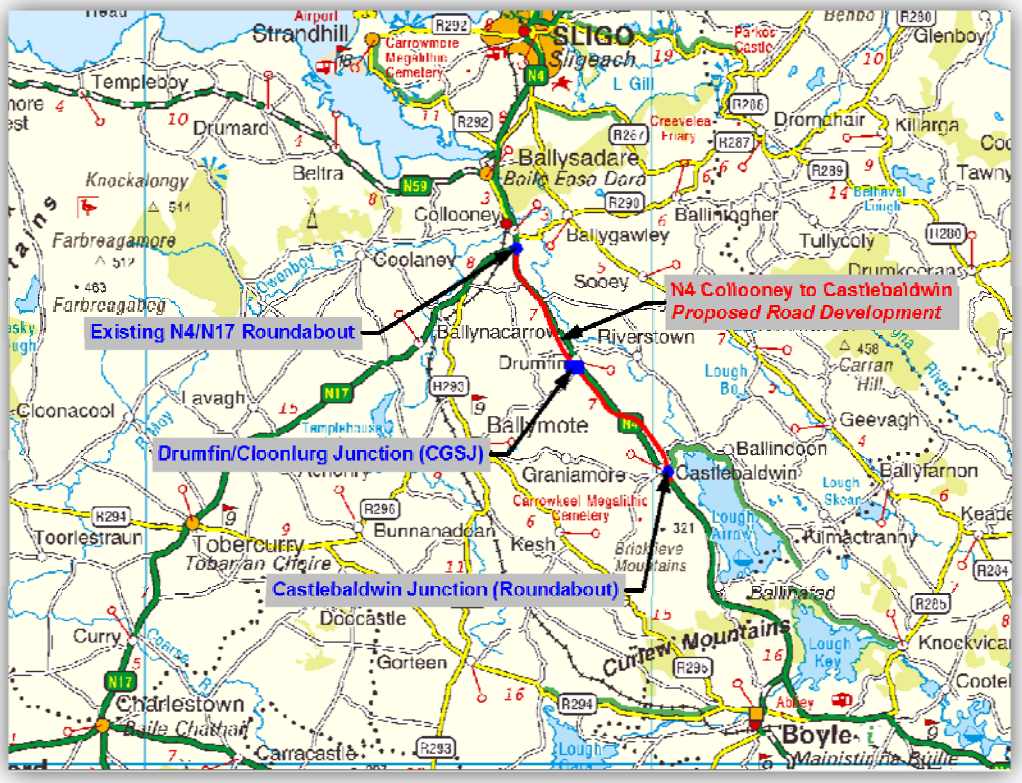
Sligo County Council is advancing the design of a *Proposed Road Development* from Collooney to Castlebaldwin in accordance with the NRA National Roads Project Management Guidelines (NRAPMG).

1.1 Location

The N4 National Primary Route is part of the East/West road corridor linking Irelands largest transportation node (Dublin) with the largest transportation node in the North-West (Sligo). It measures c. 34.8km in County Sligo of which c. 11.6km between Sligo Town and Collooney is Type 1 Dual Carriageway with c. 8.8km south of Castlebaldwin having already been realigned to Standard Single Carriageway standard.

The *Proposed Road Development* (as indicated in *Figure 1-1*) is the remaining portion of the N4 national primary route in Co. Sligo requiring improvement and measures approximately 14.71km in length passing through the townlands of *Collooney, Toberbride, Mullaghnabreena, Ardcurley, Cloonamahan, Doorly, Knocknagroagh, Drumfin, Cloonlurg, Carrowkeel, Carrownagark, Kingsbrook, Aghalenane, Ardloy, Springfield, Tawnagh, Cloonymeenaghan, Sheerevagh, Cloongad, Drumderry, Castlebaldwin, Cloghoge Upper and Cloghoge Lower.* The road type will be Type 2 Dual Carriageway tied into the existing network to the south via a section of Standard Single Carriageway.

Figure 1-1: Location of Proposed Road Development



1.2 Purpose of This Report

In consideration of the fact that the Route Selection for the *Proposed Road Development* (PRD) dates back to 2002, it was considered prudent for the purposes of the EIS to review the original RSR (and the Constraints Study area) when providing '*an outline of the main alternatives studied by the road authority concerned and an indication of the main reasons for its choice; taking into account the environmental effects*.' This report thus is in effect a supplementary study to the original RSR of the main alternatives for the PRD.

In this regard the purpose of this report is to document the review of the route corridor selection process and the establishment of the preferred route corridor for the proposed N4 Collooney to Castlebaldwin Proposed Road Development. This report details the review and provides an overview of the alternatives and how they compare with the Emerging Preferred Route, it considers principally a review of:

- National and Local Policy Context;
- Design Standards and Guidelines;
- Project Apprasial Guidelines;
- Environmental Guidelines;
- Planning and Development;
- Land Use and Traffic;
- Environmental Designations;

The report also considers the online upgrade between Toberbride Td. and Doorly Td. which was not originally included in the RSR as discussed above. This is discussed in section 0 of this report.

This report has been prepared by the Design/EIS Team with the assistance/input of the following:

- Aecom: Traffic and Project Need;
- NRA Archaeology: Archaeology;
- Ecofact Ltd.: Ecology;
- MosArt Ltd.: Landscape and Visual;
- Optimize consulting: Socio Economic

Additionally, guidance has been sought from AWN Consulting and Minerex Environmental.

The report should be read in conjunction the original RSR to allow a fuller appreciation of the alternatives.

2 Constraints Study Area

2.1 Adoption of Constraints Study Area

2.1.1 Overview

The Constraints Study for the PRD was published in November 2000 and was thus carried out in accordance with the 2000 version of the NRA PMG.

The purpose of the Constraints Study for the PRD was to identify the nature and extent of significant constraints within a defined study area. These constraints were documented and mapped to allow the subsequent development of feasible route options.

The identified study area as indicated in Fig. N4-RSA-01 (appendix 1) was *'determined to the north and south by the improved sections of road which terminate in Doorly to the north and Castlebaldwin to the south. As the option of bypassing Castlebaldwin is to be included in the study, the constraints area commences in the townland of Dromdoney, just south of Castlebaldwin. The constraints study area is confined in the north-east by the Unshin river and a line of drumlins which lie along a north-west to south-east axis. The constraints study area is confined in the north-west by Lough Corran and a line of drumlins which lie along a north-west to south-east axis.'* [1]

The Constraints Study published in November 2000 gathered and examined information on:

- Environmental and Engineering desk studies;
- Site Survey Work;
- Planning searches;
- Land ownership searches; and

It also allowed for the first official public engagement on the development, with the invitation for submissions in August 2000. Direct consultations were also undertaken with agencies such as the North Western Fisheries Board[2], Archaeological and NPWS sections of Duchas[3], Sligo branches of An Taisce, Bird Watch Ireland, Sligo Field Club and the Sligo County Recorder (for botany).

The principal constraints as outlined in the Executive Summary of the Constraints Study Report[4] were as follows:

2.1.2 Physical and topographical constraints

The presence of drumlins and small lakes will influence the alignment of the route options.

2.1.3 Archaeological constraints

There are many listed archaeological sites (Map 7 of the Constraints Study Report) within the constraints study area and every effort will be made to avoid or reduce the impact on these sites.

2.1.4 Ecological constraints

A number of areas of ecological sensitivity have been identified (Map 8 of the Constraints Study Report) and the North Western Regional Fisheries board have identified sensitive streams within the area (Map 3 of the Constraints Study Report). Every effort will be made to avoid or reduce the impact on these areas.

[1] Sligo County Council; *N4 Realignment, Constraints Study Report, November 2000*

[2] Now known as Inland Fisheries Ireland

[3] The function of Duchas now rest with the Department of the Arts, Heritage and Gaeltacht.

[4] Italics indicate extracts from the Constraints Study Report

2.1.5 Local development and land use

The village of Castlebaldwin is the main settlement within the area and every effort will be made to avoid severance of this community and to minimise the impact on other property owners within the constraints study area.

2.1.6 Services

All services have been identified and the principal constraint is the presence of the Sligo-Flagford 110kV line which runs along the north-east boundary of the constraints study area.

3 Identification of need

3.1 The NRA, National Road Needs Study

The original basis for the current proposal was highlighted in a report produced by the NRA, entitled *The National Road Needs Study* (NRNS) in 1998. This study assessed the adequacy and performance of the national road network on the basis of the ability of existing roads to deliver a quality level of service consistent with the efficient movement of traffic. The study represented a comprehensive assessment of the network against the average inter-urban speed of at least 80kph, which is categorised within the report as a Level of Service (LOS) D objective. The LOS is a technical concept which attempts to describe the travel experience in terms of operating speed, the ability to overtake traffic in safety, traffic congestion, overall safety and driver and passenger comfort. The Authority's objective for road planning purposes was to achieve a minimum LOS of D, equivalent to the aforementioned 80kph inter-urban journey speed on the network.

The N4 realignment (Collooney to Ballinafad) was identified at that time as having 'Phase 2' needs. This meant that the existing road was considered to be no longer able to provide a level of service D, equivalent to an inter-urban travel speed of 80kph. By realigning the road, the level of service would be improved; therefore it was scheduled at that time for improvement during the years 2005-2009 under the NRNS.

Plate 3-1: Existing N4 at Carrownagark Td. (picture following a traffic incident in 2012)

3.2 Existing Network

The existing road network in the area is multi-functional and is required to cater for conflicting demands, including accommodating long distance through traffic and locally generated trips.

The existing route is sub-standard with overall pavement widths varying from c. 6.5m to 7.5m and average verge widths of 1.0m. There is restricted overtaking along approximately 70% of its length while it also passes through the village of Castlebaldwin which has a speed limit of 50kph. This is with the exception of a 2.6km section between *Collooney/Toberbride* and *Doorly* which was improved geometrically in the 1980's.

There are a significant number of junctions (29) with local roads along the existing route and including the village of Castlebaldwin there are approximately 78 houses and 130 agricultural entrances onto the existing route. Of these accesses, a high percentage occur (17%) on the aforementioned improved section.

From a safety point of view, field accesses are especially problematic as they encourage slow moving and frequently heavy agricultural traffic onto the high-speed national primary network. The increasing volumes of inter-urban traffic on this strategic east-west route corridor will lead to a greater risk of road accidents and a significant loss of amenity to the local residential population. The rural sections of the existing route are deficient in traffic capacity due to the proliferation of vehicular entrances and inadequacies in cross section and alignment.

The stretch of road proposed to be replaced herein constitutes one of the few sections of the N4 between Dublin and Sligo which is not of a standard commensurate with the NRA DMRB; furthermore, with the exception of its northern limits, this particular section has not received any significant improvements (with the exception of localised minor improvements) since its designation from a Trunk Road to a National Primary Route in 1977 and has very restricted opportunities for safe overtaking.

3.3 Traffic

Traffic count surveys show traffic volumes on the existing N4 in 2008[5] of 9,300 AADT at Drumfin Td. and 7,500 AADT at *Castlebaldwin Td.* rising to 11,600 and 9,200 AADT respectively in a design year of 2032 in a Do-Minimum Medium Growth Scenario. It is also predicted that c. 8-10% of traffic on the existing route consists of HGV's.

The risk of accidents will increase as vehicles seeking to access the N4 from side roads will find fewer opportunities to do so and may through frustration take unnecessary risks. The increase in traffic will give rise to an increase in noise nuisance and community severance.

3.4 Economy

The existing road is operating within capacity during the Peak Periods under current traffic flows however travel speeds are impacted by the alignment and gradient of the road together with the high number of on road accesses. The N4/M4 is a key national corridor and delays to traffic have a negative impact upon the economy. It is an objective of the *Proposed Road Development* to reduce journey times and improve journey time reliability, both of which will generate positive economic benefits to businesses and consumers.

The Economic justification for the *Proposed Road Development* as set out in the Business Case undertaken by Aecom is based on a Benefit to Cost Ratio in the range of 1.45 to 1.79 (Based on Total Scheme Budget and a Medium Growth Scenario). This figure demonstrates the Present Value of Benefits to be greater than the Present Value of Costs, therefore the proposal is deemed to be economically justifiable.

3.5 Safety

There have been 72[6] traffic reported accidents to the Garda Síochána between the period 1996 to 2011 on that c. 14.36km section of existing route proposed to be replaced by the *Proposed Road Development*. These accidents are composed of a notable 8 fatalities, 8 serious injuries and 56 minor injuries. In acknowledgement of the significant number of Material Damage accidents which were reported to An Garda Síochána but are not collated by the RSA, Sligo County Council have collated same for a trial period of 2008 to 2011 which reveals on average 34 traffic accidents per year resulting in Material Damage.

The proposed route will replace the existing deficient section of the N4 with a Type 2 Dual Carriageway. This will reduce the accident rate, due to a higher accident rate for single carriageway roads, and an increasing risk of certain types of accidents, such as fatal and serious injury accidents as a result of overtaking head on collisions. The Type 2 Dual Carriageway also has the benefit of separating local traffic from national traffic and does not allow for right turning movements such as those which would be required at Ghost Islands on a Single Carriageway road.

Such is the severity of the rate of accidents on the route in combination with the weekly unreported accidents and near misses; a local action group has been vociferously campaigning for the upgrade of this section of the N4. To demonstrate the extent of fatal accidents which have occurred along the existing route, this group have erected white crosses along roadside verges indicating 30 fatalities at different locations over the last forty or so years.

[5] Which was confirmed to represent current day usage via a 2012 check.

[6] Compilation of accidents from RSA and CT68 forms prepared by An Garda Síochána.

Plate 3-2: Erection of 30th white cross in April, 2013[7]

In addition to recent minor realignment[8] works (at *Springfield Td., Aghalenane Td.* and *Ardloy Td*.), numerous local improvement measures have been carried out by Sligo County Council in recent years which have maximised sightline distances achievable at localised junctions such as at *Drumfin Td., Cloonlurg Td.* and *Carrownagark Td*. These improvements although welcomed do not improve driving conditions or geometric deficiencies for National to National through traffic or National to Local traffic; their primary benefit is to maximise the sight distances currently available on the existing N4 for Local to National traffic.

Plate 3-3: White Crosses erected north of the Ballymote Junction in the townland of Cloonlurg

The safety benefits which will be derived from the incorporation of the *Proposed Road Development* into the National Primary Network are expanded upon in Chapter 4 of this EIS.

3.6 Environment

The provision of the *Proposed Road Development* will bring benefits to the existing environment in this area of County Sligo. This will include *inter-alia:*

- A reduction in Noise and Vibration impacts for those numerous properties which are currently adjacent to the existing N4.

In addition, considering that the *Proposed Road Development* will be constructed to the increasingly high standard of environmental mitigation practice there are numerous benefits which will arise to the existing environment. This is particularly true in the case of the management and treatment of road runoff which is currently being discharged untreated and un-attenuated to the Unshin River cSAC/pNHA and the Lough Arrow

[7] Picture courtesy of Brian Farrell Photography.

[8] Works carried out at this location were originally part of the current proposal and were undertaken in advance as a localised minor improvement measure.

cSAC/pNHA/SPA. The provision of infrastructure to treat this runoff will have ensuing benefits for the aquatic flora and fauna of these important biodiversity sites.

3.7 Accessibility and Social Inclusion

The development will improve road based public transport at both a local, regional and national level, by improving safety along this section of the corridor. The *Proposed Road Development* will achieve the objectives of the:

- National Development Plan which although no longer a live document, is still relevant in terms of setting the Initial Need for the PRD.
- National Spatial Strategy; and
- County Development Plan

The project will generally improve quality of life and improve accessibility to work, education and other activities.

3.8 Integration

The *Proposed Road Development* is intended to integrate the recent investments in the N4 and the Major Inter Urban (MIU) corridors, namely the M4, as part of a strategy to provide a consistent quality road link between Dublin and Sligo.

3.9 Additional Benefits of the Proposed Road Development

The project, when complete, will provide a high quality road for the transport of people and goods in safety and comfort in accordance with national and local objectives.

The generation of traffic as a result of the realignment is likely to be modest though there may be some minor increase due to the reduction in journey times to Sligo which may make it a more attractive commuting town.

The provision of the realignment provides the following key benefits:

- Improves the N4 route to modern day standards including the provision of safe overtaking and appropriate road width;
- Provides a high quality road for strategic routes with reserve capacity for future demand;
- Assists in improving the competitiveness and efficiency of the economy both locally and nationally;
- Reduces travel times and improves access to the north-west region;
- Improves transport infrastructure for local traffic;
- Improves safety along the existing roads and at junctions/accesses;
- Reduces environmental and social impacts on the local residents and communities along the existing N4.

4 Traffic assessment & Route cross section

4.1 Traffic

4.1.1 Traffic

Traffic count surveys show traffic volumes on the existing N4 in 2008[9] of 9,300 AADT at Drumfin Td. and 7,500 AADT at *Castlebaldwin Td.* rising to 11,600 and 9,200 AADT respectively in a design year of 2032 in a Do-Minimum Medium Growth Scenario. It is also predicted that c. 8-10% of traffic on the existing route consists of HGV's.

The risk of accidents will increase as vehicles seeking to access the N4 from side roads will find fewer opportunities to do so and may through frustration take unnecessary risks. The increase in traffic will give rise to an increase in noise nuisance and community severance.

4.2 Route Cross Section

4.2.1 Road type at the time of Route Selection

The road type at the time of RS comprised a standard single carriageway. This was derived principally at that time from recommended road types outlined in the NRNS which was carried out in 1998.

4.2.2 Road Type for the Purposes of this Report

The road type for the Proposed Road Development will as explained in section 6.2.8.1.1.1 of this report be that of a Type 2 Dual Carriageway. However, considering the original RSR assessed the proposal as a Standard Single Carriageway, some elements of the comparables used were maintained within this report. These relate principally to geometric properties including FOSD which although not relevant to dual carriageways are useful in comparing the flowing nature of different designs.

[9] Which was confirmed to represent current day usage via a 2012 check.

II. Part 2 – Route Options

5 Options Categorisation

5.1 Stage 1: Preliminary Options Assessment

5.1.1 **Overview**

The RSR as already outlined dates back to 2002. The following chapter outlines a review process which commenced in 2012 and was completed in 2013.

5.1.2 **NRA PAG Consideration of Alternatives**

With cognisance of the NRA PAG which has been published in the interim to the aforementioned Route Selection Report and the consent which is currently being sought; it was deemed responsible to consider additional options which may affect the consideration of alternatives. In this regard and supplementary to the Route Selection Process an appraisal (in accordance with the NRA PAG) was carried out in 2012/2013 of the most appropriate form of improvements required for this section of the existing N4. An overview of the alternatives; together with the assessment carried out is outlined below.

5.1.2.1 Traffic Management Alternatives

Traffic Management Alternatives represent those which seek to respond to transportation problems by maximising the value of existing infrastructure. The Traffic Management alternatives can include:

- Removal of bottlenecks through targeted local investment;
- Local road safety improvements;
- Fiscal or Traffic Control measures to manage traffic demand;
- Public Transport Priority, capacity and/or public transport services;
- Corridor or area-wide improvements to pedestrian or cycling provision; and
- Intelligent Transport Systems to improve reliability, safety and operating capacity.

This option is deemed to represent the "best" that can be done using existing infrastructure, it is noted that in some cases this option may also fit into the 'Major Scheme Alternative' outlined below.

Section 2.3.5 of the *Guidelines on a Common Appraisal Framework for Transport Projects and Programme* refers to a Management Option as follows:

> *Investment options will not always represent the most appropriate response to identified needs or objectives. Better management or pricing of existing networks and services may either reduce demand or expand the effective capacity of networks. A management option may also be more environmentally acceptable...*

5.1.2.2 Major Scheme Investment Alternative

The Major Scheme Investment Alternative is a corridor improvement which can be delivered through a major investment to widen an existing road, or to develop a new alignment. This alternative represents all of the route options considered in the Route Selection Report.

5.1.2.3 Appraisal of Traffic Management Alternative against Major Scheme Investment Alternative

In 2012, Aecom were procured to undertake a Project Appraisal of the *Proposed Road Development* in accordance with the NRA PAG. As part of this process and in accordance with PAG Unit 4.0, an appraisal was carried out which considered the viability of a Traffic Management Alternative against the aforementioned Major Scheme Investment.

This assessment investigated the potential of an on-line upgrade of the existing N4 to the standards prescribed in the NRA DMRB which would deliver the required levels of service and safety. In summary it was considered that the high level of existing agricultural access (circa 130), junctions (circa 20) and residential/commercial properties (circa 70) fronting onto the existing N4 between *Cloonamahan* and *Cloghoge Lower* would mean that a Traffic Management Alternative would be impracticable as there would be a potential requirement to

partially or fully acquire a significant number of residential properties along the route. Additionally as the route would continue to pass through the village of Castlebaldwin, the requirement to maintain the 50kph speed limit in this area would significantly impact upon potential journey time savings from the *Proposed Road Development*.

In this regard, due to the predicted increases in traffic along the route and the major constraints to local improvement, an on-line widening alternative which would constitute a Traffic Management Alternative was not considered viable in terms of delivering the required levels of service.

Plate 5-1: Existing N4 through Castlebaldwin

This assessment reaffirmed that a Major Scheme Investment represented by the original route options selected, remains the optimal investment solution for the *Proposed Road Development.*

6 Route Corridor Options

6.1 Introduction

The Study Area for the proposed N4 Cloonamahan to Castlebaldwin *Proposed Road Development* road was developed in 2000 as part of the Constraints Study prepared by the Road Design Section of Sligo County Council. For the purposes of this route selection addendum, the boundaries for the study area were checked principally to identify if any changes in the built environment over the intervening period from 2000 to 2012 would have any implications on the original boundary selected. It was found that there was no requirement to alter the original boundary. (See appendix 1, Drawing No. N4 RSA-01 for details).

In relation to access onto the *Proposed Road Development*, the NRA published a document in May, 2006 entitled *Policy Statement on Development Management and Access to National Roads*. In order to improve road safety and efficiency of any *Proposed Road Development*, the NRA have outlined within this report that as part of design of a new national road; alternative means of access from existing development should be provided to local roads via service roads or other appropriate means of access to the local roads if possible.

6.2 Route Corridor Options

The Road Design Section of Sligo County Council was requested by the NRA to develop a project from the townland of Doorly to a location south of Castlebaldwin Village as the current N4 route brings all traffic through a badly aligned, narrow road with a large number of minor junctions. The Constraints Study for the proposed N4 Cloonamahan to Castlebaldwin *Proposed Road Development* Road was completed in 2000. Based on the constraints identified at that time; five route corridor options were selected, assessed and a preferred route corridor option was established in 2002. The Route Corridors were evaluated in terms of Engineering, Environmental Impacts, Economics and Agronomy with the aim of recommending a particular route corridor, the Preferred route Corridor.

Two of the route options were located on the south west side of the existing road which were referred to as Option 1 and Option 2 in the RSR. One option followed the existing road with some improvements both horizontally and vertically in order to achieve design standard requirements (Option 3) while the remaining two options were located on the north east side of the existing N4 and were referred to as Option 4 and Option 5. (See appendix 1, Drawing No. N4 RSA-02 for details of the Route corridors and Drawing No. N4 RSA-03 for details of the Preferred route).

6.2.1 **Description of Route Options**

In all five route options consisting of Standard Single Carriageway cross section were considered. Each route commenced in the townland of *Doorly* and tied back into the N4 at *Carrowkeel (ED Templevanny)*. These options were all considered within the Constraints Study area which is indicated in drawing N4 RSA-01.

6.2.2 **Option 1**

Option 1 was c. 12.32km in length and passed through the townland's of *Doorly, Lackagh, Knocknagroagh, Drumfin, Cloonlurg, Knockmoynagh, Kilmorgan, Kingsbrook, Cams, Ardlee, Coolskeagh, Lecarrow, Cleavry, Cloghoge Upper* and *Cloghoge Lower*, bypassing the village of Castlebaldwin to the South West and returning to the N4 at *Carrowkeel (ED Templevanny)*.

6.2.3 **Option 2**

Option 2 with a total length of c. 12.125km traversed west of the existing N4, passing through the townlands of Knocknagroagh, Drumfin, Cloonlurg, Carrowkeel, Carrownagark, Kingsbrook, Aghalenane, Cams, Ardloy, Coolskeagh, Lecarrow and *Cleavry, Cloghoge Upper* and *Cloghoge Lower*, bypassing the village of Castlebaldwin to the South West and returning to the N4 at *Carrowkeel (ED Templevanny)*. .

6.2.4 Option 3

Option 3 with a total length of c. 11.86km bypasses the small village of *Lackagh* to the East and rejoins the existing road at *Drumfin*. It then followed the existing road all the way to Castlebaldwin passing through the village. This option represents the online or *Do-Minimum* option considered during the RSP.

6.2.5 Option 4

Option 4 measuring c. 11.87km in length, traverses South East through the townland's of *Doorly, Lackagh, Drumfin, Murillyroe, Behy, Carrowkeel, Knockadoo, Carrownagark, Tawnagh, Springfield, Cloonymeenaghan, Sheerevagh and Drumderry*. It bypasses the village of Castlebaldwin to the North East before rejoining the existing N4 at *Carrowkeel (ED Templevanny)*.

6.2.6 Option 5

Option 5 measuring c. 11.91km traversed South East through the townland's of *Doorly, Lackagh, Drumfin, Murillyroe, Behy, Carrowkeel, Ogham, Tawnagh, Whitehill, Cloonymeenaghan, Sheerevagh and Drumderry, Castlebaldwin,* bypassing the village of Castlebaldwin to the North East before rejoining the existing N4 at *Carrowkeel (ED Templevanny)*.

6.2.7 Option 6: Preferred Route

Following assessment of the Route Options, the optimal or preferred route was considered to be a combination of Options 2 and 4, including the northern part of Option 2 to a point at *Aghalenane Td.* and continuing with the southern part of Option 4. For comparison purposes this preferred route will be discussed in tandem with the original options within this Chapter.

In summation the realigned road will depart to the western side of the existing N4 route at *Doorly* and extends southwards through *Knocknagroagh, Drumfin, Cloonlurg, Carrowkeel, Carrownagark, Kingsbrook and Aghalenane*. At this point the preferred route travels eastwards from *Aghalenane*, through *Ardloy* and *Springfield*, and then veers southwards again, through *Tawnagh, Springfield, Cloonymeenaghan, Sheerevagh, Cloongad, Drumderry, Castlebaldwin* and *Cloghoge Upper* before returning to the existing N4 route at *Cloghoge Lower.*

The Preferred Route is shown figuratively in N4 RSA-03 (appendix 1).

6.2.8 Option 6+: Preferred Route (with EIS Stage Design Amendments)

As the design of the *Proposed Road Development* progressed during Phases 3 and 4 of the NRA PMG (2010), the consideration of alternatives was maintained as more detailed site specific information became available and where discrete alignment changes were feasible. This allowed for a subtle evolvement of the route from that which emerged from the Route Selection Report (Option 6). Some changes to the Preferred Route were considered and subsequently incorporated for the reasons which are outlined in section 6.2.8.1.1 of this Chapter.

This option has become the *Proposed Road Development* and is described figuratively in N4 RSA-03 (appendix 1). This is the route which others are compared to when considering alternatives.

6.2.8.1.1 *Application of Design Alternatives*

6.2.8.1.1.1 *NRA Standards*

There have been numerous changes to NRA standards since the emergence of the Preferred Route; these changes have resulted in modifications to the route as outlined in the following paragraphs;

Road type

The rational which determined the evolvement of the road type from the time of Route Selection to the current time stems from the NRA's consideration of new road types in the mid part of the 2000's. This was in acknowledgement of the fact that there was a large gap, in terms of capacity, cost and safety, between the Standard Single Carriageway and a Dual Carriageway with at grade junctions.

This led the NRA to develop other new divided road categories, which provided a capacity range between that of a single carriageway and a dual carriageway, i.e. between 11,600 and 26,500 AADT. This resulted in the development of the Type 2 Dual Carriageway which was piloted on the N4 Dromod/Roosky Bypass and incorporated into the DMRB in 2007. This Type of road was derived principally from the Swedish experience of similar roads which provided the following benefits over a Standard Single Carriageway Road:

- Segregation benefits of a dual carriageway;
- Reduction in the severity of all accidents;
- Reduction in number of head on collisions;
- Reduction in driver frustration by provision of overtaking opportunities;
- Elimination of uncontrolled right turning movements;
- Controlled access onto national routes.

Incremental Analysis

The selection of the Road Type for the *Proposed Road Development* was based on an incremental analysis approach adopted in accordance with the advice of the NRA PMG (2010). This was in recognition of the fact that AADT threshold flows outlined in NRA DMRB TD 09/12 should be used as a guide only in the selection of different road types. This is as advised by the NRA Project Appraisal Guidelines (PAG Unit 4: Definition of Alternatives). The analysis was carried out by Aecom in consultation with the design team and was supported by the traffic models developed as part of the project.

Having regard to the provisions of NRA TD 09/12 and considering the range of traffic figures currently using and predicted to use the *Proposed Road Development* it was determined that the most appropriate road types would be the Standard Single Carriageway or the Type 2 Dual Carriageway. The analysis thus sought to compare these two road types.

The following summarises the results of this assessment, which considered the route in 2 separate segments in recognition of the geometric improvements which have been carried out on the portion between *Collooney/Toberbride Td.* and *Doorly Td*. The geometrically deficient section is initially considered.

Cloonamahan Td. to Cloghoge Lower Td.: Geometrically Deficient Section

- Based on National Parameter values extracted from the NRA PAG, the Type 2 Dual Carriageway has significantly lower (50%) accident rates than the Type 1 Single Carriageway as per Table 6-1, moreover, indices indicate that in an accident the average number of casualties are likely to be significantly lower for an accident which occurs on a dual carriageway;
- The analysis suggests that the dual carriageway option will result in daily journey time savings of over 28 hours in 2032 when compared to the single carriageway option, equating to a daily journey time saving of approx 3-4%;
- Travel distance and average speed remain reasonably constant for both road types;
- The aforementioned guidelines in NRA TD 09/12 advise that a Type 1 Single Carriageway road will operate at LOS D up to an AADT of 11,600. The demand forecasts suggest that the existing N4 (Do-Minimum) will experience AADT of 11,600 under medium growth conditions in the design year of 2032 in the townland of *Drumfin*;
- The economic effects of developing a Type 2 Dual Carriageway over a Standard Single Carriageway are of a modest nature (c. 3-4% greater expenditure of Total Scheme Budget) considering the total additional cross sectional area required is only 3.2m.

Table 6-1: Accident Rates by Road Types[10]

Road Type	Accident Rate PIA/mvkm
Speed Limit	>60kph
2 lane Single Carriageway	0.111

[10] Extracted from Unit 6.11 the NRA PAG.

Road Type	Accident Rate PIA/mvkm
Dual Carriageway	0.056

Table 6-2: Average Number of Casualties per Accident[11]

Road Type	Casualties per PIA		
Speed Limit >60kph	Fatal	Serious	Minor
2 lane Single Carriageway	0.106	0.219	1.295
Dual Carriageway	0.075	0.104	1.202

Collooney/Toberbride Td. to Cloonamahan Td.: Geometrically Improved Section

An NRA Peer Review process undertaken in early 2013 suggested that the intended commencement point (at that time) for the *Proposed Road Development* at *Cloonamahan Td*. would leave a c. 2.2km section of single carriageway with numerous direct accesses in place which may in the long term, impact on connectivity and level of service provided by the N4. This would be in addition to an inconsistency of layout insofar as a short section of single carriageway with direct access would separate two considerable lengths of divided roadway.

The additional key findings of the assessment are outlined below;

- Based on National Parameter values extracted from the NRA PAG, the Type 2 Dual Carriageway has significantly lower (50%) accident rates than the Type 1 Single Carriageway as per Table 6-1, moreover, indices indicate that in an accident the average number of casualties are likely to be significantly lower for an accident which occurs on a dual carriageway;
- Travel distance and average speed remain reasonably constant for both road types;
- The NRA DMRB TD09/12 gives a guideline that a Type 1 Single Carriageway road will operate at LOS D up to an AADT of 11,600. The demand forecasts suggest that the existing N4 (Do-Minimum) will experience AADT of 13,000 under medium growth conditions in the design year of 2032 in the townland of Ardcurley;
- Local traffic which currently has access directly onto the N4 will experience a slight disbenefit as these accesses would be relocated to a new location on the network.

Incremental Analysis Conclusion

Considering the foregoing it was decided, that the road type for the *Proposed Road Development* be changed from a Standard Single Carriageway to a Type 2 Dual Carriageway between tie in roundabouts at the existing N4/N17 junction (*Collooney/Toberbride Td.)* and at *Castlebaldwin Td.* The decision was based primarily on the long term safety benefits which will accrue from segregating carriageways. In relation to the existing geometrically improved section the decision was similarly based on safety considerations and in order to ensure consistency of layout providing an unbroken dual carriageway layout between Sligo town and Castlebaldwin.

The aforementioned roundabouts will provide for an opportunity to clearly define the change in road type from a Standard Single Carriageway to a Type 2 Dual Carriageway in *Collooney/Toberbride Td* and from a Type 2 Dual Carriageway to a Standard Single Carriageway in the townland of *Castlebaldwin Td*. By way of comparison, drawing N4 RSA-04 contained within appendix 1 of this report demonstrates figuratively and through the use of specially developed photomontages, the relatively modest cross sectional difference between the Standard Single Carriageway and the Type 2 Dual Carriageway[12]. A Type 1 Dual Carriageway is also shown to demonstrate its dimensional difference with the Standard Single Carriageway.

[11] Extracted from Unit 6.11 the NRA PAG.

[12] The wire rope segregating barrier type depicted in the Photomontage is for indicative purposes only.

Junction Strategy

In terms of junction strategy the NRA DMRB has evolved in terms of design standards since the period of the Route Selection Process. In this regard the DMRB now restricts provision of Major/Minor priority junctions to situations where the design flow in the minor road is not expected to exceed about 300 vehicles 2 way AADT, and that on the major road is not expected to exceed 13,000 vehicles 2-way AADT; moreover, cross roads are now prohibited for proposed new developments. In relation to direct access, the NRA DMRB (TD 41/42 12) states that:

> *there is a potential saving in collisions where there is a reduction in the number of lightly trafficked direct accesses and minor junctions made directly on to each national road. Such accesses can be joined together with a link or service road before they join the main carriageway of the national road. Options for such indirect connections should always be explored, as should providing the access from the local road network.*

Table 6-3 outlines the local road treatments/junction arrangements at the time of the Preferred Route selection and the current status following the design of the *Proposed Road Development*.

Table 6-3: Changes to Local Road treatment from that considered at Route Selection Stage

Road Number	Local Road Treatment/Junction Arrangement during Route Selection Report	Proposed Arrangement
L55015-0	Underbridge	Underbridge
L55016-0	Road Closed	Overbridge
L5502-0	Underbridge	Overbridge
L1502-32	Grade Separated Junction	Compact Grade Separated Junction
L5402-0	Underbridge	Underbridge
L54033-0	Underbridge	Underbridge
Existing N4 (*Ardloy Td.)*	Underbridge	Underbridge
L5401-0	Underbridge	Underbridge
L54041-0	Road Closed	Road Closed
L1404-0	Overbridge	Roundabout Junction

6.2.8.1.1.2 *Environmental*

In recognising the fact that avoidance is the most effective way of mitigating environmental Impacts, the design remained to a degree flexible during the initial stages of Environmental Impact Assessment. Interaction between the design team and the various sub-consultants allowed for the identification of potential significant impacts from initial designs which could be eliminated or reduced by modifications to the design while maintaining the general alignment of the Preferred Route. Examples of the main modifications made to the design for this purpose are outlined below.

Horizontal Alignment

Table 6-4 below outlines reasons for and locations of changes made to the horizontal alignment to avoid/reduce environmental impacts. These changes are outlined figuratively in drawing N4 RSA-03 (appendix 1) of this report.

Table 6-4: Horizontal Alignment, changes to avoid/reduce environmental impacts

Location	Reason for alteration	Design measure adopted
Doorly, Lackagh & Knocknagroagh Td.	To avoid and reduce direct impacts on the undesignated ecological site described in the EIS as Lackagh Fen and attributed the ecological value of being important at the National scale. This design change also provides the dual benefit of reducing volumes of PEAT material generated by the *Proposed Road Development*.	The geometry of the alignment was modified to facilitate the moving of the road footprint to the west of the centreline of the Preferred Route; thereby significantly avoiding direct impacts on Lackagh Fen.
Drumfin & Cloonlurg Td.	To reduce volumes of unsuitable subsoil and PEAT material generated by the *Proposed Road Development*.	The geometry of the alignment was modified to facilitate the moving of the road footprint to the west of the Preferred Route, thereby reducing volumes of PEAT generated by the *Proposed Road Development*.
Kingsbrook & Aghalenane Td.	To avoid and reduce direct impacts on the undesignated ecological site described in the EIS as Ardloy & Aghalenane Loughs and attributed the ecological value of being important at the International scale. This design change also provides the dual benefit of reducing volumes of PEAT material generated by the *Proposed Road Development*.	The geometry of the alignment was modified to facilitate the moving of the road footprint to the west of the centreline of the Preferred Route, thereby avoiding direct impacts on Ardloy & Aghalenane Loughs.

Vertical Alignment

Although changes to the vertical alignment do not impact as significantly on the location of the route, they are none the less important in avoiding/reducing indirect impacts on the environment, particularly where there is a risk of intercepting karstic groundwater flows or encountering flood plains. Table 6-5 outlines measures which have been taken during the design process to avoid/reduce impacts on the environment through the modification of the vertical alignment.

Table 6-5: Vertical Alignment, changes to avoid/reduce environmental impacts

Location	Reason for change	Design measure adopted
Doorly Td.	To reduce the potential for indirect impacts to ground water contributions to Lackagh Fen. Particularly in order to reduce the risk of encountering karstified bedrock.	The vertical alignment was raised in road cut areas at c. Ch. 2,850m and c. Ch. 3,100m above predicted saturated bedrock level.
Knocknagroagh Td.	To reduce the potential for indirect impacts to ground water contributions to Lackagh Fen. Particularly in order to reduce the risk of encountering karstified bedrock.	The vertical alignment was raised in road cut areas at c. Ch. 4,000m above predicted saturated bedrock level.
Cloonlurg Td.	To avoid/reduce potential flooding impacts as a result of a flood plain identified during the design phase.	The vertical alignment was raised in road fill areas at c. Ch. 6,700m and c. Ch. 7,500m to a level which is predicted to be above the potential Flood levels.
Carrownagark Td.	To avoid/reduce potential interception of groundwater contributions to Carrownagark Group Water Supply scheme.	The vertical alignment was raised in road cut areas at c. Ch. 8,250m above predicted saturated bedrock level.
Ardloy & Springfield Td.	To reduce the potential for indirect impacts as a result of impacts to surface water contributions to the Turlough and Swallow Hole Complex at Tawnagh.	The vertical alignment was maintained above saturated bedrock level at c. Ch. 10,400m.

6.3 Methodology of Comparison

The original assessment process compared each of the options under the following categories:

- Engineering Considerations;
  - Passing Sight Distance, no. of junctions, no. of accesses and ground conditions;
- Economic Considerations;
  - Estimated cost and estimated benefit;
- Environmental Considerations;
  - Ecology, archaeology, air quality, noise impact, landscape and agricultural and non-agri. properties;
- Public Preference;

As already outlined, this information was augmented during the 2012/2013 review with a renewed perspective of the above categories supplemented with others.

The following chapters outline the findings of the original route selection assessment process and the current review which considers the changes which have occurred in the intervening period and which could in hindsight have influenced the selection of a preferred route.

6.4 Route Corridor Consultation

6.4.1 **Route Corridor Selection Process**

Public Participation in the Route Selection Process included two separate public consultations. The first consultation was based on the initial 5 route options and was held during the period 14th May 2001 to 15th June 2001. This allowed for the public opinion to be considered within the methodology for selection of the Preferred Route which is stated in the Route Selection report as follows:

The preferred route takes into account the concerns of the public in relation to land severance…

The second consultation presented the Preferred Route Corridor to the public in March 2002. The results of this consultation allowed for modifications to be made to Preferred Route prior to its adoption by Sligo County Council.

6.4.2 **Additional Consultations**

Project Liaison has been ongoing and continuous through the interaction of the Project Liaison Officer with landowners who are affected by the route and through the EIS coordinators (and various environmental specialists) interaction with various statutory bodies. These liaisons have in instances aided in the design process and influenced some decisions relating to farm accommodation tracks and the environmental design considerations described in section 6.2.8 of this report.

In recognition of the *ad-hoc* nature of these consultations, the time lapse since the original statutory public consultation and the design changes which have been applied during the EIA/design process, a Project Information evening was held in November 2013; this allowed for the consideration of final modifications to be made to the design prior to the publication of statutory documents.

7 Engineering Assessment

7.1 Introduction

Engineering Assessment, Traffic Assessment and Economic Assessment are closely intertwined. In particular, many of the impacts associated with Engineering are monetised through the project costs and benefits in the cost-Benefit analysis that forms the basis of the economic assessment criterion of the Project Appraisal.

Engineering is also a significant component of the other appraisal criteria; in particular environment and safety.

7.2 Existing Road Network

The existing road network within the study area comprises the N4 National Route and a relatively dense network of local roads serving local communities and providing them with access to the National Route.

7.3 Road Geometry

Each of the corridors provides opportunity to develop road alignments that meet all road design standards as determined in accordance with the DMRB. The differences between the options on geometric grounds are relatively small, however, varying degrees of passing sight distance are provided by each option as follows:

Table 7-1: Percentage Passing Sight Distance Achieved.

Option No.	Percentage Passing Sight Distance Achieved
Option 1	54.2%
Option 2	62.2%
Option 3	47.3%
Option 4	68.39%
Option 5	55.08%
Option 6	70.5%
Option 6+	70.5%

7.4 Drainage

Each of the route options will require the provision of road surface water facilities and based on initial assessments the requirements for each of the corridors will be similar in scale and will discharge to similar receiving waters.

7.5 Junction and Structures Proposals

The RSR (2002) detailed cross roads or T-Junctions to treat various local roads along the proposed routes as shown in Table 7-2. However, design standards in relation to geometric design of Major/Minor priority junctions on single carriageway (S2) roads have changed since the preparation of the RSR (2002). The current geometric standard for Major/Minor Junctions (NRA TD 41-42/11) does not permit the use of cross road type junctions arrangements on new national road *Proposed Road Developments*. Simple junctions in the form of T-Junctions or Staggered junctions are permitted for minor junctions on single carriageway roads in rural areas, if the design flow in the minor road is not expected to exceed about 300 vehicles 2 way AADT, and that on the major road is not expected to exceed 13,000 vehicles 2-way AADT. This together with the fact that AADT figures on local roads have increased significantly since 2002 means that either underbridges or overbridges would be required to treat the majority of side roads intersected by each option.

The following structures and junctions were proposed within the RSR (2002) for each option as shown in Table 7-2. However, as discussed above further structures would be required to treat local roads with AADT in excess of 300. Further design and topographical survey information would be required to establish proposed treatment of side roads along each of the proposed options. Therefore at this stage in the design process it is assumed that there will be similar treatment requirements for each of the proposed options as they cross a similar number of local roads. It is felt however, that Option 3 which follows largely the existing road would require demolition of a large number of dwellings in order to achieve the junction design standards required. Therefore, Option 3 has a greater potential impact on dwellings than either Option 1, 2, 4 or 5 and is the least preferred.

Table 7-2: Structures and Junction Strategy Proposed within the RSR (2002).

Option No.	Structures and Junction Strategy Proposed
Option 1	Underbridge proposed on local roads L15021-0, L-1404-0 and L-58015-0. Crossroads or T-junctions proposed at junctions with local roads L-1302-0, L-55016-0, L5502-0, L-5402-0, L-5403-0 and the L-54051-0. In all this would mean there would be 7 junctions with unrestricted right hand turning.
Option 2	Underbridge proposed on local roads L15021-0, L-5402-0 and L-1404-0 and L-58015-0. Crossroads or T-junctions proposed at junctions with local roads L-1302-0, L-55016-0, L5502-0, L-5402-0, L-5403-0 and the L-54051-0. In all this would mean there would be 7 junctions with unrestricted right hand turning.
Option 3	No underbridges proposed on this option. All existing junctions were proposed to be upgraded to provide access to the new proposed design. In all this would mean there would be 18 junctions with unrestricted right hand turning.
Option 4	Underbridge proposed on local roads L-1401-0, L-54013-0, L-5401-0 and the L-1404-0. Crossroads or T-Junctions were proposed at junctions with local roads L-1302, L54016-0, L-54017-0 and L-54041-0. In all this would mean there would be 5 junctions with unrestricted right hand turning.
Option 5	Underbridge proposed on local roads L-1401-0, L-5401-0 and L-1404-0. Crossroads or T-Junctions were proposed at junctions with local roads L-1302-0, L-54016-0 and L-54041-0. In all this would mean there would be 4 junctions with unrestricted right hand turning.
Option 6	Underbridges proposed on local roads L-55015-0, L-5502-0, L-5402-0, L-54033-0, Existing N4 at Ardloy and the L-5401-0. An overbridge was proposed on the L-1404-0. A grade separated interchange was proposed on the L-1502-32.

7.6 Utilities

Overall, in relation to utilities there is little difference between the options therefore an assessment of conflicts was not carried out.

7.7 Ground Conditions

Ground Conditions are assessed in section 14.2.3 (Soils and Geology) of this addendum report. The results of this as outlined in Table 7-3 confirm that each of the route options encounter areas of soft ground of approximately 20% to 44% of their various route lengths. The *Proposed Road Development* (Option 6+) encounters approximately 34% of soft ground along its length mainly between *Doorly Td.* and *Ardloy Td.* Although this is a high percentage, it is the least intrusive of those route options which are located south-west of the existing N4 between the aforementioned townlands.

Table 7-3: Soil and Subsoil Geology

Route Option	% of Soft Ground interpreted from Soil mapping	% of Soft Ground interpreted from Subsoil mapping	Rank
Option 1	40%	44%	7
Option 2	35%	35%	5
Option 3	24%	24.5%	1
Option 4	43%	20%	3

Route Option	% of Soft Ground interpreted from Soil mapping	% of Soft Ground interpreted from Subsoil mapping	Rank
Option 5	27%	24.3%	2
Option 6	35%	38%	6
Option 6+	34%	34%	4

7.8 Assessment and Evaluation – Engineering

The overall Engineering assessment and evaluation of the route corridor options was based on the criteria as outlined above. From this initial assessment it is clear that all proposed route options with the exception of Route 3 are similar in terms of Engineering. The preferred route has the highest percentage passing sight distance with Option 3 having the lowest. Option 3 is least preferred in terms of junction treatment as it would require:

- A significant number of direct accesses; or
- The demolition of a significant number of roadside properties.

8 Impact on Archaeology

Given the time lapse since the preparation of the N4 Cloonamahan to Castlebaldwin Route Selection Report, 2002 (RSR, 2002) a review of route options was carried out by Michael McDonagh, NRA Senior Archaeologist, in accordance with the methodology used during the preparation of the original Route Selection Report. This review was compiled using the following sources:

- The Records of Monuments and Places for County Sligo;
- Record of Protected Structures for County Sligo within the Sligo County Development Plan (2005-2011); and
- The National Monuments for County Sligo (2009-latest).

A field inspection of the routes was carried as part of the original assessment and therefore no further fieldwork was deemed necessary. Following the review, Table 3.4 of the Route Selection Report is amended as outlined below in Table 8-1:

Table 8-1: Impact of Route Options on Archaeology

Option	1		2		3		4		5		Preferred	
	<25m	>25m	<25m	>25m	<25m	>25m	<25m	>25m	<25m	>25m	<25m	>25m
Enclosure	34:191		34:191		34:191			34:191		34:191	34:191	
Enclosure		34:187		34:187								
Holy wells					34:186							
Enclosure							34:184		34:184			34:184
Fortified House							34:185		34:185			
Enclosure								34:086				
Encl (site of)								34:087				
Enclosure								34:084				
Castle								34:001				
Ecclesiastical Site										34:085		
Enclosure										34:004		
Enclosure										34:002		
Total	1	1	1	1	2	0	2	5	2	4	1	1

No new sites were noted in the current Records of Monuments and Places. It should be noted that site 034:111 which was marked adjacent to Option 3 in the route options mapping of the RSR (2002), is now a 'redundant record' deemed non-archaeological and accordingly is not assessed here. Minor amendments are included in Table 8-1 to numbers of sites under each option based on distances due to the availability of improved mapping. A number of buildings were noted as now being Protected Structures within the current Sligo County Council Development Plan. These occur in the village of Castlebaldwin, where any works associated with any proposed road would be confined to pavement works on the existing carriageway and so their protection status does not in any way affect any review. The fortified House at Castlebaldwin (34:185) is now a National Monument in State Care. No reference was made to this in the RSR (2002). Therefore, this being the case, route options 4, 5 as well as the preferred route must get marked down slightly in the ranking process shown in Table 8-1 of the N4 Cloonamahan to Castlebaldwin RSR (2002). Route options running west of Castlebaldwin would have avoided any indirect impact on this National Monument. That said the emerging

preferred route as identified at the time remains a good route overall from an archaeological, architectural and cultural heritage perspective. The ranking for Archaeology is now amended as shown in Table 8-2 below. A ranking of 1 indicates the least impact or most favourable result and a ranking of 6 indicates the greatest impact or least favourable result.

Table 8-2: Impact of Route Options on Archaeology

Route Option	No. of listed monuments within 25m	No. of listed monuments between 25m and 50m	Rank[13]
Option 1	1	1	1
Option 2	1	1	1
Option 3	2	0	2
Option 4	2	5	4
Option 5	2	4	3
Option 6	1	1	1
Option 6+	1	1	1

[13] Similar Ranks have been scored where impacts are considered similar.

9 Ecology

9.1 Introduction

ECOFACT Environmental Consultants Ltd. were contracted by Sligo County Council to provide an addendum to the existing *N4 Cloonamahan to Castlebaldwin Route Selection Report (2002)* in relation to Ecological Considerations; taking cognisance of the '*N4 Realignment Cloonamahan to Castlebaldwin Constraints Study Ecological Report (2000)*' that was compiled by Dr. Don Cotton with regard to the proposed Route Options identified in Figure 9-1.

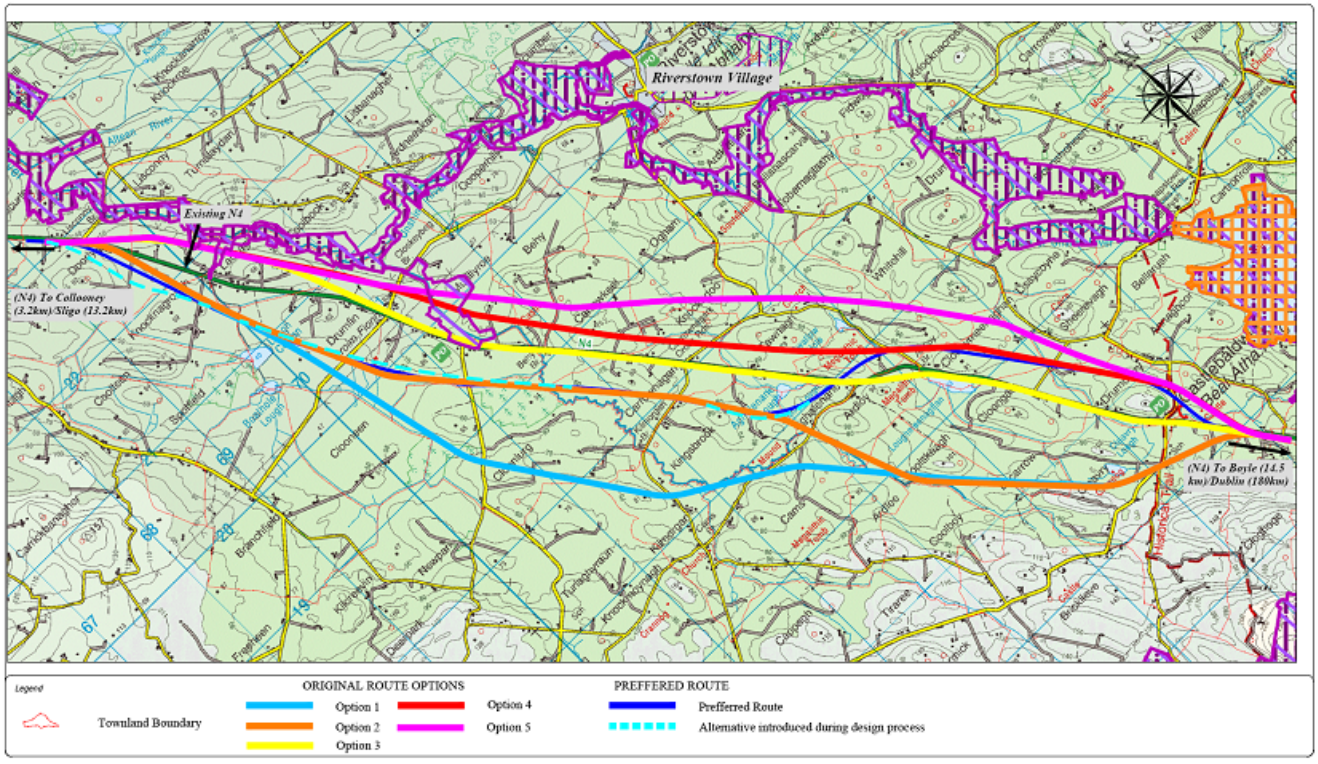
This chapter provides a brief overview of the ecological considerations within the Route Corridor Study Area, identifying the key ecological receptors for each of the proposed six Route Options with regard to:

- designated conservation sites;
- undesignated ecological receptors; and
- watercourses.

Sections of relevant Route Options were subject to a site visit where they intersected with designated Natura 2000 sites.

This chapter sets out necessary amendments to the original Route Selection Report (2002) taking the above information into account and is to be read in conjunction with the Ecology Chapter as well as Appendix 2 to that report. During the preparation of this chapter reference has been made to the National Road Authority's '*Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2*' (NRA, 2009); Chapter 5 of which addresses the requirements for Route Corridor Selection Studies.

Figure 9-1: Route Options and Designated Sites



9.2 Description of the Existing Environment within the Study Area

9.2.1 Designated Conservation Sites

The European Union Directive 92/43/EEC (The 'Habitats' Directive) was transposed into Irish law by The European Community (Natural Habitats) Regulations 1997 (S.I. No. 94/1997). The most recent transposition of this legislation is the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of

2011). The Birds Directive (2009/147/EC) which is now included in the former Regulations seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs), whereas the Habitats Directive does the same for habitats and other species groups within Special Areas of Conservation (SACs), which are currently designated as candidate Special Areas of Conservation (cSAC) in Ireland. It is the responsibility of each member state to designate SPAs and SACs, both of which will form part of Natura 2000, a network of protected areas throughout the European Union. Designated Natura 2000 sites identified within the zone of influence of the proposed Route Options are presented in Table 9-1; in addition to sites located in closest proximity to the Route Options, lying outside of the zone of influence. The zone of influence and potential for significant effects on designated sites was identified through aerial photography and site walkover at the crossing points / intersections of each proposed Route Option with a designated Natura 2000 site. The Plates section in this chapter presents images from the field survey at each designated site directly affected.

Table 9-1: Designated Natura 2000 sites within the zone of influence of the proposed Route Options.

Site Name	Site description / Qualifying interests	Receptor importance / Evaluation
Unshin River cSAC (1898)	Floating river vegetation [3260] Alluvial woodlands [91E0] Atlantic salmon (*Salmo salar*) [1106] Otter (*Lutra lutra*) [1355]	International Importance
Lough Arrow cSAC (1673)	Hard oligo-mesotrophic waters [3140] Otter (*Lutra lutra*) [1355]	International Importance
Lough Arrow SPA (4050)	Little grebe (*Tachybaptus ruficollis*) [A004] Tufted duck (*Aythya fuligula*) [A061] Wetlands & waterbirds [A999]	International Importance
Bricklieve Mountains and Keishcorran cSAC (1656)	Turloughs [3180]; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*)(*important orchid sites) [6210]; Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) [6510]; Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) [8120] Marsh fritillary (*Euphydryas aurinia*) [1065] White-clawed crayfish (*Austropotamobius pallipes*) [1092].	International Importance
Union Wood cSAC (000638)	Old oak woodland [91A0]	International Importance

Natural Heritage Areas' (NHAs) are an Irish designation, protected under the Wildlife (Amendment) Act (2000). These designations include those sites formally designated as NHAs and also those sites proposed as NHAs (pNHA sites) which have yet to be formally designated. There are no NHA and pNHA sites within the zone of influence of the proposed Route Options, the closest being the Knockmullin Fen pNHA (site code 1904), located approximately 1km to the west of the proposed Route Options at the northern end of the alignment. This site is proposed for designation for the Annex I habitat 'Alkaline Fen'.

9.2.2 Undesignated Ecological Receptors

Sensitive ecological receptors within the study area were identified using aerial photography and with reference to a series of reports on wetland habitats, produced by the Sligo County Council Heritage Section with the support of the Heritage Council. The purpose of the '*County Sligo Wetland Survey*' reports was to map the type, extent and condition of wetlands in the county with a view to protecting their conservation status by including these sites on a register of County Biodiversity Sites. This survey was commissioned by Sligo County

Council in 2008 (Wilson, 2008) and continued in 2009 and 2010 (Wilson 2009, Wilson, Foss and Crushell, 2011a & 2011b). A summary of the wetland sites identified within the zone of influence of the proposed Route Options is presented in Table 9-2. The Sligo County Development Plan (2011-2017) (Sligo Co. Co., 2011) outlines the following objective in relation to nature conservation outside of designated sites:

'*O-NH-9: Identify and protect, in co-operation with the relevant statutory agencies and other relevantgroups, County Biodiversity Sites which are not otherwise protected by legislation*.'

Table 9-2: County Biodiversity Sites within the zone of influence of the proposed Route Options, taken from the Sligo County Development Plan (2011-2017) and the 'County Sligo Wetland Survey' reports (Wilson et al., 2008, 2009, 2011a and 2011b).

Biodiversity Site	General Description	Receptor Importance / Evaluation*
Toberscanavan Lough	Lake, transition mire and fen	National Importance
Lackagh Fen	Fen	National Importance
Boathole Lough and Lough Corran	Lake and raised bog	County Importance
Cuilleencroobagh Lough	Transition mire and quaking bog	County Importance
Kingsbrook Bog	Cutover bog	
Ardloy and Aghalenane Loughs Complex	Lake and Fen	International Importance**
Tawnagh	Turlough	National Importance
Swallow Hole near Riverstown	Turlough	National Importance
Loughmeenaghan	Lake with reedbeds, fen and marsh	International Importance
Drumderry Marsh	Raised bog, Cutaway	Local importance (higher value)
Cleavry Lough	Lake with transition mire and fen	National Importance

* Evaluation is taken from the 'County Sligo Wetland Survey' Reports (Wilson *et al.*, 2008, 2009, 2011a & 2011b).

**Taking account of the evaluation from Moorkens (2012) which recorded the Annex II *Vertigo geyeri* at this site; in addition to the priority Annex I habitat 'Tufa forming springs' also present.

9.2.3 Aquatic habitats

Following the requirements for Route Selection Reporting set out in the NRA publication '*Guidelines for Assessment of Ecological* Impacts of National Road Schemes Rev 2' (NRA, 2009) the main surface waters (e.g. rivers, streams and lakes) intersected by any of the proposed Route Options are identified and their fisheries value and ecological sensitivities evaluated. Waterbodies and watercourses identified within the study area are set out in Table 9-3.

Table 9-3: Aquatic habitats including watercourses and lake waterbodies identified within the zone of influence of the proposed Route Options.

Ecological Receptor	Site description	Receptor Importance / Evaluation
Toberscanavan Lough	Mesotrophic lake with associated fen and wetland habitats. Limited fisheries value	National Importance
Boathole Lough and Lough Corran	Ecologically sensitive areas with a diverse array of habitats. Maybe of local fisheries value. Otters likely to occur, crayfish may occur.	County importance
Aghalenane and Ardloy Loughs	Important habitats with a high floral diversity. No fisheries value.	International Importance
Springfield Swallowhole	Turlough and seasonally flooded lake	National Importance

Ecological Receptor	Site description	Receptor Importance / Evaluation
Loughmeenaghan	Mesotrophic lake with associated fen and wetland habitats. Limited fisheries value	International Importance
Cleavry Lough	Mesotrophic lake with associated fen and wetland habitats. Limited fisheries value	National Importance
Lough Arrow	Large limestone lake with important aquatic flora community; lake habitat corresponds to Annex I 'Hard oligo-mesotrophic waters'. High fisheries value as a brown trout fishery. Otter, possibly brook lamprey within the afferent streams.	International importance (designated cSAC)
Markree Demesne Stream	Tributary of the Unshin River SAC. Important as a corridor for habitat connectivity for otter, eels and salmonids.	Local importance (higher value)
Turnalaydan Stream (Lough Corran Outflow)	Small drained river with gravel substrate and moderate naturalness. Spawning nursery area and tributary of Unshin River SAC. Salmon, otter, brook lamprey, White clawed crayfish	County Importance
Drumfin River	Small river with cobble/gravel bottom and a high degree of naturalness. Good water quality. Spawning nursery area and tributary of Unshin River SAC. Salmon, otter, brook lamprey	County Importance
Tawnagh Stream	Minor drain with generalised flora community. No fisheries value.	Local importance (lower value)
Ardlee Stream	Significant tributary of the Drumfin River. Spawning nursery area and tributary of Unshin River SAC.	Local importance (higher value)
Lissycoyne Stream (Cleavry Lough outflow)	Minor drain with generalised flora community. No fisheries value.	Local importance (lower value)
Springfield Stream	Small stream with impoverished aquatic flora. No fisheries value.	Local importance (lower value)
Drumderry Stream	Minor drain with generalised flora community. High fisheries value. Spawning tributary for trout in Lough Arrow SAC. Otter and maybe brook lamprey.	Local importance (higher value)

9.3 Route Corridor Options evaluation

This section provides an evaluation of the six Route Options, taking account of the ecological receptors along each route and also taking account of the assumption that general mitigation measures will be implemented in line with relevant environmental guidance published by the National Roads Authority. Following the '*Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2*' (NRA, 2009) site-specific mitigation is not included for sensitive ecological receptors and the evaluation of impact significance does not represent residual impacts, post-mitigation. Significant effects are those that would adversely affect the integrity of the ecological receptor i.e. the conservation status of the ecological interests within the site / receptor (NRA, 2009).

9.3.1 Route Option 1

The ecological receptors within the zone of influence of Route Option 1 are set out in Table 9-4; the potential for significant impacts is also identified where applicable.

Table 9-4: Ecological Receptors identified within the zone of influence of Route Option 1.

Ecological Receptor		Receptor importance	Impact significance
Designated sites	Lough Arrow cSAC (1673)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow SPA (4050)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
Wetland sites	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lackagh Fen	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Boathole Lough and Lough Corran	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Cleavry Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
Aquatic habitats	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Boathole Lough and Lough Corran	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Cleavry Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lough Arrow	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Markree Demesne Stream	Local Importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Turnalaydan Stream (Lough Corran Outflow)	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumfin River	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Ardlee Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lissycoyne Stream (Cleavry Lough outflow)	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Springfield Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumderry Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

9.3.2 Route Option 2

The ecological receptors within the zone of influence of Route Option 2 are set out in Table 9-5; the potential for significant impacts is also identified where applicable.

Table 9-5: Ecological Receptors identified within the zone of influence of Route Option 2.

Ecological Receptor		Receptor importance	Impact significance
Designated sites	Lough Arrow cSAC (1673)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow SPA (4050)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
Wetland sites	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lackagh Fen	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Boathole Lough and Lough Corran	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Cuileencroobagh Lough	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Cleavry Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
Aquatic habitats	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Boathole Lough and Lough Corran	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Cleavry Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lough Arrow	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Markree Demesne Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Turnalaydan Stream (Lough Corran Outflow)	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumfin River	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Ardlee Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lissycoyne Stream (Cleavry Lough outflow)	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Springfield Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumderry Stream and its tributary	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

9.3.3 **Route Option 3**

The ecological receptors within the zone of influence of Route Option 3 are set out in Table 9-6; the potential for significant impacts is also identified where applicable.

Table 9-6: Ecological Receptors identified within the zone of influence of Route Option 3.

Ecological Receptor		Receptor importance	Impact significance
Designated sites	Unshin River cSAC (1898)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

Ecological Receptor		Receptor importance	Impact significance
	Lough Arrow cSAC (1673)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow SPA (4050)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
Wetland sites	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Ardloy and Aghalenane Loughs Complex	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Loughmeenaghan	International Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
Aquatic habitats	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Aghalenane and Ardloy Loughs	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Loughmeenaghan	International Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lough Arrow	International importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Markree Demesne Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Turnalaydan Stream (Lough Corran Outflow)	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumfin River	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Tawnagh Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lissycoyne Stream (Cleavry Lough outflow)	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Springfield Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumderry Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

9.3.4 **Route Option 4**

The ecological receptors within the zone of influence of Route Option 4 are set out in Table 9-7; the potential for significant impacts is also identified where applicable.

Table 9-7: Ecological Receptors identified within the zone of influence of Route Option 4.

Ecological Receptor		**Receptor importance**	**Impact significance**
Designated sites	Unshin River cSAC (1898)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow cSAC (1673)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow SPA (4050)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
Wetland sites	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this

Ecological Receptor		Receptor importance	Impact significance
			site in the absence of mitigation.
	Tawnagh	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Swallow Hole near Riverstown	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Drumderry Marsh	Local importance (higher value)	Potential for significant effects on the integrity of this site in the absence of mitigation.
Aquatic habitats	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lough Arrow	International importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Markree Demesne Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Turnalaydan Stream (Lough Corran Outflow)	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumfin River	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Tawnagh Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Springfield Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lissycoyne Stream (Cleavry Lough outflow)	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumderry Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

9.3.5 **Route Option 5**

The ecological receptors within the zone of influence of Route Option 5 are set out in Table 9-8; the potential for significant impacts is also identified where applicable.

Table 9-8: Ecological Receptors identified within the zone of influence of Route Option 5.

Ecological Receptor		Receptor importance	Impact significance
Designated sites	Unshin River cSAC (1898)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow cSAC (1673)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow SPA (4050)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
Wetland sites	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Swallow Hole near Riverstown	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Drumderry Marsh	Local importance (higher value)	Potential for significant effects on the integrity of this site in the absence of mitigation.
Aquatic habitats	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.

Ecological Receptor		Receptor importance	Impact significance
	Springfield Swallow hole	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lough Arrow	International importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Markree Demesne Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Turnalaydan Stream (Lough Corran Outflow)	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumfin River	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Tawnagh Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Springfield Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lissycoyne Stream (Cleavry Lough outflow)	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumderry Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

9.3.6 **Route Option 6**

The ecological receptors within the zone of influence of Route Option 6 are set out in Table 9-9; the potential for significant impacts is also identified where applicable.

Table 9-9: Ecological Receptors identified within the zone of influence of Route Option 6.

Ecological Receptor		Receptor importance	Impact significance
Designated sites	Lough Arrow cSAC (1673)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lough Arrow SPA (4050)	International Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
Wetland sites	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lackagh Fen	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Boathole Lough and Lough Corran	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Cuilleencroobagh Lough	County Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Ardloy and Aghalenane Loughs Complex	International Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Swallow Hole near Riverstown	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Drumderry Marsh	Local importance (higher value)	Potential for significant effects on the integrity of this site in the absence of mitigation.
Aquatic habitats	Toberscanavan Lough	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Boathole Lough and	County importance	Potential for significant effects on the integrity of this

Ecological Receptor		Receptor importance	Impact significance
	Lough Corran		site in the absence of mitigation.
	Aghalenane and Ardloy Loughs	International Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Springfield Swallowhole	National Importance	Potential for significant effects on the integrity of this site in the absence of mitigation.
	Lough Arrow	International importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Markree Demesne Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Turnalaydan Stream (Lough Corran Outflow)	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumfin River	County Importance	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Springfield Stream	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Lissycoyne Stream (Cleavry Lough outflow)	Local importance (lower value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.
	Drumderry Stream	Local importance (higher value)	Potential for adverse effects but not likely to affect the integrity of this site i.e. not significant.

9.4 Preferred Route Selection and Conclusions

The preparation of the Route Selection evaluation with regard to ecological constraints has been undertaken with reference to the National Road Authority's '*Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2*' (NRA, 2009); Chapter 5 of which addresses Route Corridor Selection Studies. In line with this guidance the level of impact and its significance with regard to each proposed Route Option has been applied with the assumption that general mitigation measures, following relevant NRA environmental guidance, will be implemented. However, site-specific mitigation measures are excluded in the assessment of impacts at this stage.

With reference to the '*Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2*' (NRA, 2009) and in particular *Figure 5: Consideration of European Sites during Route Corridor Selection*, there is a clear instruction that where proposed routes may adversely affect the integrity of European Sites the following approach in route selection must be undertaken:

"*Disregard all feasible alternative solutions affecting the integrity of the European site and continue with alternatives that do not.*"

The preferred route selection stage provides a quantifiable evaluation of the potential for the proposed Route Options to affect sensitive ecological receptors. Included in the basic addition of ecological receptors, is a weighting in terms of geographic importance. This section also includes an evaluation of Route Option 6 with additional modifications arising as alternatives during the design process. This modified Route Option is identified as Route Option 6+ (see Table 9-10 below).

From a review of the proposed Route Options it is considered that there are no routes likely to give rise to impacts affecting the conservation status of qualifying interests or conservation objectives with regard to integrity-level impacts affecting any Natura 2000 site. Taking cognisance of this, but with regard to minimising the risk to adverse effects on designated Natura 2000 sites, Route Options that require direct landtake within designated Natura 2000 sites (i.e. Route Options 3, 4 and 5) have been negatively weighted. This is with reference to crossings of the Turnalaydan Stream and the Drumfin River which are designated within the River Unshin cSAC. It is noted that the permanent or significant loss of Annex I habitat or permanent or significant effects on the Annex II species listed as qualifying interests of this site which would constitute an integrity level impact would be unlikely at the proposed crossing points.

None of the proposed Route Options affect nationally designated NHA or pNHA sites.

In terms of undesignated sites of National (and International) Importance (Sligo County Wetland Sites), Option 5 and Option 6+ are deemed to have the least impact, where the number of sites potentially affected by each route are added to give a sum total. Route Option 3, although potentially affecting the least number of sites, would have the potential for direct and significant impacts on the Loughmeenaghan wetland site, which is evaluated as being of international importance in the County Sligo Wetland Survey Report (Wilson *et. al.*, 2011).

All the proposed Route Options require crossings of 2 watercourses identified as being of County Importance; the potential for significant effects arising at these watercourse crossings is evaluated as being not significant. Route Options 3, 4 and 5 do not give rise to any further potential impacts on sites of County Importance. Route 1 and 6+ may potentially affect one additional site of County Importance.

All the proposed Route Options require crossings of minor watercourses identified as being of Local Importance (higher value). The potential for significant impacts at these watercourses is evaluated as being unlikely. Route Options 4, 5, 6, and 6+ all require additional landtake within Drumderry Marsh, a wetland site evaluated as being of Local Importance (higher value).

Taking the above into account, Table 9-10 summarises the potential for significant effects of the proposed Route Options on ecological considerations from an ecological perspective and replaces Table 2.2 of the '*N4 Cloonamahan to Castlebaldwin Route Selection Report*' (Cotton, 2002). The number of ecological features affected within each category is presented as a sum total in the vertical column for each Route Option. On this basis **Route Option 6+** is identified as the preferred route.

Table 9-10: Comparison of potential impacts affecting ecological receptors identified for the six route corridor options, with an addition of Route Option 6 + (Design Process Alternatives). The number of each impact receptors affected within each category is presented in the vertical column for each proposed Route Option. This is then added to give a sum total for each route. Those sites requiring landtake within a Natura 2000 site are further negatively weighted against.

Significant Impact Receptor	Route Corridor Options													
	Route Option 1		Route Option 2		Route Option 3		Route Option 4		Route Option 5		Route Option 6		Route Option 6+	
Significant impacts on designated European Site	Potentially affecting 2 Natura 2000 sites: Not significant.	*0*	Potentially affecting 2 Natura 2000 sites: Not significant.	*0*	Potentially affecting 3 Natura 2000 sites: Not significant.	*0*	Potentially affecting 3 Natura 2000 sites: Not significant.	*0*	Potentially affecting 3 Natura 2000 sites: Not significant.	*0*	Potentially affecting 2 Natura 2000 sites: Not significant.	*0*	Potentially affecting 2 Natura 2000 sites: Not significant.	*0*
Sites with direct land-take within a Natura 2000 site	None.	*0*	None.	*0*	River Unshin cSAC	*1*	River Unshin cSAC	*1*	River Unshin cSAC	*1*	None.	*0*	None.	*0*
Significant impacts on Nationally designated site	None.	*0*	None.	*0*	None.	*0*	None.	*0*	None.	*0*	None.	*0*	None.	*0*
Significant impact on feature of national importance	Potential for significant effects on 3 sites.	*3*	Potential for significant effects on 3 sites.	*3*	Potential for significant effects on 1 site. Potentially affecting 2 undesignated sites of International Importance: 1 significant.	*1* *1*	Potential for significant effects on 3 sites.	*3*	Potential for significant effects on 2 sites.	*2*	Potential for significant effects on 3 sites. Potential for significant effects on 1 undesignated site of International Importance.	*3* *1*	Potentially affecting 3 sites: 2 significant Potentially affecting 1 undesignated site of International Importance: Not significant	*2* *0*
Significant impact on feature of County importance	Potentially affecting 3 sites: 1 significant	*1*	Potentially affecting 4 sites: 2 significant	*2*	Potentially affecting 2 sites: Not significant.	*0*	Potentially affecting 2 sites: Not significant.	*0*	Potentially affecting 2 sites: Not significant.	*0*	Potentially affecting 4 sites: 2 significant	*2*	Potentially affecting 4 sites: 1 significant	*1*
Significant impact on feature of Local importance (higher value)	Potentially affecting 5 sites: Not significant.	*0*	Potentially affecting 5 sites: Not significant.	*0*	Potentially affecting 5 sites: Not significant.	*0*	Potentially affecting 6 sites: 1 significant.	*1*	Potentially affecting 6 sites: 1 significant.	*1*	Potentially affecting 5 sites: 1 significant.	*1*	Potentially affecting 5 sites: 1 significant.	*1*
Order of preference	**2**	*4*	**3**	*5*	**7**	*3*	**6**	*5*	**5**	*4*	**4**	*7*	**1**	*4*

9.5 Ecology Plates

The following plates relate to the ecology section of this addendum report.

Plate 9-1: View downstream along the Turnalaydan Stream within the Unshin River cSAC designation at the crossing point of Route Options 3, 4 and 5

Plate 9-2: View upstream along the Turnalaydan Stream within the Unshin River cSAC designation at the crossing point of Route Options 3, 4 and 5.

Plate 9-3: View north along the existing N4 corridor (south of Drumfin) where Route Option 3 (the online route option) includes the Unshin River cSAC designation.

Plate 9-4: View south along the existing N4 corridor (south of Drumfin) where Route Option 3 includes the Unshin River cSAC designation.

Plate 9-5: View of the Drumfin River within the Unshin River cSAC, downstream of the crossing points of Route Options 4 & 5.

Plate 9-6: View of the Drumfin River within the Unshin River cSAC at the crossing point of Route Option 5.

Plate 9-7: View of the Drumfin River within the Unshin River cSAC at the crossing point of Route Option 4.

10 Agriculture and Non-Agricultural Property

10.1 Agriculture

An assessment of the impact of the individual route options and the preferred route on agriculture was completed by a Sligo based auctioneer namely, John Murphy B.Agr.Sc. using a combination of a desktop survey, a site visit and local knowledge of the study area.

The assessment considered impacts on agriculture under several categories such as landtake, land quality, land use, land severance and farmyard disturbance and each route option was ranked in order of preference. The Road Design Section of Sligo County Council has reviewed the land ownership details along all route options by comparison of current land registry mapping with land ownership mapping used for the Route Selection Report analysis. The results of this analysis show that some changes have occurred with regards to land ownership along the route. However, it was found that the size of individual farm holdings in the main remained similar to those assessed for the Route Selection Report. Therefore no amendments are required to this section of the N4 Cloonamahan to Castlebaldwin RSR.

10.2 Non-Agricultural Property

An assessment of the impact of the individual route options on property was completed by the Road Design section of Sligo County Council using a combination of a desktop survey of information, a roadside inspection and local knowledge of the study area for the RSR.

Given the fact that there has been a significant amount of development; particularly one off dwellings within the study area, the Road Design Section has carried out an assessment of each of the route options and also the preferred route.

The assessment of the impact on non-agricultural property included the following categories:

- Acquisition of residential property
- Acquisition of non-residential property
- Property impact to gardens
- Property within 50m of the route option

The assessment involved recording the number of properties under each category within an eighty metre wide corridor. A property impact to a garden was recorded where there is a direct impact on the curtilage of a residential property. The non-agricultural property assessment compared route options under each of the above categories and outlined a route option of least impact.

The assessment of impacts on non-agricultural properties will apply a greater weighting to the acquisition of properties over impacts on gardens and properties in close proximity to the scheme.

The ranking for agriculture and non-agricultural property is shown in Table 10-1 below. A ranking of 1 indicates the least impact or most favourable result and a ranking of 6 indicates the greatest impact or least favourable result.

Table 10-1: Impacts On Non-Agricultural Property For Each Route Option

Route	Property acquisition		Property impacts to gardens	Non-agricultural property <50m	Rank
	Residential property	Non-residential property			
Option 1	11	19	6	15	4
Option 2	11	26	6	16	5
Option 3	41	72	7	74	6
Option 4	9	14	4	15	2
Option 5	11	13	5	15	3
Option 6	2	4	2	2	1
Option 6+	2	4	2	2	1

The preferred route option would have the least impact on property under this assessment. Acquisitions of one property would be required due to direct impact by the proposed route. A second property lies within the 80 metre corridor and therefore has been included in the property acquisition column. There are a relatively low number of garden impacts.

Option 3 which largely follows the existing mainline would have the greatest impact on property with the acquisition and demolition of a large number of residential properties. This option also impacts on a large number of non agricultural properties.

Option 1, 2 and 5 are similar in terms of impacts to residential properties requiring acquisition of 11 properties based on an eighty metre wide corridor, however, Option 2 has the greatest impact on non-residential properties

Under the assessment of the impact on non-agricultural property the preferred route would also have the least impact.

11 Air Quality and Climate

11.1 Introduction

The major source of air pollution within the study area is road traffic, predominantly that from the N4, and to a lesser extent, the surrounding local roads. Air quality is variable and subject to significant spatial variation, with concentrations generally falling significantly with distance from major road sources. The highest levels of air pollution are experienced along the N4 (including Castlebaldwin Village), with the remainder of the study area generally experiencing rural background concentrations of pollutants.

In the Route Selection Report the route corridors were assessed in accordance with the Design Manual for Roads and bridges, Volume 11, Section 3. This set out air quality standards for assessment of forecast concentrations and also a methodology for estimating levels of Carbon dioxide, Oxides of Nitrogen, Non-methane hydrocarbons and total suspended particulates concentrations at sites along a route. Using these methods concentrations of pollutants were estimated for a location 10m from the centre of the road for various years. From this assessment the results showed that although the traffic levels predicted for the design year were more than double the levels at that time, the pollution concentrations predicted for the design year were lower. Given the fact that vehicle emission levels are reducing over time, it is not proposed to revisit this exercise.

A local impact assessment was also carried out which assessed all properties within 200m of each route option. The DMRB recommended a generalized appraisal of route options by banding the properties up to 200m from the roadside, with pollutant weightings given in each band, so that total numbers and total changes in pollution levels could be compared. Given the time lapse since the preparation of the Route Selection Report, this exercise has been revisited to take account of new dwellings, changes, etc, over time. In the current assessment, the number of properties within 200m of each route have been identified. A comparison of the proposed route corridors has been carried out based on a calculation of the Index of Overall Change in Exposure to nitrogen dioxide (NO_2) and particulate matter less than 10 microns (PM_{10}) resulting from each individual route corridor. The calculation considers sensitive receptors in the region of each route corridor.The results of these are shown in Table 11-1.

Since the preparation of the Route Selection Report, the NRA published guidelines for the treatment of Air Quality during the planning and construction of National road Schemes. This document provides guidance on the approach to be taken during the Route Selection Process in terms of Air Quality. It outlines that a calculation of the index of overall change in exposure should be carried out. This index is based on identifying 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 options. It notes however, that there will be in general an improvement in traffic emissions on existing national roads being bypassed. Although taking cognizance of this new guidance, it was considered for the reasons outlined below that a review of the assessment procedure would not have any significant impact on the outcome of the route selection process.

- In relation to design and operational aspects of road schemes, emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems (UK DEFRA 2009b).
- Improvements in air quality are likely over the next few years as a result of the on-going comprehensive vehicle inspection and maintenance program, fiscal measures to encourage the use of alternatively fuelled vehicles and the introduction of cleaner fuels.
- Considering the nature of the existing environment which is predominately rural in nature in combination with the developments characteristics which will largely provide for free-flowing traffic movements it is not expected that there will be any significant environmental effects arising from the development in relation to Air Quality.

11.2Assessment of Route Corridor Options

11.2.1 Air Quality

11.2.1.1.1.1 *Sensitive Receptors*

The number of properties sensitive to air quality within 200m of each of the proposed route corridors has been determined and is shown in Table 11-1. Sensitive properties may include residential units, schools and retirement homes although at this stage of the assessment no further distinction is made between these different types of property. The results of this exercise were used for the calculation of the Index of Overall Change in Exposure.

A large number of sensitive receptors within the study area are located along the N4 as well as Castlebaldwin Village. Receptor locations in the remainder of the study area are less sensitive to an increase in pollutant levels as they generally experience rural background levels of pollutants**.**

Table 11-1: The Number of Properties Sensitive To Air Quality Within 50m of Each Route Corridor.

Route Corridor	Number of Properties Sensitive to Air Quality Within 50m	Number of Properties Sensitive to Air Quality Within 50-100m	Number of Properties Sensitive to Air Quality Within 100-200m	PM	NO2	Ranking
PM Weighting	1	0.65	0.55	Weighted Total	Weignted Total	
NO2	1	0.8	0.65	No. of houses(0-200m)	No. of houses(0-200m)	
Option 1	13 (13) (13)	29 (18.85) (23.2)	50 (27.5) (32.5)	59.35	68.7	4
Option 2	12 (12) (12)	28 (18.2) (22.4)	56 (30.8) (36.4)	61.0	70.8	5
Option 3	50 (50) (50)	22 (14.3) (17.6)	48 (26.4) (31.2)	90.7	98.8	6
Option 4	9 (9) (9)	11 (7.15) (8.8)	32 (17.6) (20.8)	33.75	38.6	2
Option 5	9 (9) (9)	15 (9.75) (12)	40 (22.0) (26.0)	40.75	47	3
Option 6	1 (1) (1)	10 (6.5) (8.0)	25 (13.75) (16.25)	20.60	25.25	1
Option 6+	1 (1) (1)	10 (6.5) (8.0)	25 (13.75) (16.25)	20.60	25.25	1

11.2.2 Conclusions

11.2.2.1.1.1 *Air Quality*

The guidance document prepared by the NRA entitled "Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes" outlines that the air quality input for the Route Corridor Selection should consider the relative impacts of each of the route corridor options, on exposure to air pollution at sensitive locations. It also outlines that the assessment should focus on nitrogen dioxide and PM_{10} as these are considered the pollutants of greatest concern with respect to road traffic emissions.

Following a comparison of the proposed route corridors, the preferred route is ranked as best based on a calculation of the Index of Overall Change in Exposure to nitrogen dioxide (NO_2) and particulate matter less than 10 microns (PM_{10}) resulting from each individual route corridor.

12 Noise and Vibration

12.1 Introduction

Up until 2003, best practice in Ireland had involved a design standard of 68 dB(A) $L_{10(18hour)}$ based on U.K. guidance. There were no national standards in Ireland and each situation was considered on an individual basis. However, the NRA published "Guidelines for the treatment of Noise & Vibration in National Road Schemes" in 2006. These guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration during the various phases of road planning.

In order to carry out a preliminary comparison of route options in the N4 Cloonamahan to Castlebaldwin Route Selection Report, the number of receptors within 300m of each route option were identified and put into one of four "bands". These bands were defined by their distance to either side of the centreline of each route option.

Given the time lapse since the preparation of the Route Selection Report as well as the guidance document noted above, this section of the Route Corridor Selection Report Addendum reassesses and evaluates the potential noise and vibration impacts of the proposed route corridors for the N4 Collooney to Castlebaldwin *Proposed Road Development*. This route corridor assessment focuses on the potential noise and vibration impacts along the various route corridors and tries to quantify and qualify these constraints as appropriate to reach a conclusion on the most acceptable route in terms of potential noise impacts.

12.2 Appraisal Methodology

In the Environmental Noise Survey Guidance Document (2003) issued by the EPA the definition of noise is given (guidance only) as follows:

"Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound, that could cause actual physiological harm to a subject exposed to it, or physical damage to any structure exposed to it, is known as noise."

12.3 Description of the Existing Environment

The area in the vicinity of the proposed N4 Collooney to Castlebaldwin *Proposed Road Development* is a predominantly rural area of county Sligo. The noise climate in the area is dominated by the existing traffic flows on the N4.

12.4 Assessment of Route Corridor Options

12.4.1 Assessment of Potential Impact Based on Receptor Counts

This aspect of the route selection process has involved identification of all receptors within 300m of each route option and assigning into one of four "bands". These bands are defined by their distance to either side of the centre line of each route 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. For this purpose, a receptor 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. (**Note:** this process was carried out in the Route Selection Report completed for the scheme in 2002. However, given the time lapse since 2002, the number of properties within 300m of each route may have changed due to new developments, etc.)

The total number of receptors 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 option, termed the Potential Impact Rating (PIR). The PIR values have been used to assess the potential impact of each route option, the larger the PIR the greater the potential impact. The figures outlined in Table 12-1 are based on Band Count Numbers.

It should be noted that it is within approximately 100 m from the noise sensitive receptors to the centreline of the preferred route option where the requirement for noise attenuation design is most likely. Therefore,

when assessing the PIR for each of the route options, the PIR values for the 0-50 and 50-100m bands have been closely assessed.

Table 12-1: Overall Potential Impact Rating.

Route Options	Bands multiplied by relevant rating factor				PIR Total	Rank
	0 to 50m	50 to 100m	100 to 200m	200 to 300m		
Option 1	52	87	100	42	281	4
Option 2	48	84	112	44	288	5
Option 3	200	66	96	40	402	6
Option 4	36	33	64	57	190	2
Option 5	36	45	80	35	196	3
Option 6	4	27	50	57	138	1
Option 6+	4	27	50	57	138	1

12.4.2 Opportunities for Noise Mitigation Measures

Throughout the length of each of the proposed route options, cuttings and embankments will be required to allow for the construction of the proposed route options. The occurrence of cuttings on a route option has the potential to provide natural noise attenuation whereas embankments have the potential to allow road traffic noise to propagate unabated further from the road. Deep cuttings will attenuate the potential noise impact to a greater extent than a shallow cutting. However, the relative expense of constructing a road through an area requiring deep cutting will generally greatly exceed the cost of noise barrier construction adjacent to a road constructed at grade or on an embankment.

In often cases the road surfacing on new road development entails the use of hot rolled surfacing, which is an impervious surface that does not allow for any noise attenuation. It is possible that the proposed road development will be completed using a pervious surface which among other potential benefits in terms of Health & Safety on the proposed road allows for a lower noise impact. The use of this road surfacing can be assumed to allow for a minimum overall noise reduction of 2 – 2.5dB(A) at all sensitive receptor locations. This is a conservative assumption as it is often quoted that such pervious road surfacing can allow for considerably greater noise attenuation of in excess of 3.5 dB(A).

12.4.3 Construction Noise & Vibration Impacts

Each of the route options may have varying lengths of cuttings and embankments which will be required to allow for the construction of the proposed route options. In terms of construction noise and vibration impacts, it is Route Option 3 which will have the greatest potential for noise and vibration impacts at the nearest sensitive properties.

During the construction of any of the ultimately preferred route option, Property Condition Surveys will be carried out at all properties within 250m of proposed areas of blasting. This is now a common inclusion in the Schedule of Commitments on major road development in recent years. Trial Blasts will be also be a requirement outlined in the relevant Contract Documents to ensure that the least vibration impact is experienced at nearby properties in line with the NRA Guidelines Construction Noise and Vibration limit values, as outlined below.

As stated in the NRA 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 12-2 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 options.

Table 12-2: Maximum permissible noise levels at the façade of dwellings during construction.

Days & Times	$L_{Aeq\ (1hr)}$ dB	L_{Amax} dB(A)
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturday 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30hrs	60*	65*

1. 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.

[Reference: National Road Authority - Guidelines for the Treatment of Noise & Vibration in National Road Schemes – 2004]

As stated in the NRA Guidelines, "there is no published Irish guidance relating to vibration during construction activities. Common practice in Ireland has been to use guidance from internationally recognised standards. Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, the magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) in millimetres per second (mm/s). In order to ensure that there is no potential for vibration damage during construction, the NRA recommends that vibration from road construction activities be limited to the values set out in Table 12-3.

Table 12-3: Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration.

Frequency	Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
Allowable Peak Particle Velocity	8 mm/s	12.5 mm/s	20 mm/s

[Reference: National Road Authority - Guidelines for the Treatment of Noise & Vibration in National Road Schemes – 2004]

Noise occurring during the construction phase will be minimised using best practice such as binding noise limits and hours of operation and the implementation of appropriate noise control measures. Vibration nuisance during construction is not expected to be significantly intrusive or capable of giving rise to structural or cosmetic damage.

12.5Conclusions

12.5.1 **Noise and Vibration**

Based on PIR values, as quoted in Table 12-1, the Preferred Route option is rated as having the least impact in terms of noise. It is also notable that this route option has the lowest PIR in the 0 – 50m, 50 to 100m bands and 100m to 200m bands, i.e. the bands in which mitigation is most likely to be required. Therefore, on the basis of the band count numbers and subsequent PIR calculations for the entire length of the route options, the preferred route is ranked as the best route in terms of noise and vibration.

It is also worthy of note that the proposed route options through more rural areas have a lower PIR than the route options which are closer to, or partially online, the existing N4. While a partially online route option will have a higher PIR they are also likely to result in a lower perceived noise impact on the surrounding noise sensitive receptors.

13 Impact on Landscape

13.1 Introduction

MosArt were commissioned by the National Road Design Department of Sligo County Council to assess landscape and visual impacts of six route corridor options in relation to a proposed N4 type 2 dual carriageway road development from Toberbride to Castlebaldwin in County Sligo. For the purposes of this study six route corridors were selected including the currently preferred route. This report focuses solely on predicted considerable visual and landscape impacts and does not comment upon other possible impacts. The overall objective is to present a comparative overview of the likely impacts of the six route corridor options.

13.2 Study Approach

13.2.1 Guidance Documents

The landscape and visual impact assessment is based on desktop studies and fieldwork carried out in accordance with current guidance and best practice including; the Environmental Protection Agency 'Guidelines on the Information to be contained in Environmental Impact Statements' (2002) and the 'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements' (2003); the Landscape Institute (UK) and the Institute of Environmental Management and Assessment (UK) 'Guidelines for Landscape and Visual Impact Assessment' third edition (2013); the National Road Authority (NRA) publications 'Environmental Impact Assessment of National Road Schemes – A Practical Guide' (NRA, 2008), the NRA 'A Guide to Landscape Treatments for National Road Schemes in Ireland' (2006) and the NRA 'Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland' (2011).

13.2.1.1 Distinction between Visual Impact and Landscape Impact

Landscape and visual impacts are two separate but closely related elements. Landscape impacts relate to physical changes to the landscape, visual impacts relate to visual changes resulting from a proposed development.

Landscape impacts relate to the impacts of development upon the physical characteristics or components of the landscape, which together form the character of that landscape, e.g. landform, vegetation and buildings.

- The extent of the impact upon specific landscape elements;
- The extent of the impact on any sensitive or designated landscape, amenity or conservation area;
- Degree of effects on the overall landscape pattern (at the macro scale).

Note: In the case of road developments, MosArt do not consider micro level landscape impacts at the residential property scale. For example, the loss of a front boundary wall or hedge. If such losses affect visual amenity or screening they will be assessed as visual impacts.

Visual impacts in this study are considered in relation to changes in the nature and character of the available views and visual amenity resulting from the Proposed Road Development. Such changes can impact on a range of receptors including road users and local residences located within the visual catchment of the proposed N4 road realignment corridor. The criteria used in the assessment of visual impacts are as follows:

- *Intrusion*, concerning the sense of visual disruption brought about by either the road or resulting traffic;
- *Obstruction*, implying the blocking of a view (whether fully, partially or intermittently) by either the road and associated structures or resulting traffic.

13.2.1.2 Study Approach

An outline of the methodology is used to determine the level of visual and landscape impact is provided below:

- Desk study review of mapping, aerial photography, property band counts and the Sligo County Development Plan;

- Field work by experienced Landscape Architects assessing the likely impact of the routes on-the-ground. This involved assessment from existing public roads and, where necessary, from private dwellings;
- Collation and assessment of data from both the desk study and fieldwork stages for the purposes of making a semi-quantified initial comparison of the different routes;
- Route Addendum Report preparation.

13.2.1.2.1 *Desktop Study*

The desktop study was the first aspect of the Alternative Route Assessment (ARA) to be undertaken by the landscape and visual assessors. One of the key aspects of the desktop study was a review of the Sligo County Development Plan (2011 - 2017) principally in relation to the location of designated areas of 'Normal' and 'Sensitive' Rural Landscapes, scenic views and scenic routes.

In addition the following principle landscape features within the study area were identified:

- Rolling Drumlin Hills;
- Wetland areas/ Lakes;
- River Valleys;
- Forests and Woodlands;
- Hedgerow and roadside vegetation network

The desktop study also utilised aerial photography and 1:50,000 scale Ordinance Survey mapping.

The output from the desktop study phase was a preliminary assessment of likely significant landscape and visual impacts.

13.2.1.2.2 *Site Visits*

Following the desktop study phase, windshield site surveys were undertaken to confirm or refute the initial impact predictions. These surveys took account of such factors as the relative elevation of the site and surrounding receptors as well as the level of terrain and/or vegetation screening.

The site visits afforded the landscape and visual assessors an opportunity to become familiar with the landscape character of the study area generally and more specifically, the areas subject of potential development in relation to the N4 road development project.

It was not considered necessary to enter onto private land in order to undertake the assessments for this stage of the project.

13.2.2 **Assessment of Significance**

Evaluation of each aspect of the Alternative Route Assessment is based on the probability and magnitude of predicted landscape and visual impacts with regard to a variety of sensitive receptors and landscape features, which are used as assessment criteria. For this Alternative Route Assessment study only potentially considerable impacts ranging from Moderate Adverse to Profound Adverse have been considered. They are defined as:

Level of impact	Description
Profound Adverse	An impact which obliterates sensitive characteristics.
Significant Adverse	An impact, which by its character, magnitude, duration or intensity considerably alters a sensitive aspect of the environment.
Moderate Adverse	An impact that would cause a noticeable deterioration of a sensitive aspect of the environment.

The classification used is drawn from the EPA's '*Guidelines on the Information to be contained in Environmental Impact Statements*" and the subsequent "*Advice Notes on Current Practice in the Preparation of Environmental Impact Statements*". The assessment is also in accordance with the Landscape Institute and Institute of Environmental Assessment guidelines (LI and IEMA, 2002).

13.2.3 Quality of Impact

New road developments will typically result in adverse (negative) landscape and visual impacts. However, there may be situations where impacts of the Proposed Road Development could be positive. For the purpose of this Alternative Route Assessment only potentially considerable or higher grade impacts (Moderate to Profound Adverse) have been considered.

13.2.4 Significance of Impact and the Role of Mitigation Measures

The level of impact described in this report is concerned with that which would arise prior to the implementation of mitigation measures. As might be expected, the level of initial impact would be reduced in many instances once mitigation measures have been put in place and once they start to mature (in the case of screening using trees, for example).

13.2.5 Operational Impacts

For the purpose of this comparison report only anticipated critical operational and impacts were considered as construction impacts are expected to equally arise on all route options.

13.2.6 Direct and Indirect Impacts

This report deals principally with direct visual and landscape impacts as likely to be experienced on-the-ground. Indirect impacts are defined by the EPA as those which "are caused by the interaction of effects, or by associated or off-site developments". The NRA provides a fuller interpretation of Indirect Impacts as those "which are not a direct result of the project, possibly produced some distance away from the project or as a result of a complex pathway … Many indirect impacts are related to the construction process with little information available during the preparation of an EIS".

13.3Description of the Existing Environment

The landscape context of the proposed N4 Collooney to Castlebaldwin road development comprises the margins of a drumlin zone with a series of low interlocking hills aligned in a northeast to southwest direction. The area is relatively low lying with extensive wet peatlands and several small lakes found throughout this area. In terms of land use and land cover, the area is used primarily for agriculture. Land quality is marginal and much of the land is being infested by rush. A network of hedgerows and shelterbelts, often comprising conifers, covers much of this landscape extending over hill tops to the peatland fringes.

Whilst the area is relatively sparsely populated there are a number of existing houses located close to the existing N4 alignment as well as strung out along side roads. The age of these houses varies considerably, some having been recently completed while others are old and derelict. With the exception of Collooney, north of the proposed road development there are no larger settlements or towns within the vicinity of the existing or proposed N4 alignments. Riverstown approximately 2km to the east of the N4. Village clusters include Castlebaldwin to the south and Drumfin and Lackagh further north along the existing N4. There appears to be very little industry in the area.

The main transport corridor in the study area is the existing N4, which travels northwest to southeast between Collooney and Castlebaldwin. It connects with the N17 to the south of Collooney at Toberbride. All other roads within the area under assessment are local roads, lanes and tracks. There is no railway line in the study area.

13.3.1 Image

In terms of image, Sligo County is generally appreciated as a high quality landscape, popular both with domestic and foreign tourists alike. The coast, Benbulben and Lough Gill are all popular tourist destinations located to the north of the study area. The existing N4 route between Collooney and Castlebaldwin, however, does not have a particularly strong image in its own right, likely being perceived as a through route rather than a destination.

13.3.2 Landscape Sensitivity

Sensitivity in this study is concerned with the acceptability of change to the landscape in respect of various attributes and features to which values might be attached for both the landscape itself and the people who view and/or use it. Values might be due, for instance, to the attractiveness, use and/or importance of these

attributes and features in the public mind. Sensitivity plays a major part in the later determination of the significance of impact and is assessed in the context of the wider region but also at specific locations, taking into account views of the surrounding landscape. The evaluation is based on experience, observation and professional judgement.

A five-point scale is typically used by landscape consultants to indicate the degree of landscape sensitivity from very *low, low, medium, high and very high*. This process is similar to that proposed by the *Department of the Environment and Local Government in their Landscape and Landscape Assessment Guidelines issued for consultation (2000*). This exercise is important as an *indication of the relative sensitivity* of a location.

The landscape sensitivity of the study area is generally considered to be 'low'. This sensitivity judgement in relation to the Proposed Road Development is concurrent with the current Sligo County Development Plan Landscape Characterisation outlined in section 1.5.1.

13.4Visual Amenity and Sensitivity

Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric basis. 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.

In this 'Normal Rural Landscape' setting the visual resource between Collooney and Castlebaldwin does not provide any exceptional or highly scenic views or offers a strong sense of remoteness or tranquillity. It does, however, meet some of the visual sensitivity criteria particularly in relation to its high intensity of use and the provision elevated panoramic views over the wider landscape from some sections of the existing alignment. It is also assumed that a considerable proportion of tourists and recreationalists are likely to travel on this route towards Sligo to experience views of the landscape and are highly attuned to it. In relation to residential receptors whilst this a sparsely populated area dwellings are often sited in elevated location or on lake edges and are oriented to take advantage of views of the surrounding landscape.

On this basis, taking into account the 'Normal Rural Landscape' setting the visual sensitivity of road users in this study area is deemed to be in the order of 'Low to Medium' and 'High' for residential dwellings.

13.5Planning Context

13.5.1 **Sligo County Development Plan (2011 – 2017)**

13.5.1.1 Visual Policy and Designations

The Sligo County Development Plan (2011 – 2017) identifies 'Visually Vulnerable Areas' and 'Scenic Routes' throughout the County. *Visually Vulnerable Areas are described as: '...distinctive and conspicuous natural features of significant natural beauty or interest, which have extremely low capacity to absorb new development.'* Only one designated 'Visually Vulnerable Area' is located within the study area. It comprises the Toberscanavan Loughs and their surrounds to the west of the existing N4 at Ardcurley and is of relatively small extent. This area is not affected by any of the proposed route alignment options which commence further south at Doorly Hill.

Designated Scenic Routes are confined to the extreme south of the proposed road development at Castlebaldwin and are listed below:

- N4 Castlebaldwin to Ballinafad (views of Bricklieve Mountains, Lough Arrow and Curlew Mountains);
- Lakeshore drive around Lough Arrow from Castlebaldwin to Roscommon County boundary (L-1404, L-1403 & L-1905, Views of Lough Arrow and Bricklieve Mountains);
- From Castlebaldwin southwards to junction with R295, southwest to Templevanny Lough (L-1404 & L-5801, Views of Bricklieve Mountains, Kesh Corran and Lough Arrow).

Filtered views of the Bricklieve Mountains are displayed from several locations east of Castlebaldwin. In turn elevated panoramic views are displayed from this mountain range and Carrowkeel, which take in Castlebaldwin and Drumderry Hill.

13.5.1.2 Landscape Policy and Designations

The current Sligo County development plan distinguishes between 'Normal Rural Landscapes' and 'Sensitive Rural Landscapes' throughout County Sligo.

Normal rural landscapes are defined as

'...areas with natural enclosing features (e.g. topography, vegetation), which have the capacity to absorb a wide range of new development forms – these are the main farming areas of the County.'

Sensitive Rural Landscapes are described as:

'...areas that tend to be open in character, with intrinsic scenic quality and a low capacity to absorb new development...'

The landscape context throughout the study area is principally classified as 'Normal Rural Landscape' with the exception of one confined 'Sensitive Rural Landscape' area at Corran Lough in the vicinity of the route options 1-3.

13.6Description of Route Corridor Options

Option 1, is the longest route option with c. 12.32km in length. It deviates considerably to the south west of the existing N4 alignments. It passes through the townland's of Doorly, Lackagh, Knocknagroagh, Drumfin, Cloonlurg, Knockmoynagh, Kilmorgan, Kingsbrook, Cams, Ardlee, Coolskeagh, Lecarrow, Cleavry, Cloghoge Upper and Cloghoge Lower, bypassing the village of Castlebaldwin to the South West and returning to the N4 at Carrowkeel (ED Templevanny).

Option 2, with a total length of c. 12.125km also traverses south west of the existing N4, passing through the townlands of Knocknagroagh, Drumfin, Cloonlurg, Carrowkeel, Carrownagark, Kingsbrook, Aghalenane, Cams, Ardloy, Coolskeagh, Lecarrow and Cleavry, Cloghoge Upper and Cloghoge Lower, bypassing the village of Castlebaldwin to the South West and returning to the N4 at Carrowkeel (ED Templevanny). This alignment is an alternative to Option 1. It follows Option 1 between Doorly and Knocknagroagh and between Coolskeagh and Carrowkeel but runs considerably closer to the existing N4 between Drumfin and Coolskeagh.

Option 3 with a total length of c. 11.86km is substantially an online option but bypasses the small village of Lackagh to the East and rejoins the existing road at Drumfin further north.

Option 4 measuring c. 11.87km in length, traverses south east of the existing N4 through the townland's of Doorly, Lackagh, Drumfin, Murillyroe, Behy, Carrowkeel, Knockadoo, Carrownagark, Tawnagh, Springfield, Cloonymeenaghan, Sheerevagh and Drumderry. It bypasses the village of Castlebaldwin to the North East before rejoining the existing N4 at Carrowkeel (ED Templevanny).

Option 5 measuring c. 11.91km also traverses south east of the existing N4. It is identical to Option 4 between the townland's of Doorly and Lackagh but deviates further east at Drumfin through the townland's of Murillyroe, Behy, Carrowkeel, Ogham, Tawnagh, Whitehill, Cloonymeenaghan, Sheerevagh and Drumderry where it rejoins with Option 4 to the North East of Castlebaldwin.

Option 6+ is the preferred route option. It departs to the western side of the existing N4 route at Doorly and extends southwards through Knocknagroagh, Drumfin, Cloonlurg, Carrowkeel, Carrownagark, Kingsbrook and Aghalenane. At this point the preferred route travels eastwards from Aghalenane, through Ardloy and Springfield, and then veers southwards again, through Tawnagh, Springfield, Cloonymeenaghan, Sheerevagh, Cloongad, Drumderry, Castlebaldwin and Cloghoge Upper before returning to the existing N4 route at Cloghoge Lower. Route option 6+ is largely a combination of route options 2 and 4. It substantially follows route option 2 between the townlands of Knocknagroagh and Ardloy and option 4 between Springfield and Carrowkeel.

13.7Visual Impact Assessment

Visual impact assessment was examined using both a desk study overview as well as detailed examination in-the-field from nearby occupied. Details of the assessments are provided below.

13.7.1 Visual Impact on occupied properties

The focus of the assessment was to estimate the number of properties which are anticipated to experience considerable visual impacts. Considerable Visual impacts are defined as impacts ranging from Moderate Adverse to Profound Adverse as a result of the proposed road development.

Table 13-1: Alternative Routes Assessment: Estimated number of properties with considerable adverse visual impacts from occupied properties

Visual Receptors	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6+
Doorly	5	5	3	0	0	1
Lisconny/ Coolbrook	0	0	0	10	10	0
Lackagh Village	5	5	0	0	0	4
Drumfin	1	2	6	0	0	2
Behy Bridge	0	0	12	6	6	0
Carrowkeel/Knockaddo	0	0	0	10	10	0
Cloonlurg/ Kilmorgan	10	0	0	0	0	0
Carrownagark	0	3	9	3	0	2
Tawnagh/ Kingsbrook	8	0	7	7	12	1
Aghalenane	1	6	2	9	0	6
Cloonymeenaghan	0	0	6	2	0	2
Cloongad/ Cleavry	8	7	8	0	0	0
Sheerevagh	0	0	0	8	9	8
Castlebaldwin	13	13	13	4	4	4
TOTAL	51	41	66	59	51	40

The potential impacts of the proposed alternative route options on designated Scenic Routes, Views of road users and from Heritage and Amenity Features are listed on Table 13-2 below. The assessment distinguishes between potential higher ranging impacts (Moderate Adverse or higher) or lower ranging impacts (Slight Adverse or lower) or no impacts.

Table 13-2: Alternative Routes Assessment: Potential to impact considerably on views to road users, heritage sites and designated scenic routes

Visual Receptors	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Designated scenic routes at and south of Castlebaldwin	low	low	none	low	low	low
Castle Baldwin House heritage site	none	none	low	high	high	low
Carrowkeel heritage site	high	high	low	low	low	low
N4 Road Users	high	high	low	high	high	high
Cumulative Visual Impacts	low	low	none	low	low	low

In relation to visual impacts to occupied properties Option 3 is anticipated to affect the highest number of properties in relation to considerable adverse visual impacts and is the least preferred route option in this category. The route alignment with the least number of occupied properties likely to experience considerable impacts is Option 6+ followed closely by Option 2.

In relation to visual impacts on road users, heritage sites and designated routes online Option 3 is easily the preferred option. It avoids largely the disturbance of adjacent landscape features or changes to the wider

setting of the heritage sites. All other offline options are expected to result in considerable visual impacts to road users. The second preferred option is Option 6+, due to its lower ranging visual impacts to the heritage sites. Considerable visual impacts are expected at Option 1 & Option 2 on the Carrowkeel heritage site to their close proximity to the foothills of the Bricklieve Mountains. Option 4 and Option 5 would enclose the Castle Baldwin heritage site at close proximity in conjunction with the existing N4 alignment and are also expected to result in higher grade visual impacts at this location.

Cumulative Visual impacts are not considered to be critical for any of the proposed offline route options due to the considerable spatial and visual separation between the existing and proposed N4 alignments in all cases. However some of the proposed routes are more distant or better screened in relation to topography and land cover then others. Online option 3 only deviates in one location considerably from the existing alignment and is the preferred option in relation to cumulative visual impacts. Offline options 5 and 1 are located furthest away from the existing N4 alignment with the least anticipated cumulative visual impacts and are therefore jointly the second preferred options in this category. Option 4 is the least preferred option. It is spatially less separated to the existing N4 particularly between Drumfin and Springfield with the highest anticipated visual impact in this area. Option 6+ is considerably separated from the existing N4 but is the only option which crosses the existing alignment. For this reason it is the second least preferred option in this category.

13.8Landscape Impacts

The landscape impact of the different options can be affected by many different criteria. On examining the N4 Toberbride to Castlebaldwin scheme, as well as reflecting over several recent landscape impact assessment studies of similar projects, the following criteria are chosen to provide the basis for assessment:

Route Length – the longer the route, the higher generally will be the level of impact due to the imposition of a road structure and resulting traffic through an area that is currently 'undeveloped' (in the case of this project, mostly comprising farmland).

Number of road and river crossings – at road and river crossings the proposed route is likely to run at elevated levels requiring additional structures and embankments.

Amount of cut and fill and maximum levels of cut and fill – roads that require extensive lengths of cut and fill generally resulting in 'scarring' the landscape more so than routes that travel at grade over the majority of their length.

Impact on macro landscape features – Features of distinction add considerably towards local landscape character and quality and adverse impacts thereon should be avoided.

Table 13-3 below summarizes key aspects relation to the level of basic construction of each route option.

Table 13-3: Physical Characteristics of Route Corridor Options

Element of construction	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 6+
Length of main Alignment (km)	12.32	12.125	11.86	11.87	11.91	12.2	12.2
No. of Road Crossings	9	10	18	8	6	7	7
No. of River / Stream Crossings	12	6	7	6	5	5	5
Number of Cut	9	7	11	8	8	10	10
Number of Fill	9	8	15	10	9	13	13
Maximum level of Cut	9.6	8.5	5.8	9.8	9.6	21.4	21.4
Maximum level of Fill	17.9	19.5	10.6	16.1	12.6	12.1	12.1

Option 1 is a medium scoring option. It is marginally longer than all other options with the highest number of river crossings, medium number of road crossing, medium number of cut and fill areas and a medium value for maximum level of cut. This option has, however the second highest maximum level of fill.

Option 2 is also a medium range option with the third longest road length, second highest number of road crossings, third highest number of river crossings and second lowest maximum level of cut. It has the lowest number of cut and fill areas but the highest maximum level of fill.

Online Option 3 is shortest in length by a marginal distance but requires the highest number of road crossings, second highest number of river crossings and the highest number of cut and fill areas (26). It also has the second highest maximum level of fill. For these reasons it is the least preferred route option in this category.

Option 4 is the second shortest option with a medium number of road and river crossings, cut and fill areas and medium values for maximum levels of cut and fill.

Option 5 is the slightly longer than the shortest options but has the least number of road and river crossings and cut and fill areas. It has medium values for maximum levels of cut and fill. Option 5 is the overall preferred option in this category.

Options 6+ requires the least number of road and river crossings but has the second highest number of cut and fill areas. It also has the highest maximum levels but the second lowest maximum level of fill.

Table 13-4: Impact to Landscape Features

Landscape Features	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Doorly Hill	none	none	none	none	none	high
Lackagh Fen	high	high	none	none	none	low
Unshin River Valley	none	none	high	high	high	none
Lough Corran wetland basin – Sensitive Rural Landsape	high	low	none	none	none	low
Drumfin Hill	none	high	none	none	none	high
Murillyroe wetland basin	none	none	none	high	high	none
Clooneen wetland	high	none	none	none	none	none
Clooneen forest	high	none	none	none	none	none
Cloonlurgh forest	none	high	none	none	none	high
Behy and Carrowkeel Hills	none	none	none	high	high	none
Drumfin River Basin	low	high	none	none	none	high
Knockadoo Hill	none	none	none	high	high	none
Carrownagark Hill	none	high	none	none	none	high
Kingsbrook Hill	none	high	none	none	none	high
Aghalenane Lough wetland basin	none	high	low	none	none	high
Tawnagh Hill/ Springfield Hill	none	none	low	high	none	high
Cloonymeenaghan Hill	none	none	low	high	none	high
Loughmeenaghan	none	none	high	none	none	none
Wetland basin north of Sheerevagh	none	none	none	high	high	high
Drumderry Hill	none	none	low	high	high	high
Forest plantation at Lecarrow	high	high	none	none	none	none
Local Hill and wetland at Cleavry	high	High	none	none	none	none
Existing hedgerow and roadside vegetation network	low	low	high	low	low	low

Landscape Features	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Cumulative Landscape Impacts	low	low	none	low	low	low

Table 13-4 above lists the most distinctive landscape features within the Study Area. These are typical landscape elements of this drumlin and marginal farmland zone. Most of these landscape features are located within areas of 'Normal Rural Landscapes' as defined by the current Sligo County Development Plan and are considered to be of local importance. Only the wetland areas surrounding Lough Corran, are considered to be 'Sensitive Rural Landscape'.

In relation to anticipated impacts to landscape features the preferred option is online Option 3, which avoids largely any higher grade impacts to existing landscape features. This option would, however, required largely the removal most of the existing roadside vegetation and is the route option with the highest predicted losses of the existing hedgerow network in the study area. Option 5 is the preferred offline option in this category with the least number of macro landscape features impacted on. It also avoids the only 'Sensitive Rural Landscape Area' in the study area. The least preferred option in relation to landscape impacts to macro landscape features is Option 6+ followed by Option 2. These route alignments would affect the highest number of macro landscape features including the 'Sensitive Rural Landscape' at Lough Corran. Option 1 affects a slightly lower number of landscape features but would have a higher impact on the 'Sensitive Rural Landscape' at Lough Corran.

In relation to cumulative landscape impacts the proposed road development will introduce a second major transport corridor in addition to the existing N4 into this rural working landscape. For all five offline routes cumulative landscape effects are, however, not considered to be critical in this case, due to the considerable spatial separation between all alignment options in relation to the existing N4 in most cases and the diverse and undulating marginal farmland setting. Preferences for the route option from a landscape impact perspective are similar to the cumulative visual effects section with an overall preference to online option 3, which has the least number of route deviations followed by the alignments with the largest separation distances option 1 and 5. Option 4, which runs between Behy and Springfield in relatively close proximity to the existing N4 will result in a considerable combined massing of both alignments and is the least preferred option in relation to landscape impacts. Option 6+ is the second least preferred option due to the proposed crossing and tie in area at Springfield.

13.9Conclusion

This section will present a relative ranking of each of the six route corridor options presented by the National Road Design Department of Sligo County Council for assessment. This presents a considerable challenge to the Landscape Assessors as one route option might, for example, create a high visual impact but a low landscape impact. Some of the assessment criteria may also be given more weighting than others.

The results from the preceding tables are clustered below in Table 13-5 under the headings of Visual Impact and Landscape Impact Assessment.

Table 13-5: Summary Impact – Preference Table

Assessment Criteria	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6+
Visual Impact Assessment						
Visual Impact occupied properties	Joint 2nd	Joint 1st	5th	4th	Joint 2nd	Joint 1st
Visual Impact N4 Road users	Joint 2nd	Joint 2nd	1st	Joint 2nd	Joint 2nd	Joint 2nd
Visual Impact scenic routes and heritage sites	Joint 3rd	Joint 3rd	1st	Joint 3rd	Joint 3rd	2nd
Cumulative Visual Impact	Joint 2nd	3rd	1st	5th	Joint 2nd	4th
Overall Ranking	Joint 1st	Joint 2nd	3rd	4th	Joint 1st	Joint 2nd

Assessment Criteria	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6+
Landscape Impact Assessment						
Route length	4th	2nd	Joint 1st	Joint 1st	Joint 1st	3rd
Road crossings	4th	5th	6th	3rd	1st	2nd
River crossings	4th	2nd	3rd	2nd	Joint 1st	Joint 1st
Cut and Fill number	3rd	1st	5th	3rd	2nd	4th
Macro landscape features	3rd	5th	1st	4th	2nd	6th
Hedgerow and roadside vegetation network	Joint 1st	Joint 1st	2nd	Joint 1st	Joint 1st	Joint 1st
Cumulative Landscape Impact	Joint 2nd	3rd	1st	5th	Joint 2nd	4th
Overall Ranking	2nd	Joint 4th	5th	3rd	1st	Joint 4th

Of the assessment categories examined above, offline route corridor Option 5 to the east of the existing N4 is the favoured or second favoured option in 11 out of 12 categories and is in relation to visual and landscape impacts the overall optimal option. It is one of the shortest route options with the least or second least number of road and river crossings, second least number of cut and fill areas and is the option with the least anticipated impacts in relation to the macro landscape and second least cumulative landscape and visual impacts. Its anticipated visual impact is rated slightly higher in the categories of occupied properties and in relation to the Castlebaldwin heritage (Fortified House) site.

The remaining online and offline route options will result in considerable visual or landscape impacts in some of the assessed landscape and visual impact categories, but are in all cases also the favoured or second favoured options in other categories and therefore differences between the different route corridor options in the overall rankings tends to be slight.

Offline route corridor Option 1 to the west of the existing N4 is the second most favourable route in terms of landscape and visual impacts. It is the joint favoured overall option in relation to visual impacts and the second favoured option in relation to overall landscape impacts. It is slightly longer than all other options and has the highest number of river crossings but is the second favoured route in relation to cumulative impacts and visual impacts to occupied properties. It is a medium scoring option in other categories.

Offline route corridor Option 2 to the west of the existing N4 is a medium scoring route option in relation to landscape and visual impacts. Option 2 is slightly longer than all other options and has the highest number of road crossings but has lower anticipated impacts in relation to cumulative landscape and visual impacts and visual impacts to occupied properties. Option 2 is together with option 6+ the third favoured route option.

Online Option 3 is the least favoured option in relation to visual impacts to occupied properties, number of road crossings, number of cut and fill areas and impacts to the hedgerow and roadside vegetation network. This is considered to outweigh higher preference scorings in other categories and this option is judged to be the least preferred option overall.

Offline Option 4 to the east of the existing N4 is the least favoured option in relation to cumulative landscape and visual impacts and the second least favoured option in relation to visual impacts to occupied properties and landscape impacts to macro landscape features and is overall the second least favoured option.

Option 6 and Option 6+ alternating to the east and west of the existing N4 is the favoured route in relation to visual impacts to occupied properties and scenic routes and heritage sites compared to the other offline options and requires the least number of river crossing and second least number of road crossings. Its overall route length and number of cut and fill areas is, however, higher than some of the comparator route options. It is also considered to result in higher cumulative impacts and is the least favoured route in relation to impacts to landscape features. In the overall assessment it is a medium scoring option and with route option 2 is the third favoured option.

Table 13-6: Overall Landscape and Visual Route Options Ranking

Route Option	Overall Rank
Option 1	2
Option 2	3
Option 3	5
Option 4	4
Option 5	1
Option 6	3
Option 6+	3

14 Soils and Geology

14.1 Overview

Although the RSR has quantified a ranking system for impacts on soils and geology as per Table 3.1 of the Route Selection Report. It was deemed prudent considering the vast collection of information which is now available particularly from sources such as Teagasc and the GSI to undertake a review in this report.

14.2 Soils and Subsoil's

14.2.1 Soil Geology

The regional soil geology for the study area is mapped by Teagasc as predominantly soil association no. 28, with interspersed pockets of soil associations no.s 7, 43 and 44 (Ref. 10). The following Table summarises the principal and associated soil types for each association, the parent material, the broad physiographic division, the topography and the land use potential.

Table 14-1: Regional Soil Types

No.	Principal Soil Type	Associated Soil Types	Parent Material	Physiographic Division	Topography	Usage
28	Grey brown podzolics (60%)	Gleys (20%, Inter-drumlin peats & peaty gleys (20%)	Mostly limestone glacial till	Drumlin with drier mineral & organic soils	Gently rolling with subdued drumlins	Limited use range, tillage or grassland
7	Rendzinas (15%) & outcropping bedrock (75%)	Lithosols (5%) & shallow brown earths (5%)	Limestone	Hill	Rolling to steep	Limited use range, sheep & dry stock grazing
43	Gleys (60%)	Brown earths (20%) & peaty gleys (20%)	Alluvium	Flat to undulating lowland	Flat	Production of wide range of tillage crops & pasture production
44	Basin peat	-	-	Flat to undulating lowland	Flat	Very limited usage

According to the soil geology mapping compiled by Teagasc, the study area is underlain predominantly by acid brown earths and brown podzolics (AminDW) derived chiefly from non-calcareous sandstone/ shale till parent material, interspersed with pockets of surface and groundwater gleys (AminPD), peaty gleys (AminPDPT), basin peats and blanket peats (Cut), renzinas and lithosols (BminSW) and alluvium type soils (A). The following Table summarises the soil types, drainage characteristics and parent material.

Table 14-2: Soil Types

Code	Soil type	Drainage characteristics	Parent material
AminDW	Acid brown earths & brown podzolics	Deep well-drained mineral soil	Non calcareous sandstone/ shale till
AminPD	Surface & groundwater gleys	Deep poorly-drained mineral soil	Non calcareous sandstone/ shale till
AminPDPT	Peaty gleys	Peaty gleys	Non calcareous sandstone/ shale till
Cut	Basin peats & blanket peats	Cutaway/ cutover peat	Cutaway/ cutover peat
BminSW	Renzinas & lithosols	Shallow well-drained mineral soil	Calcareous - limestone till
AlluvMin	Alluvium	Variable	Variable

14.2.2 Subsoil Geology

According to the subsoil geology mapping compiled by Teagasc, the study area is underlain predominantly by shale and sandstone till, derived chiefly from till derived chiefly from Namurian rocks, interspersed with pockets of alluvium, karstified bedrock at the surface and cutover PEAT..

Till is a non-lithified, non-sorted or poorly sorted sediment, which contains a wide range of particle sizes deposited by or from glacier ice and are also referred to as 'boulder clays'. Alluvium is a post-glacial deposit, usually bedded, may consist of GRAVEL, SAND, SILT or CLAY in a variety of mixes and usually consists of a fairly high percentage of organic carbon (10%-30%). Alluvium is mapped only on modern day river floodplains. PEAT is also a post-glacial deposit, consisting mostly of vegetation which has only partially decomposed. This vegetation fills and compacts in marshes, ponds and other lakes carved out and left by Quaternary ice sheets. Thus, in Ireland, PEAT usually overlies badly drained glacio-lacustrine SILTS and CLAYS. Cutover PEAT is mapped where peat thickness is of 1 metre or more.

14.2.3 Comparison of Ground Conditions

In order to compare the different route options, an assessment has been undertaken on the mapping compiled by Teagasc. This assessment focussed on the lines of each of the specific corridors and the different soil types which they each encountered.

In terms of ranking it is considered that those that cross the least amount of soft ground areas are generally more preferable. In this regard the % of each route which traverses the soil/subsoil types outlined below has dictated the specific ranking which is outlined in Table 14-3 and Table 14-4.

- Soil geology; as
  - Basin & Blanket Peats; and
  - Alluvium
- Subsoil geology; as
  - Cutover Peat; and
  - Alluvium

Table 14-3: Overall Soils Ranking

Option No.	Soft material encountered	Overall % of Route	Ranking
Option 1	4.9km	40%	7
Option 2	4.2km	35%	6
Option 3	2.82km	24%	2
Option 4	2.7km	23%	1
Option 5	3.2km	27%	3
Option 6	4.23km	35%	5
Option 6+	4.1km	34%	4

Table 14-4: Overall Subsoils Ranking

Option No.	Soft material encountered	Overall % of Route	Ranking
Option 1	5.4km	44%	7
Option 2	4.3km	35%	5
Option 3	2.9km	24.5%	3
Option 4	2.3km	20%	1
Option 5	2.9km	24.3%	2
Option 6	4.5km	38%	6
Option 6+	4.1km	34%	4

14.3Bedrock

14.3.1 Bedrock Geology

According to the bedrock mapping compiled by the Geological Survey of Ireland (GSI), the study area is underlain by wholly Carboniferous bedrock. Each of the routes generally pass through Bricklieve Limestone Formation (lower) (BKL), Bricklieve Limestone Formation (upper) (BKU), and the Lisgorman Shale Formation (LG), in addition Route Option 1 passes locally through an area of Leitrim Group.

The significance of the bedrock geology is that it permits the formation of distinct karst features and solutionally-enlarged subsurface drainage in areas underlain by the Bricklieve Limestone and potentially along the lithological boundary with the lesser permeable Lisgorman Shale. The sensitivity of the bedrock geology lies in the fact that karstified bedrock can be susceptible to subsidence and that the excavation of road cuts has the potential to impact on subsurface karst features.

Based on the foregoing and the mapping available, it is considered that there is no discernible difference between the different route options in terms of impacts on Bedrock Geology.

14.3.2 Structural Geology

The Bricklieve Limestone and Lisgorman Shale formations form part of the Ballymote Syncline, which is bound to the northwest by the Ox Mountains Inlier and to the southeast by the Curlew Mountains Inlier. Within this larger structure, there are two smaller synclines, separated by the north-east to south-west trending Belhavel Fault.

This fault separates the Bricklieve Limestone (upper) from the Lisgorman Shale and the Bricklieve Limestone (lower). Each of the route options traverse the fault.

The significance of the structural geology is that the lithological boundaries between the Bricklieve Limestone and the lesser permeable Lisgorman Shale where each of the route options traverse the mapped Belhavel Fault, may result in the localised formation of karst features.

Considering the regional nature of the structural geology it is considered that there is no discernible difference between the different route options in terms of impacts on Bedrock Geology.

14.3.3 Karstification

Karstification is the process whereby limestone is slowly dissolved away by percolation waters and results in landscapes characterised by largely underground drainage. The Bricklieve Limestone Formation is extensively karstified with numerous karst features evident at the surface. The national karst feature database, compiled by the GSI generally indicates that the area in the vicinity of each of the route options is generally populated with karst features. The majority of these features lie in a region just over half way along each of the route options and in the area mapped as being underlain by the Bricklieve Limestone (upper). The clean, thick-bedded nature of the formation, along with the presence of abundant chert renders them very susceptible to karstification. The presence of chert in the limestone acts to concentrate flow into pathways around the highly resistant chert material, thereby enhancing the process of karstification. The remainder of these features are mapped as being underlain by the Lisgorman Shale and the Bricklieve Limestone (lower).

Considering the generally similar extents of kart features along each of the route options it is considered that there is no discernible difference between the different route options in terms of impacts on Bedrock Geology.

15 Hydrology, Flooding and Hydrogeology

15.1 Hydrology

The original Route Selection Report did not specifically consider impacts of a Hydrological nature. The addendum report in the ecological section considers impacts on the aquatic environment which for the purposes of demonstrating comparisons is deemed adequate for Hydrology.

15.2 Flooding

According to the flood mapping compiled by the OPW, there are several locations within the study area prone to recurring flooding. From an examination of the mapping none of the Route Options cross in the vicinity of these locations.

Based on a combination of OPW Preliminary Flood Risk Assessment mapping, NRA National Network Flood Risk Mapping and detailed FRA mapping carried out during the design process, the following is an overview of identified localised flood plains in the vicinity of the Route Options. These generally consist of flood plains associated with the following rivers and streams:

- Unshin River;
- Turnalaydan Stream;
- Drumfin River;
- Springfield Stream;
- Lissycoyne Stream.

Table 15-1: Unshin River Flood Plain

Route Option	Proximity	Notes	Rank
1	+50m	No perceived impact	1
2	+50m	No perceived impact	1
3	+50m	No perceived impact	1
4	0-50m	Route appears to be within or very close to the flood plain at two locations in Lackagh and Drumfin over distances of c. 300m and 400m respectively.	5[14]
5	0-50m	Route appears to be within or very close to the flood plain at two locations in Lackagh and Drumfin over distances of c. 300m and 400m respectively.	5[15]
6	+50m	No perceived impact	1
6+	+50m	No perceived impact	1

Table 15-2: Turnalaydan Stream Flood Plain

Route Option	Proximity	Notes	Rank
1	0	Route passes within flood plain over c. 300-350m	4
2	0	Route passes within flood plain over c. 300-350m	4

[14] Ranking of 5 used because of the sensitivity of the receiving watercourse (i.e. cSAC)

[15] Ranking of 5 used because of the sensitivity of the receiving watercourse (i.e. cSAC)

Route Option	Proximity	Notes	Rank
3	0	Route passes within flood plain over c. 30-70m	2
4	0	Route passes within flood plain over c. 30	2
5	0	Route passes within flood plain over c. 30	2
6	0	Route passes within flood plain over c. 300-350m	4
6+	0	Route passes within flood plain over c. 300-350m	4

Table 15-3: Drumfin River Flood Plain

Route Option	Proximity	Notes	Rank
1	0-50m	Route passes within flood plain over c. 0.9-1km	4
2	0	Route passes within flood plain over c. 600-650m	3
3	0	Route passes within flood plain over c. 30-70m	1
4	0-50m	Route passes within flood plain over c. 0.9-1km	5[16]
5	0	Route passes within flood plain over c. 300-400m	5[17]
6	0	Route passes within flood plain over c. 600m	3
6+	0	Route passes within flood plain over c. 600m	3

Table 15-4: Springfield Stream Flood Plain

Route Option	Proximity	Notes	Rank
1	50m+	No perceived impact	1
2	50m+	No perceived impact	1
3	0-50m	Route passes within flood plain over c. 50-100m	2
4	0-50m	Route passes within flood plain over c. 50-100m	2
5	0	Route passes within flood plain over c. 200-300m	3
6	0	Route passes within flood plain over c. 200-300m	3
6+	0	Route passes within flood plain over c. 200-300m	3

[16] Higher ranking applied because of sensitivities of receiving watercourse (i.e. cSAC)

[17] Higher ranking applied because of sensitivities of receiving watercourse (i.e. cSAC)

Table 15-5: Lissycoyne Stream Flood Plain

Route Option	Proximity	Notes	Rank
1	50m+	No perceived impact	1
2	50m+	No perceived impact	1
3	50m+	No perceived impact	1
4	0	Route passes within flood plain over c. 50-150m	3
5	0	Route passes within flood plain over c. 50-150m	3
6	0	Route passes within flood plain over c. 50-150m	3
6+	0	Route passes within flood plain over c. 50-150m	3

Based on the foregoing assessment, Table 15-6 outlines how each route compares in terms of Flood Risk. This indicates that the online option 3 would be the most favourable followed by options 2 and 1. The preferred route and the Proposed Road Development are medium preferences followed by options 4 and 5.

Table 15-6: Overall Ranking

Route Option	Identified Flood Plain					OVERALL
	Unshin River	Turnalaydan Stream	Drumfin River	Springfield Stream	Lissycoyne Stream	
1	1	4	4	1	1	3
2	1	4	3	1	1	2
3	1	2	1	2	1	1
4	5	2	5	2	3	5
5	5	2	5	3	3	6
6	1	4	3	3	3	4
6+	1	4	3	3	3	4

15.3Hydrogeology

In terms of Hydrogeology, the aforementioned ecological section also deals with impacts on Ground Water Dependent Ecosystems. In a broader sense the aquifer and karst sensitivities for each of the route options are generally similar, that is with the exception of Option 3 which would most likely require less excavation and thus potentially fewer impacts on the Hydrogeological environment.

16 Socio Economic/ Community

This section provides an overview of the potential impacts of the proposed *Proposed Road Development* on the Human environment. In particular, the route corridors identified in the Route Selection Report are examined.

Table 16-1: Route Options Considered.

Option No.	Location in context of existing N4
Option 1	Aligned South West of the existing N4 Road
Option 2	Aligned South West of the existing N4 Road
Option 3	Largely follows the existing N4 Road with some modifications to align with NRA DMRB standards
Option 4	Aligned North East of the existing N4 Road
Option 5	Aligned North East of the existing N4 Road
Option 6	This option is a combination of both Option 2 and Option 4 above
Option 6+	This option is a combination of both Option 2 and Option 4 above

16.1 Regional Context

The N4 is one of the State's key national primary routes linking the Midlands and the East of the country with the North-west, including County Sligo, North County Leitrim and County Donegal. The road is described in the National Spatial Strategy as a National Transport Corridor connecting the Gateway town of Sligo and as being fundamental to the development potential of the Western Region.

16.2 Economic Activity and Tourism

As outlined in the Route Selection Report (2002), the route options are located to the south east of County Sligo. Much of this region has been suffering from the visible signs of rural decline over many years. Castlebaldwin is the only concentrated community settlement along the *Proposed Road Development* section. The village has grown organically around a crossroads between the existing N4 and the L1404-0 to Ballymote, More recent developments have taken place to the west of the village, largely in the form of suburban type housing estates. Businesses in the village include a furniture showroom/factory, public house/restaurant, restaurant, repair and service garage, takeaway, a local convenience shop and a filling station/convenience shop,. The post office, car dealership and a panel beating facility have closed their operations since the Route Selection Report was completed in 2002. There is also a primary in the village. An additional classroom has been added to this school in recent years. Castlebaldwin is the starting point for some of the ten Lough Arrow Walks which are located around the scenic areas of Lough Arrow and Lough Key. The Miner's Way and Historical Trail (118km in length) which starts and finishes in Arigna passes through the village of Castlebaldwin.

As outlined in the RSR (2002) there is an Art Gallery with framing service located beside the existing N4 to the north of Castlebaldwin in the townland of Tawnagh. There is also a car servicing and repair facility located on the L-1502-32 adjacent to the N4 at Drumfin. There is a B&B located along the existing N4 at Drumfin and a boarding kennel and dog training school in Cloonteen. There is also a farm, plant, parts and machinery sales workshop in Lackagh. A public house at Lackagh has closed since the preparation of the RSR.

Since the publishing of the RSR, a Field Study Centre which was under construction at that time is complete and has become a regional office for the NPWS as well as providing other local services.

16.3 Assessment of Route Corridor Options

The Route Option Assessment considers each Route Option in the context of the current socio-economic context for the Study Area. Impacts which are considered in the socio-economic study include:

- Demography;
- Residential and Business Properties;
- The Business Community;
- Tourism and Recreation;
- Community Facilities and Community Impacts; and
- Planning Policy and Planning Permissions.

16.4Impact on Demography

Both the existing road and the proposed new alignment pass through a lightly populated rural area. No large towns are directly affected, although Ballymote, Collooney and Ballysadare fall just outside the study area and Sligo town is only twelve kilometres to the north. The largest community in the road corridor is Castlebaldwin, although the core of this settlement is represented by only around 20 properties. Riverstown is a larger community situated three kilometres east of the existing road. Along the route there are small concentrations of houses at Drumfin and Lackagh, although there is much scattered housing along the length of the route and in the surrounding countryside. In recent years there has been considerable new development in and around Riverstown and in surrounding townlands such as Coolbock. By comparison, there has been relatively little new development west of the existing N4 corridor excepting some single house construction along the minor road between Castlebaldwin and Ballymote. In part, this is because much of the land here is low lying and wet. Some of the land within the corridor is given over to poor quality grazing.

Analysis of the demographic profile is based on data from the 2002, 2006 and 2011 Census of Population as published by the Central Statistics Office (CSO). The population of Sligo town and its environs rose only slightly between 2002 and 2006 from 36,295 to 37,294. However, by comparison, there was a significant increase in the population of surrounding communities such as Collooney and Strandhill. Collooney is located just to the north of the route corridor. Its population increased significantly by 44% between 2002 and 2006 largely in response to the residential tax incentives that became available for new builds under the former Rural Renewal Scheme. These incentives applied to the Upper Shannon Region, but were not available in Sligo Borough. Likewise, there was a sizeable resurgence in the population in Ballymote by 25% following earlier falls and in Ballysadare and the surrounding area to the north of the study area. Overall, the population of County Sligo increased by a respectable 5.3% between 2002 and 2006 and has since risen by 7.2% to 65,270 during the most recent inter-censal period. Since this time, birth rates have been high, but national economic conditions have led to a consolidation in the population and the replacement of net in-migration to Ireland by out-migration. Within the road corridor area, the population of the Electoral Division (ED) of Riverstown increased by over 13% between 2002 and 2006 due largely to the appeal of its traditional village core and the surrounding attractive countryside.

Preliminary data from the 2011 Census is now available at ED for the period 2006 to 2011. Of the EDs in the study area, Collooney recorded a further substantial increase in population of 46%. A significant increase of 22% was also recorded by Drumfin following a absence of population growth in the after a former period. Overall, though, the area has a light population density.

It can reasonably expected that during the construction phase of the N4 Collooney to Castlebaldwin *Proposed Road Development* the workforce will travel from their existing place of residence to the construction site given its short term nature, rather than set up new residence in the vicinity of the subject lands. It is therefore unlikely that any of the Route Options will directly result in variations to population or demography in the Study Area. The enhanced road network conditions provided by any of the route options will improve traffic flow on the existing route which is prone to delays due to its poor alignment and condition. These same road conditions also present poor journey amenity and a high safety risk as evidenced by numerous accidents over the years.

In the longer term operational context, all route options will likely have an equal impact in terms of serving population growth and each are rated as having equal (similar) impact in this regard.

16.5Impact on Residential Properties and Zoned Lands

The development of a new road can have both direct and indirect impacts on property. In some cases, properties could need to be demolished to allow the route to be delivered. Direct and indirect impacts could

occur which relate to the environmental impacts on existing properties resulting from noise, air quality, visual amenity and general disruption during construction. These Environmental Impacts are dealt with in the respective Environmental Chapters of this Route Selection addendum. Generally, at a broader level for Options 1, 2, 4, 5 and 6 residential properties along the existing N4 will benefit as a result of improvements to the road infrastructure and from the transfer of traffic to the proposed road development. However, the layout of the routes at local road crossings as well as the environmental impacts of the project and mitigation measures taken will determine the impact of the routes on individual properties within close proximity. Residences along Route 3 which runs broadly along the existing alignment would not benefit if this route were chosen.

A mini-plan has been developed for Castlebaldwin which forms part of the Sligo County Development Plan 2011-2017. The preferred route corridor for the N4 *Proposed Road Development* is included as an objective within this plan. Taking the mini plan into account, it can be seen that Options 1, 2 and 3 would impact on the proposed development within this settlement. Options 1 and 2 in particular run through lands which are zoned for residential use and also adjacent to the existing primary school facility on the south west side of the village. Also Options 1 and 2 run in very close proximity to a housing estate in Castlebaldwin which was constructed in recent years.

16.6Impact on Community Facilities and Businesses

There are a limited number of community facilities in the area. The main centre in this respect is Riverstown which possesses two churches, a community centre and Folk Park, a post office, a Garda station, a national school (Ardkeeran), a creche, a motor workshop, pub and shops. Outside of Riverstown there are national schools at Coolbock, Doobeg (Knockmina) and Castlebaldwin (Cloghoge). There is also a crèche at Castlebaldwin (Sheerevagh), Co. Sligo. In the north of the study area at Cloonamahan, there is a HSE centre for learning disability. Just to the north there is a transient site for the Traveller Community beside Toberscanavan Lough.The main secondary schools serving the study area would be Boyle, Ballymote, Ballysadare and Coola (to the north-west of the study area).

A variety of car and furniture show rooms and various other retails units/warehouses have been constructed in recent years in the vicinity of Collooney both along the N4 north of the N4/N17 junction and to the east of the N4/N17 Roundabout. However, many some of these have closed in recent times due to the national economic situation.

There is likely to be an adverse impact on three businesses due to some loss of passing trade and familiarity of Castlebaldwin, at least for Options 1, 2, 4, 5 and 6. Loss of passing trade would also be an issue for the art gallery at Tawnagh and for a B&B at Drumfin. Overall, though, the impact is likely to be positive for the wider area due to improved accessibility for industry, tourism, and services. While this will be a local reduction in passing trade, the removal of traffic from communities can enhance retail and commercial activity due to improvements in the environment. A roundabout type junction is proposed at Castlebaldwin which will facilitate access to these areas and the surrounding hinterland such as Ballymote, Riverstown, etc.

16.7Impact on Tourism Industry

In terms of amenity and tourism, the main regional destinations include the beach at Strandhill. Castlebaldwin is the starting point for some of the ten Lough Arrow Walks which are located around Lough Arrow and Lough Key which are areas of scenic beauty and much archaeological/historical interest. The Miner's Way and Historical Trail (118km in length), which starts and finishes in Arigna, passes through the village of Castlebaldwin, Carrowkeel and the Bricklieve Mountains before heading down the eastern edge of the Curlew Mountains towards Boyle and Lough Key. There is a Folk Park at Riverstown which hosts regular cultural events and a popular annual fair. Stables are located at Toberbride near Collooney.

Lough Key is a major amenity destination for day trips all year around and for summer camping. The lough itself, Lough Gill, Lough Arrow, Toberscanavan Lough and Lough Bo are also popular angler destinations. Lough Arrow and Lough Bo are accessible from Castlebaldwin. Lough Arrow can be accessed at various points including from a slipway just off the N4 four kilometres to the south of Castlebaldwin. Lough Bo is located seven kilometres to the east via minor roads. Clay pigeon shooting is also available here.

The region is rich in archaeological remains. These include the Carrowmore Megalithic Cemetery. The complex is accessible from Castlebaldwin and receives modest numbers of visitors every week. There are tentative plans for visitor facilities. To the east of Castlebaldwin there is a cairn near Heapstown that is believed to be

associated with Carrowkeel. The ruins of Ballindoon Abbey are located nearby on the east bank of Lough Arrow.

Accommodation in the immediate area is limited to a small number of bed and breakfasts or guest houses, but there is also a well-known hotel and restaurant, the Cromleach Lodge Hotel, at Carrickglass on the eastern edge of Lough Arrow together with a nearby independent hostel. The Clevery Mill Restaurant is located in Castlebaldwin.

All route corridors have the potential to impact positively on tourism in the wider area due to reduced journey times . Locally, there is the prospect that this will result in a pleasant and safe environment which could allow the villages such as Castlebaldwin to expand to their true potential.

During the construction phase there may be some minor short term negative impacts along the N4 corridor as a result of potential traffic delays and the visual impact of the proposals. Mitigation measures could be employed along each of the proposed route corridors, for example traffic management plans and screening, to alleviate any of these minor impacts. In summary, all routes are considered equal in terms of impacts to the Tourism Industry.

16.8Beneficial Impacts

The principal beneficial impact arising from the *Proposed Road Development* is common to all route options excluding route 3, (i.e.) that of reduction of traffic volumes on the existing N4 route and of improved journey amenity associated with the safer road conditions. There is the prospect of an enhancement to the village centre environment of Castlebaldwin, reduced community severance and improved neighbourhood interaction along the existing N4. Lackagh which is currently a small settlement on the existing N4 will also experience similar benefits to that described above. Options 4, 5 and the preferred route option provide the greatest benefit to the village of Castlebaldwin as these options are located to the northeast side of the existing N4 thereby allowing the village to develop in accordance with the proposed mini plan which forms part of the Sligo County Development Plan (2011-2017).

At present, Castlebaldwin experiences high traffic flow on the existing N4. Speed restrictions and congestion currently increase traffic travel times. However, these will be greatly reduced through the provision of the *Proposed Road Development*. In terms of beneficial impacts to the village and its community, Option 4, 5 and the preferred route have the greatest potential and in this respect are considered equal.

16.9Impact on Policies and Plans

Statutory planning objectives are in place within the Sligo County Development Plan 2011-2017 and the Castlebaldwin Mini Plan 2011-2017 and previous plans since the preferred route was adopted in 2002 by the Elected Members of Sligo County Council for the provision of the N4 Cloonamahan to Castlebaldwin *Proposed Road Development*. Objectives in the Sligo County Development (2011-2017) seek to facilitate the *Proposed Road Development* of the N4 from Cloonamahan to Castlebaldwin (Objective O-NR-1). The Castlebaldwin Mini Plan reserves lands for a *Proposed Road Development* which broadly forms the corridor for the preferred route chosen in the Route Selection Report. Therefore the aims and objectives of the Plans for the *Proposed Road Development* would be met with the preferred route.

16.10 Planning Applications

It has been the policy of Sligo County Council to protect the preferred route corridor for the N4 Cloonamahan to Castlebaldwin *Proposed Road Development* from any proposed development since its adoption into the Sligo County Development Plan in 2002. The remaining options have not been have not been vetted in this regard and therefore development may have occurred along these corridors since the publishing of the RSR for the scheme.

16.11 Relative impacts of route options

Most socio-economic impacts arise from the use of an alternative route to the existing N4 and the transfer of traffic from this road. In this respect, route option 3 would involve a widening of the existing road with inevitable adverse impacts on private properties located beside the road during both construction and operation. More specifically, impacts would be realised by people living in properties on the west side of the road between Castlebaldwin and north of Behy Bridge, and to the east side of the road between here and

Drumfin. In addition, the route option would have a negative impact on any amenity (e.g. angling) associated with Loughymeenaghan, although the lough is already located alongside the existing road. The option diverges from the existing N4 between Ardloy Bridge and Ardloy. The Option also passes within 200-300 metres of a very pleasant stretch of the Unshin River east of Lackagh which possesses an attractive cascade. The river is also a cSAC and presents opportunities for wildlife viewing, e.g. otter, etc. However, socio-economic impacts are muted by the absence of public access to the location other than occasional use of the river by kayakers. Road traffic would also likely be audible to private properties along the adjacent ridge at Coolbock.

In addition, there are potential impacts on businesses located beside the road, principally the public house/restaurant and filling station in Castlebaldwin and the art gallery located between Ardloy Bridge and Carrownagark. The significance of the net impact depends on relative material impacts on the properties and accessibility from the proposed road development for passing trade. The B&B between Drumfin and Lackagh is located close to the divergence of the route option from the existing N4, although the impact would depend on its accessibility from the road. Although not directly impacted, a car maintenance business is located at Drumfin which could incur impacts depending on the business's accessibility to the proposed road development.

Route Options 1 and 2 run to the west of the existing road. They would both pass within an area beside Castlebaldwin that has been identified for the future physical growth of the community as well as being located close to the primary school and a small housing estate. As with other route options they cross the Historical Trail, in this case west of Castlebadlwin, but also pass within 2½km of the megalithic tombs at Carrowkeel, from which the road could potentially be more audible. Given that the tombs are visited by tourists and local people, this would present a potentially significant amenity and heritage impact. Although the number of visitors is not high, visits are regular during weekends and there are tentative proposals for a visitor centre. Options 1 and 2 also pass through areas that are used for some local shooting of game. The route also crosses a minor cul-de-sac (L55016-0) which connects private properties at Knockagroagh to the N4 (although severance of this road would be highly unlikely). There are no other significant socio-economic impacts excepting the transfer of traffic from the existing N4, including the associated potential impact on passing trade for businesses noted above and positive impacts on journey amenity (safety), residential amenity, neighbourhood interaction.

Route options 4 and 5 run to the east of the existing N4. These options pass close to a seventeenth century fortified house near Castlebaldwin although the property is not easily accessible and therefore any socio-economic impacts would be negligible. There are possible issues of connectivity or severance to be considered in relation to a minor road (L54041-0) between the N4 and Sheerevagh and for some other lightly used minor roads to Tawnagh, Carrowkeel and Behy. Route option 4 also passes close to another fortified house near Behy Bridge, although this is more ruined than that at Castlebaldwin and is again not easily accessible, therefore being of low socio-economic significance. As with Route option 3, both roads pass close to the Unshin River SAC east of Lackagh and therefore present potential amenity impacts due to their proximity to this section of the river, although as noted above the river is not easily accessible except by very occasional users of the river itself. There are no other significant socio-economic impacts excepting the transfer of traffic from the existing N4.

While each route option presents possible socio-economic impacts, those presented by Route option 3 are most significant and adverse. The most significant amongst the impacts for the other route options is the potential impact on the growth of Castlebaldwin together with the amenity and heritage impact on Carrowkeel megalithic tombs presented by options 1 and 2.

16.12 Conclusions

The impact of the five Route Options as well as the preferred route on the Socio-Economic and Community Profile of the Lackagh, Drumfin, Castlebaldwin and its hinterland has been discussed above. It is deemed that Option 3 is the least preferred. With any of the routes except route 3, Castlebaldwin village itself will be relieved from severance and development opportunities will be improved. Options 1 and 2 run through lands which are zoned for residential use and would be located close to the existing primary school facility on the west side of the village as well as a recently constructed housing estate. Options 4, 5 and the preferred route option provide the greatest benefit to the village of Castlebaldwin as these options are located to the northeast side of the existing N4 and would thereby allow the village to develop in accordance with the proposed mini plan which forms part of the Sligo County Development Plan (2011-2017). All routes except route 3 will have a similar impact on retail and commercial activity. In terms of National Roads objectives, the

aims and objectives of the Sligo County Development Plan as well as the Castlebaldwin Mini Development Plan (2011-2017) are met with the preferred route.

The preferred route is the only route which has been vetted in terms of planning permissions since the adoption of the route in 2002. Taking the above into account the preferred route is that which will have the lowest impact on the Socio-Economic and Community Aspects of the area.

16.13 Ranking

Taking the above into account, it is considered that all options will improve socio economic aspects in the vicinity of the area, however, options 6 and 6+ would appear to be the most preferred considering that they have been audited for planning permissions over the last 11 years. Option 3 is likely to be the worse (business on the road would likely lose passing trade due to access restrictions plus many properties affected).

Table 16-2: Socio-Economic, route options Rank

Route Option	Rank
Option 1	3
Option 2	3
Option 3	4
Option 4	2
Option 5	2
Option 6	1
Option 6+	1

17 Economy Assessment

17.1Cost Estimation

Sligo County Council Roads Design Office prepared the Options Comparison Estimate for each of the route corridors in the Route Selection Report. As the corridors for each of the options remain the same no amendments are required to this section of the original report.

17.2Cost Benefit Analysis

A Cost benefit analysis was carried out by Donegal National Road Design Office using COBA. As the corridors for each of the options remain the same no amendments are required to this section of the original report.

Table 17-1: Economic Assessment Ranking

Category	Criteria	Rank							Comment
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 6+	
Economics	Cost	6	4	1	2	3	5	4 to 5	Score from RSR 2002
	Cost Benefits	6	4	5	1	2	3	2 to 3	Score from RSR 2002

III. Part 3 – Conclusion of Comparison of Options

18 Conclusion of Comparison of Route Options

As previously outlined the purpose of this report is to document the update of the route corridor selection process and the establishment of the preferred route corridor for the proposed N4 Collooney to Castlebaldwin *Proposed Road Development*. This report details the review and sets out necessary amendments to the original report and is to read in conjunction with that report.

The following provides a summary of the assessment process under the various headings.

18.1 Engineering Considerations

Engineering considerations at the time of Route Selection related principally to Full Overtaking Sight Distance (FOSD), number of junctions, number of accesses and prevailing ground condition's.

The addendum report assessed the route of the *Proposed Road Development* in terms of FOSD. This resulted in the conclusion that the route has superior sight distances (70.5%) in comparison with the other options considered at the time of Route Selection. This is reflected in *Table 18-1* below.

Table 18-1: FOSD Comparison

Proposed Route	FOSD	Ranking
Option 1	54.2%	5
Option 2	62.2%	3
Option 3	47.3%	7
Option 4	68.39%	2
Option 5	55.08%	4
Option 6	47.3% to 54.2%[18]	6
Option 6+	70.5%	1

In relation to junctions and direct assesses the addendum report reviewed the current NRA DMRB standards which states that:

...where an existing national road is to be improved on-line, there are likely to be existing accesses. Where possible these should be relocated on another road or to a better location onto the national road (such relocation would be regarded as a new or altered access). Where this is not practicable, the layout of the access onto the new road should be designed in accordance with the geometric standards for a new or altered access.

With cognisance of the foregoing it was considered that all options would now score similarly as they cross a similar number of local roads. This however, would be with the exception of Option 3 which due to the prevalence of significant direct assesses would require additional junction and direct access arrangements which has already been discussed in section 5.1.2.3 of this report.

In terms of ground conditions; considering modifications which have been made during Phases 3 and 4 of the NRA PMG as outlined in section 6.2.8.1.1.2, the impact of each of the route options was reassessed in the addendum report using desktop information from soil geology mapping compiled by Teagasc. The results of this as outlined in Table 7-3 confirm that each of the route options encounter areas of soft ground of approximately 20% to 44% of their various route lengths. The *Proposed Road Development* encounters approximately 34% of soft ground along its length mainly between *Doorly Td.* and *Ardloy Td.* Although this is a high percentage, it is the least intrusive of those route options which are located south-west of the existing N4 between the aforementioned townlands.

[18] No specific value is given for FOSD in the Route Selection Report; however, the range of values provided has been derived from the Rank which is provided in the Route Selection Report.

Table 18-2: Soil and Subsoil Geology

Route Option	% of Soft Ground interpreted from Soil mapping	% of Soft Ground interpreted from Subsoil mapping	Rank
Option 1	40%	44%	7
Option 2	35%	35%	5
Option 3	24%	24.5%	1
Option 4	43%	20%	3
Option 5	27%	24.3%	2
Option 6	35%	38%	6
Option 6+	34%	34%	4

18.2Economic

Cost Estimates at the time of Route Selection were based on figures set out in the National Roads Needs Study (NRNS, 1998). The result of the estimates which are outlined in *Table 18-3* were generally reflective of each route options length, the associated earthworks and number of structures which would be required. The costs indicated that the online option (Option 3) appeared the most economical to construct with other options showing cost increases ranging from 18% to 33%. The Preferred Route showed an increase of 29%. As part of the addendum report, it was not considered necessary to re-cost the options as the figures produced in 2002 allow for a suitable comparable of the various options.

Table 18-3: Estimated Cost of Routes

Proposed Route	Cost (£m)	Ranking
Option 1	25.4	6
Option 2	24.2	4
Option 3	19.1	1
Option 4	22.6	2
Option 5	22.9	3
Option 6	24.7	5
Option 6+	N/A[19]	N/A[19]

Based on the estimates, Donegal National Roads Design Office (as part of the Route Selection Report) carried out a Cost Benefit Analysis on each of the route options. The results of the exercise are outlined in Table 18-4 and revealed that the benefits of the most economical option would be much less in the overall term of the project where compared with Option 1 which would deliver the highest level of benefits. It was indicated that the Preferred Route would provide benefits which would be in the order of 14% less than those provided by Option 1.

Table 18-4: Benefits and Ranking

Proposed Route	Benefit (£m)	Ranking
Option 1	11.0	6
Option 2	12.9	4
Option 3	11.8	5

[19] N/A as option 6+ had not evolved at the time of Route Selection.

Proposed Route	Benefit (£m)	Ranking
Option 4	15.1	1
Option 5	14.7	2
Option 6	13.0	3
Option 6+	N/A[19]	N/A[19]

Although the foregoing does not represent a comparison for Option 6+ as it had not evolved at the time of Route Selection, the preceding section 18.1 illustrates that savings will be realised as a result of reduced soft ground conditions encountered in comparison to the Preferred Route (as a result of design modifications made to the Preferred Route during the design stage). This would bring the route of the *Proposed Road Development* more in line with the other higher placed routes in terms of economic considerations.

18.3Environmental

In terms of environmental effects the following outlines how the alternative routes compare with the *Proposed Road Development* based on information from the Route Selection Report and more significantly from the 2012/2013 review carried out (The addendum report).

18.3.1 Impact on Archaeology

The Route Selection Report in carrying out significant field studies recognised the archaeological richness of the existing environment in the vicinity of the *Proposed Road Development.* In order to update this assessment, a review was carried out in the addendum report which focussed on the most up to date desk study information available in 2012. This included a review of available information including *Records of Monuments and Places for County Sligo*, *Records of Protected Structures for County Sligo (2005 – 2011)* and *National Monuments for County Sligo (2009 – 2012)*.

Based on this information and in terms of potential direct impacts; *Table 18-5* indicates that Options 1, 2, 6 and 6+ all would appear to have the least impact on Archaeological sites. It was also noted during the 2012 assessment that the Castlebaldwin Fortified House would be in the viewshed of options which run to the east of the existing N4 including Option 6+, but, as described in the Route Selection Report would not require any ground disturbance in the vicinity of this structure.

Table 18-5: Impact of route options on listed archaeological monuments

Route Option	No. of listed monuments within 25m	No. of listed monuments between 25m and 50m	Rank[20]
Option 1	1	1	1
Option 2	1	1	1
Option 3	2	0	2
Option 4	2	5	4
Option 5	2	4	3
Option 6	1	1	1
Option 6+	1	1	1

Considering the above it was concluded that; the *Proposed Road Development* remains a good route overall from an archaeological, architectural and cultural heritage perspective as is reflected in *Table 18-5*.

18.3.2 Impact on Ecology

Of all the environmental disciplines, ecology represents the area where most change has occurred in the intervening years from the time of the Route Selection. The reasons for this are principally due to changes to European and Irish legislation and the effects same have had on designated sites, sensitivities to specific

[20] Similar Ranks have been scored where impacts are considered similar.

elements of Flora & Fauna and the associated environmental guidelines that have been published in line with the legislative changes and greater environmental awareness.

In this regard an ecological evaluation with regard to ecological constraints was undertaken with reference to the National Road Authority's *'Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2' (NRA, 2009)'.* In line with this guidance the level of impact and its significance with regard to each Route Option was applied with the assumption that general mitigation measures, following relevant NRA environmental guidance, would be implemented.

With reference to the Guidelines and in particular to *Figure 5: Consideration of European Sites during Route Corridor Selection*, there is a clear instruction that where proposed routes may adversely affect the integrity of European Sites the following approach in Route Selection must be undertaken:

Disregard all feasible alternative solutions affecting the integrity of the European site and continue with alternatives that do not.

The addendum report provides a quantifiable evaluation of the potential for the various route options to affect sensitive ecological receptors. Included in the basic addition of ecological receptors, is a weighting in terms of geographic importance.

From a review of the route options (and based on the assumption that it would be possible to provide similar levels of design mitigation on each of the alternative Route Options to that which is provided on the *Proposed Road Development)* it was considered that it would be likely that all of the routes could be shown, beyond reasonable scientific doubt not to pose a risk of giving rise to impacts affecting the conservation status of qualifying interests or conservation objectives with regard to integrity-level impacts affecting any European site. Taking cognisance of this, but with regard to minimising the risk to adverse effects on designated European sites, route options that require direct landtake within designated European sites (i.e. route options 3, 4 and 5) were negatively weighted. This is with reference to crossings of the Turnalaydan Stream and the Drumfin River which are designated within the River Unshin cSAC. It is noted that the permanent or significant loss of Annex I habitat or permanent or significant effects on the Annex II species listed as qualifying interests of this site which would constitute an integrity level impact would be unlikely at the proposed crossing points.

In terms of undesignated sites of National (and International) Importance, Option 5 and Option 6+ were deemed to have the least impact. Route Option 3, although potentially affecting the least number of sites, would have the potential for direct and significant impacts on the Loughymeenaghan wetland site, which is evaluated as being of international importance in the County Sligo Wetland Survey Report (Wilson *et. al*., 2011).

All the proposed route options require crossings of 2 watercourses identified as being of County Importance; the potential for significant effects arising at these watercourse crossings is evaluated as being not significant. Route options 3, 4 and 5 do not give rise to any further potential impacts on sites of County Importance. Options 1 and 6+ may potentially affect one additional site of County Importance.

All the route options require crossings of minor watercourses identified as being of Local Importance (higher value). The potential for significant impacts at these watercourses is evaluated as being unlikely. Route options 4, 5, 6, and 6+ all require additional landtake within Drumderry Marsh, a wetland site evaluated as being of Local Importance (higher value).

The results of this assessment are outlined in *Table 18-6* and indicate that each of the alternatives have a greater impact on the ecological environment when compared with the *Proposed Road Development* (Option 6+).

Table 18-6: Impact of route options on Ecology

Route Option	Significant Impact on designated European Site	Sites with direct impact on a European Site	Significant Impacts on a Nationally designated Site	Significant Impact on a feature of International/ National importance	Significant Impact on a feature of County Importance	Significant Impact on a feature of County Importance	Rank
Option 1	0	0	0	3	1	0	2
Option 2	0	0	0	3	2	0	3

Route Option	Significant Impact on designated European Site	Sites with direct impact on a European Site	Significant Impacts on a Nationally designated Site	Significant Impact on a feature of International/ National importance	Significant Impact on a feature of County Importance	Significant Impact on a feature of County Importance	Rank
Option 3	0	1	0	2	0	0	7
Option 4	0	1	0	3	0	1	6
Option 5	0	1	0	2	0	1	5
Option 6	0	0	0	4	2	1	4
Option 6+	0	0	0	2	1	1	1

18.3.3 Hydrology, Flooding & Hydrogeology

18.3.3.1 Hydrology

The original Route Selection Report did not specifically consider impacts of a Hydrological nature. The addendum report in the ecological section considers impacts on the aquatic environment which for the purposes of demonstrating comparisons is deemed adequate for Hydrology.

18.3.3.2 Flooding

The addendum report undertook an assessment of Flood Risk to each of the Route Options. This was based on a review of OPW Preliminary Flood Risk Assessment mapping, NRA National Network Flood Risk Mapping and detailed FRA mapping which was available from the design process of the *Proposed Road Development*. The following is an overview of identified localised flood plains (associated with rivers and streams) in the vicinity of the Route Options.

- Unshin River;
- Turnalaydan Stream;
- Drumfin River;
- Springfield Stream; and
- Lissycoyne Stream;

The results of the assessment are outlined in *Table 18-7*. This indicates that the online option 3 would be the most favourable followed by options 2 and 1. The preferred route and the *Proposed Road Development* are medium preferences followed by options 4 and 5.

Table 18-7: Overall Ranking

Route Option	Identified Flood Plain					OVERALL
	Unshin River	Turnalaydan Stream	Drumfin River	Springfield Stream	Lissycoyne Stream	
1	1	4	4	1	1	3
2	1	4	3	1	1	2
3	1	2	1	2	1	1
4	5	2	5	2	3	5
5	5	2	5	3	3	6
6	1	4	3	3	3	4
6+	1	4	3	3	3	4

18.3.3.3 Hydrogeology

In terms of Hydrogeology, the aforementioned ecological section also deals with impacts on Ground Water Dependent Ecosystems. In a broader sense the aquifer and karst sensitivities for each of the route options are generally similar, that is with the exception of Option 3 which would most likely require less excavation and thus potentially fewer impacts on the Hydrogeological environment.

18.3.4 Impact on Air Quality

The DMRB at the time of Route Selection recommended a generalised appraisal of route options by banding properties up to 200m from roadside, with pollutant weightings given to each band, so that total numbers and total changes in pollution levels could be compared.

In recognition of property increases since 2002, the addendum report reviewed the numbers of properties within the various bands and reapplied the 2002 Air Quality criteria the results of which are as outlined in *Table 18-8*. In applying these changes updated '*NRA Guidelines for the treatment of Air Quality during the planning and construction of National road Schemes'* were considered, however, considering the nature of the existing environment which is predominately rural in nature in combination with the *Proposed Road Developments* characteristics which will largely provide for free-flowing traffic movements it was deemed unnecessary to apply additional criteria as this ultimately would not influence the final outcome.

This reaffirms as expected that Option 3 affects the most properties from the point of view of reduction in Air Quality, while the *Proposed Road Development* (Option 6+) has the least impact.

Table 18-8: Impact of route options on Air Quality (2012)

Route Corridor	Number of Properties Sensitive to Air Quality Within 50m	Number of Properties Sensitive to Air Quality Within 50-100m	Number of Properties Sensitive to Air Quality Within 100-200m	PM	NO^2	Ranking
PM Weighting	1	0.65	0.55	Weighted Total	Weighted Total	
NO^2	1	0.8	0.65	No. of houses(0-200m)	No. of houses(0-200m)	
Option 1	13 (13) (13)	29 (18.85) (23.2)	50 (27.5) (32.5)	59.35	68.7	4
Option 2	12 (12) (12)	28 (18.2) (22.4)	56 (30.8) (36.4)	61.0	70.8	5
Option 3	50 (50) (50)	22 (14.3) (17.6)	48 (26.4) (31.2)	90.7	98.8	6
Option 4	9 (9) (9)	11 (7.15) (8.8)	32 (17.6) (20.8)	33.75	38.6	2
Option 5	9 (9) (9)	15 (9.75) (12)	40 (22.0) (26.0)	40.75	47	3
Option 6	1 (1) (1)	10 (6.5) (8.0)	25 (13.75) (16.25)	20.60	25.25	1
Option 6+	1 (1) (1)	10 (6.5) (8.0)	25 (13.75) (16.25)	20.60	25.25	1

18.3.5 Impact due to Noise

The original Route Selection Report compared the number of houses within 300m of each of the different route options; these were further assessed into bands of 0m - 50m, 50m - 100m, 100m - 200m and 200m – 300m. In recognition of property increases since 2002 and the additional guidelines which are now available, a 2012 review carried out a similar banding exercise to that outlined above with a 2012 base, it however extended to calculate Potential Impact Rating (PIR) in accordance with the *NRA Guidelines for the Treatment of Noise and Vibration of National Road Schemes* published in 2006 as outlined in Table 18-9 below.

Table 18-9: Impact of route options in relation to Noise (2012 review)

route options	Bands multiplied by relevant rating factor				PIR Total	Rank
	0 to 50m	50 to 100m	100 to 200m	200 to 300m		
Option 1	52	87	100	42	281	4
Option 2	48	84	112	44	288	5
Option 3	200	66	96	40	402	6
Option 4	36	33	64	57	190	2
Option 5	36	45	80	35	196	3
Option 6	4	27	50	57	138	1
Option 6+	4	27	50	57	138	1

Based on PIR values, the Preferred Route and the route of the *Proposed Road Development* are rated as having the least impact in terms of noise. It is also notable that this route option has the lowest PIR in the 0 – 50m, 50 to 100m bands and 100m to 200m bands, i.e. the bands in which mitigation is most likely to be required. Therefore, on the basis of the band count numbers and subsequent PIR calculations for the entire length of the route options, Option 6 and 6+ are ranked as the best route in terms of noise and vibration.

18.3.6 Impact on Landscape and Visual

The Route Selection Report (2002) noted that the routes passed through an area generally classified as *Normal Rural Landscape* within the County Development Plan with the exception of one area comprising the wetland areas of (and surrounding) Boathole Lough and Lough Corran which was considered to be *Sensitive Rural Landscape* and which was impacted on by route options 1 and 2 (this forms part of the Preferred Route at this location). It also identified a scenic route which passes through Castlebaldwin in a south-west/north-east direction and which would be impacted on by each of the route options.

In general the Route Selection Report outlined the most distinctive features of the landscape in this area to be

...drumlins and small lakes that generally lie along a north-west to south-east axis. A particularly fine group of drumlins is seen north and east of Riverstown. Travelling in a southern direction there are views of Keshcorran and the Bricklieve Mountains to the southwest and intermittent views of Carran Hill to the east. To the north the Ox Mountains, Crockauns, Killerry Mountain and Benbulbin are all visible in fine weather.

Considering the fact that visual impacts were not considered in the original Route Selection Report, the addendum report in 2013 undertook a renewed assessment which focussed on both Landscape and Visual from a current day perspective.

18.3.6.1 Visual Impacts

The focus of the 2013 assessment involved an examination of:

- The number of properties which are anticipated to experience considerable visual impacts which are defined as impacts ranging from Moderate Adverse to Profound Adverse as a result of the *Proposed Road Development*.; and
- The potential impacts of the proposed alternative route options on designated scenic routes, views of road users and from heritage and amenity features. The assessment distinguishes between potential higher ranging impacts (Moderate Adverse or higher) or lower ranging impacts (Slight Adverse or lower) or no impacts.

In relation to visual impacts to occupied properties, Option 3 is anticipated to affect the highest number of properties in relation to considerable adverse visual impacts and is the least preferred route option in this category. The route alignment with the least number of occupied properties likely to experience considerable impacts is Option 6 (and Option 6+) followed closely by Option 2.

In relation to visual impacts on road users, heritage sites and designated routes, online Option 3 is the preferred option. It avoids largely the disturbance of adjacent landscape features or changes to the wider

setting of the heritage sites. All other offline options are expected to result in considerable visual impacts to road users. The second preferred option is Option 6+, due to its lower ranging visual impacts to the heritage sites. Considerable visual impacts would be expected to arise from Option 1 and Option 2 on the Carrowkeel Cemetery National Monument (NM) site due to their close proximity to the foothills of the Bricklieve Mountains. Options 4, 5, 6 and 6+ would pass the Castlebaldwin House (NM) Heritage site at close proximity in conjunction with the existing N4 alignment and are also expected to result in higher grade visual impacts at this location.

Table 18-10: Impact of route options in relation to visual effects

Route Option	Visual Receptors					
	Total number of properties affected	Designated Scenic Routes	Castlebaldwin House (NM) Heritage Site	Carrowkeel Passage Cemetery (NM) Heritage Site	Road Users	Cumulative Visual Impacts
Option 1	51	Low	None	High	High	Low
Option 2	41	Low	None	High	High	Low
Option 3	66	None	Low	Low	Low	None
Option 4	59	Low	High	Low	High	Low
Option 5	51	Low	High	Low	High	Low
Option 6	40	None	Low	Low	High	Low
Option 6+	40	None	Low	Low	High	Low

18.3.6.2 Landscape Impacts

The Landscape assessment focussed on the physical characteristics of each of the route options and the most distinctive landscape features within the Study Area.

In terms of physical characteristics:

- Option 1 is marginally longer than all other options with the highest number of river crossings, a medium number of road crossings, medium number of cut and fill areas and a medium value for maximum level of cut. This option has however the second highest maximum level of fill;
- Option 2 has the third longest road length, the second highest number of road crossings, the third highest number of river crossings and second lowest maximum level of cut. It has the lowest number of cut and fill areas but the highest maximum level of fill;
- Option 3 is shortest in length by a marginal distance but requires; the highest number of road crossings, the second highest number of river crossings and the highest number of cut and fill areas (26). It also has the second highest maximum level of fill. For these reasons it is the least preferred route option in this category;
- Option 4 is the second shortest option with a medium number of road and river crossings, cut and fill areas and medium values for maximum levels of cut and fill;
- Option 5 is slightly longer than the shortest options but has the least number of road and river crossings and cut and fill areas. It has medium values for maximum levels of cut and fill. Option 5 is the overall preferred option in this category;
- Options 6 and 6+ require the least number of road and river crossings but the second highest number of cut and fill areas. It also has the highest maximum levels of cuts but the second lowest maximum level of fills.

In relation to anticipated impacts to landscape features the preferred option is Option 3, which avoids largely any higher grade impacts to existing landscape features. This option would, however, require largely the removal of most of the existing roadside vegetation and is the route option with the highest predicted losses of the existing hedgerow network in the study area. Option 5 is the preferred offline option in this category

with the least number of macro landscape features impacted on. It also avoids the only 'Sensitive Rural Landscape Area' in the study area. The least preferred options in relation to landscape impacts to macro landscape features is Options 6 and 6+ followed by Option 2. These route alignments would affect the highest number of macro landscape features including the 'Sensitive Rural Landscape' at Lough Corran. Option 1 affects a slightly lower number of landscape features but would have a higher impact on the 'Sensitive Rural Landscape' at Lough Corran.

Table 18-11: Landscape Impacts Ranking

Route Option	Ranking						
	Route Length	Road Crossings	River Crossings	Cut and Fills	Macro Landscape Features	Hedgerow and Roadside vegetation	Cumulative Impacts
Option 1	4	4	4	3	3	1	2
Option 2	2	5	2	1	5	1	3
Option 3	1	6	3	5	1	2	1
Option 4	1	3	2	3	4	1	5
Option 5	1	1	1	2	2	1	2
Option 6	3	2	1	4	6	1	4
Option 6+	3	2	1	4	6	1	4

18.3.6.3 Overall Ranking

Of the assessment categories examined above, offline route corridor Option 5 to the east of the existing N4 is the favoured or second favoured option in 11 out of 12 categories and is in relation to visual and landscape impacts the overall optimal option. It is one of the shortest route options with the least or second least number of road and river crossings, second least number of cut and fill areas and is the option with the least anticipated impacts in relation to the macro landscape and second least cumulative landscape and visual impacts. Its anticipated visual impact is rated slightly higher in the categories of occupied properties and in relation to the Castlebaldwin heritage (Fortified House) site.

The remaining online and offline route options will result in considerable visual or landscape impacts in some of the assessed landscape and visual impact categories, but are in all cases also the favoured or second favoured options in other categories and therefore differences between the different route corridor options in the overall rankings tends to be slight.

Offline route corridor Option 1 to the west of the existing N4 is the second most favourable route in terms of landscape and visual impacts. It is the joint favoured overall option in relation to visual impacts and the second favoured option in relation to overall landscape impacts. It is slightly longer than all other options and has the highest number of river crossings but is the second favoured route in relation to cumulative impacts and visual impacts to occupied properties. It is a medium scoring option in other categories.

Offline route corridor Option 2 to the west of the existing N4 is a medium scoring route option in relation to landscape and visual impacts. Option 2 is slightly longer than all other options and has the highest number of road crossings but has lower anticipated impacts in relation to cumulative landscape and visual impacts and visual impacts to occupied properties. Option 2 is together with option 6+ the third favoured route option.

Online Option 3 is the least favoured option in relation to visual impacts to occupied properties, number of road crossings, number of cut and fill areas and impacts to the hedgerow and roadside vegetation network. This is considered to outweigh higher preference scorings in other categories and this option is judged to be the least preferred option overall.

Offline Option 4 to the east of the existing N4 is the least favoured option in relation to cumulative landscape and visual impacts and the second least favoured option in relation to visual impacts to occupied properties and landscape impacts to macro landscape features and is overall the second least favoured option.

Option 6 and Option 6+ alternating to the east and west of the existing N4 is the favoured route in relation to visual impacts to occupied properties and scenic routes and heritage sites compared to the other offline options and requires the least number of river crossing and second least number of road crossings. Its overall route length and number of cut and fill areas is, however, higher than some of the comparator route options. It is also considered to result in higher cumulative impacts and is the least favoured route in relation to impacts to landscape features. In the overall assessment it is a medium scoring option and with route option 2 is the third favoured option.

Table 18-12: Overall Landscape and Visual Route Options Ranking

Route Option	Overall Rank
Option 1	2
Option 2	3
Option 3	5
Option 4	4
Option 5	1
Option 6	3
Option 6+	3

18.3.7 Socio Economic Impacts

The addendum to the Route Selection Report considered an up to date review of Socio Economic factors including a consideration of:

- Regional Context;
- Economic Activity and Tourism;
- Demography;
- Residential and Business Properties;
- The Business Community;
- Tourism and Recreation;
- Community Facilities and Community Impacts; and
- Planning Policy and Planning Permissions;

This reviewed analysis revealed that Options 1 and 2 run through lands which are zoned for residential use and are adjacent to the existing primary school facility on the south west side of the village as well as a recently constructed housing estate. Options 4, 5 and the 6 provide the greatest benefit to the village of Castlebaldwin as these options are located to the northeast side of the existing N4 thereby allowing the village to develop in accordance with the proposed mini plan which forms part of the Sligo County Development Plan (2011-2017). All routes will have a similar impact on retail and commercial activity. The aims and objectives of the Sligo County Development Plan as well as the Castlebaldwin Mini Development Plan (2011-2017) in terms of National Roads objectives are met with the Preferred Route. The Preferred Route (and the route of the *Proposed Road Development*) is the only route which has been vetted in terms of planning permissions since the adoption of the route in 2002.

Taking the above into account, it is considered that all options will improve socio economic aspects in the vicinity of the area. However, options 6 and 6+ would appear to be the most preferred considering that they have been audited for planning permissions over the last 11 years while option 3 is likely to be the least preferable considering that many properties would be affected and that existing businesses on the road would be likely to lose passing trade due to access restrictions.

Table 18-13: Socio-Economic, route options Rank

Route Option	Rank
Option 1	3
Option 2	3
Option 3	2
Option 4	2
Option 5	2
Option 6	1
Option 6+	1

18.3.8 Impact on land and Dwellings (Agriculture & Non-Agriculture Property)

18.3.8.1 Agriculture

Agronomy considerations were incorporated within the Route Selection Report in the form of an assessment carried out by an appointed specialist. Comparisons of route options are presented in *Table 18-14* with a severance rating of 1 indicating least impact and a rating of 5 indicating the most impact.

Table 18-14: Impact of route options on Land and Dwellings

Route Option	Severance Rating
Option 1	3
Option 2	5
Option 3	1
Option 4	2
Option 5	4
Option 6	Not Ranked
Option 6+	Not Ranked

The Preferred Route at the time was not ranked, however, a report on the Preferred Route at the time concluded that impacts would generally be of a mild to moderate nature with only 4% of properties expected to experience severe severance.

The addendum report reviewed the land ownership details along all route options by comparison of current land registry mapping with land ownership mapping used for the Route Selection Report analysis. The results of this analysis indicated that some changes had occurred with regards to land ownership along the route, however, it was found that the size of individual farm holdings in the main remained similar to those assessed for the Route Selection Report. Therefore the foregoing results were considered appropriate as a demonstration of the main alternatives considered by the Road Authority.

18.3.8.2 Non-Agricultural Property

Considering the significant amount of private developments since the Route Selection Stage, the addendum report undertook a detailed assessment of all route options using combinations of a desktop study, a roadside inspection and local knowledge of the study area.

The assessment was carried out under the following headings:

- Acquisition of residential property
- Acquisition of non-residential property
- Property impact to gardens
- Property within 50m of the route option

The conclusions for this assessment and the associated rankings for non-agricultural property are shown in *Table 18-15* below. This indicates the significant impacts which Option 3 would have on the properties which currently adjoin it, while also demonstrating that Option 6 and 6+ provide for the least impact on Non Agricultural Properties.

Table 18-15: Impacts on Non-Agricultural property for each route option

Route Options	Property Acquisition (no.)		Property impacts to gardens (no.)	Non-agricultural property 0-50m (no.)	Rank
	Residential property	Non-residential property			
Option 1	11	19	6	15	4
Option 2	11	26	6	16	5
Option 3	41	72	7	74	6
Option 4	9	14	4	15	2
Option 5	11	13	5	15	3
Option 6	2	4	2	2	1
Option 6+	2	4	2	2	1

18.4Conclusion of Route Selection Process

Based on the Route Selection Report and its 2013 addendum, Table 18-16 outlines the aptness of the route to be maintained as the optimal location for the *Proposed Road Development*.

It is generally apparent from the foregoing and the chart provided in Table 18-16 that the route of the *Proposed Road Development* scores high preference ratings for the majority of criteria with the exception of some medium scores on Ground Conditions, Hydrology, Flooding, Hydrogeology, Landscape and Agricultural Property impacts. The economical benefits of the *Proposed Road Development* are considered to be on the threshold of high to medium preference while the comparable cost is considered to be on the threshold of medium to high.

The most comparable alternatives to the *Proposed Road Development* are Options 4 and 5 which both run wholly to the east of the existing N4. The categories which make these options comparable to the *Proposed Road Development* would mainly relate to ground conditions and cost, however, in both of these categories the *Proposed Road Development* still compares well. The most severe impacts of both of these options which ultimately make them both unfavourable relate principally to the crossing of and the direct landtake required within the Unshin River cSAC/pNHA. Other notable observations are highlighted below.

From an engineering perspective all options are similar with the exception of Route 3. It is felt that Option 3 which follows largely the existing road would require demolition of a large number of dwellings in order to achieve the junction design standards required by the current NRA DMRB. Therefore, Option 3 has a greater potential impact on dwellings than either Option 1, 2, 4, 5, 6 or 6+ and is the least preferred. Passing sight distance is greatest for the preferred route and lowest for Route Option 3 while in terms of ground conditions all options are considered to transverse considerable areas of soft ground with options 3 and 5 considered to be the most preferable in this regard.

From an archaeological perspective and as outlined in Table 8-2, Option 4 is deemed to have the greatest impact on archaeology. Options 1, 2 and the preferred route are deemed to have the least impact.

Following a review of agricultural and non-agricultural properties, the preferred route option is deemed to have the least impact on non-agricultural property. It has become apparent from this assessment that the preferred route has become more favourable in this regard largely due to the fact that there has been a significant amount of development; particularly one off dwellings within the study area as well as a housing estate In Castlebaldwin Village. In terms of Agricultural property it was considered that that the size of individual farm holdings in the main remained similar to those assessed for the Route Selection Report, thus the original assessment which indicated that option 2 would be the least preferable with option 6 and 6+ based on an interpretation of results considered to be a medium scoring option.

In terms of air quality and climate; following a comparison of the proposed route corridors, the preferred route is ranked as best based on a calculation of the Index of Overall Change in Exposure to nitrogen dioxide (NO_2) and particulate matter less than 10 microns (PM_{10}) resulting from each individual route corridor.

The Preferred Route option is rated as having the least impact in terms of noise. It is also notable that this route option has the lowest PIR in the 0 – 50m, 50 to 100m bands and 100m to 200m bands, i.e. the bands in which mitigation is most likely to be required. Therefore, on the basis of the band count numbers and subsequent PIR calculations for the entire length of the route options, the preferred route is ranked as the best route in terms of noise and vibration.

Table 18-16: Performance of the Route of the Proposed Road Development in comparison to original route options.

Category	Criteria	Rank							Comment
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 6+	
Engineering Assessment	FOSD	5	3	7	2	4	6	1	Score from 2002 RSR and 2013 addendum report
	Number of Junctions	1	1	5 to 7	1	1	1	1	Score from addendum report 2013
	Number of Accesses	1	1	5 to 7	1	1	1	1	Score from addendum report 2013
	Ground Conditions	7	5	1	3	2	6	4	Score from addendum report 2013
Economics	Cost	6	4	1	2	3	5	4 to 5	Score from RSR 2002
	Cost Benefits	6	4	5	1	2	3	2 to 3	Score from RSR 2002
Environment	Impact on Archaeology	1	1	2	4	3	1	1	Score from 2002 RSR and 2013 addendum report
	Ecology	2	3	7	6	5	4	1	Score from addendum report 2013
	Hydrology	3 to 4	3 to 4	1 to 2	3 to 4	3 to 4	3 to 4	3 to 4	Score from addendum report 2013
	Flooding	3	2	1	5	6	4	4	Score from addendum report 2013
	Hydro Geology	3 to 4	3 to 4	1 to 2	3 to 4	3 to 4	3 to 4	3 to 4	Score from addendum report 2013
	Air Quality & Climate Change	4	5	6	2	3	1	1	Score from addendum report 2013
	Noise & Vibration	4	5	6	2	3	1	1	Score from addendum report 2013
	Landscape and Visual	2	3	5	4	1	3	3	Score from addendum report 2013
	Socio Economic	3	3	4	2	2	1	1	Score from addendum report 2013
	Agri. Property	3	5	1	2	4	3	3	Score from addendum report 2013 (Option 6/6+ interpreted)
	Non Agri. Property	4	5	6	2	3	1	1	Score from addendum report 2013

Table 18-17: Legend for Table 18-16

Legend for Table 18-16					
High Preference: Applied for Rankings/Ratings of 1 to 2.		Medium Preference: Applied for Rankings/Ratings of 3 to 4.		Low Preference: Applied for Rankings/Ratings of 5 to 7.	

iv. The Online Upgrade

19 The Online Upgrade

19.1 General

The alternatives in terms of the mainline alignment on the geometrically improved section between *Collooney/Toberbride Td.* and *Cloonamahan Td.* were dictated by:

- the current provision of a horizontal alignment which is adequate to accept the geometry of a Type 2 Dual Carriageway; and
- the constraints which occur to the east and west of the existing N4 meaning an offline alternative was not viable. These constraints include Markree Demesne, clusters of houses in *Mullaghnabreena Td.* to the east and Toberscanavan Loughs to the west as outlined in Figure number N4-RSA-05 provided in appendix 1 of this report.

The following paragraph's describes the alternatives explored on the online section and the reasons why the online proposal and its associated parallel links are considered the optimal choice.

The desired objective was from a safety perspective to separate the local traffic from the national traffic, thus ensuring the consistency of the Type 2 Dual Carriageway is maintained for the overall length of the route. Notwithstanding this, options which did not initially meet this criteria were also considered to provide a fuller assessment.

19.2 Initial Options Considerations

Initially following an NRA Peer Review in January 2008 three options were considered for the design of the section between the existing N4/N17 roundabout and Doorly Td.

These initial preliminary options are labelled Option A, Option B and Option C for the purposes of this report. A value engineering exercise was carried out on each option which considered:

- Effects on travel patterns; and
- Comparative cost estimates which were carried out on each option. This exercise excluded the mainline design as it is identical for each of the options. Land acquisition costs were estimated at €10,000/acre.

The following outlines the positive and negative aspects of each of the initial alternatives which are also described figuratively in each of the appropriate paragraphs.

19.2.1 **Initial Options**

19.2.1.1 Option A

Option A was the original design proposed by the design team. It provides a Compact Grade Separated Junction (CGSJ) for access to Cloonamahan and surrounding areas. A parallel road is shown on the east side of the mainline south of the junction to link with the existing N4 and to collect adjacent public and private accesses. A further parallel link road was also considered on the west side of the mainline south of the junction which also collects adjacent public and private accesses.

Local access to the townlands of Mullaghnabreena and Toberbride, west of the N4 Mainline is provided by a possible left in/ left out link road which connects the N4 Mainline to local road L-7612, an existing junction at Toberbride, and also a new left in/left out link road which connects the N17 Mainline to local road L-7611. With this arrangement, residents in the Toberbride area must travel approx 0.6km extra to reach their dwellings if travelling from a Northerly direction. They must travel an extra 1.2km if they want to travel in a Southerly direction. Residents in the Mullaghnabreena area must also travel approx 0.6km extra to reach their dwellings if coming from a Northerly direction. They must travel an extra 2.4km approx if they want to travel in a Southerly direction.

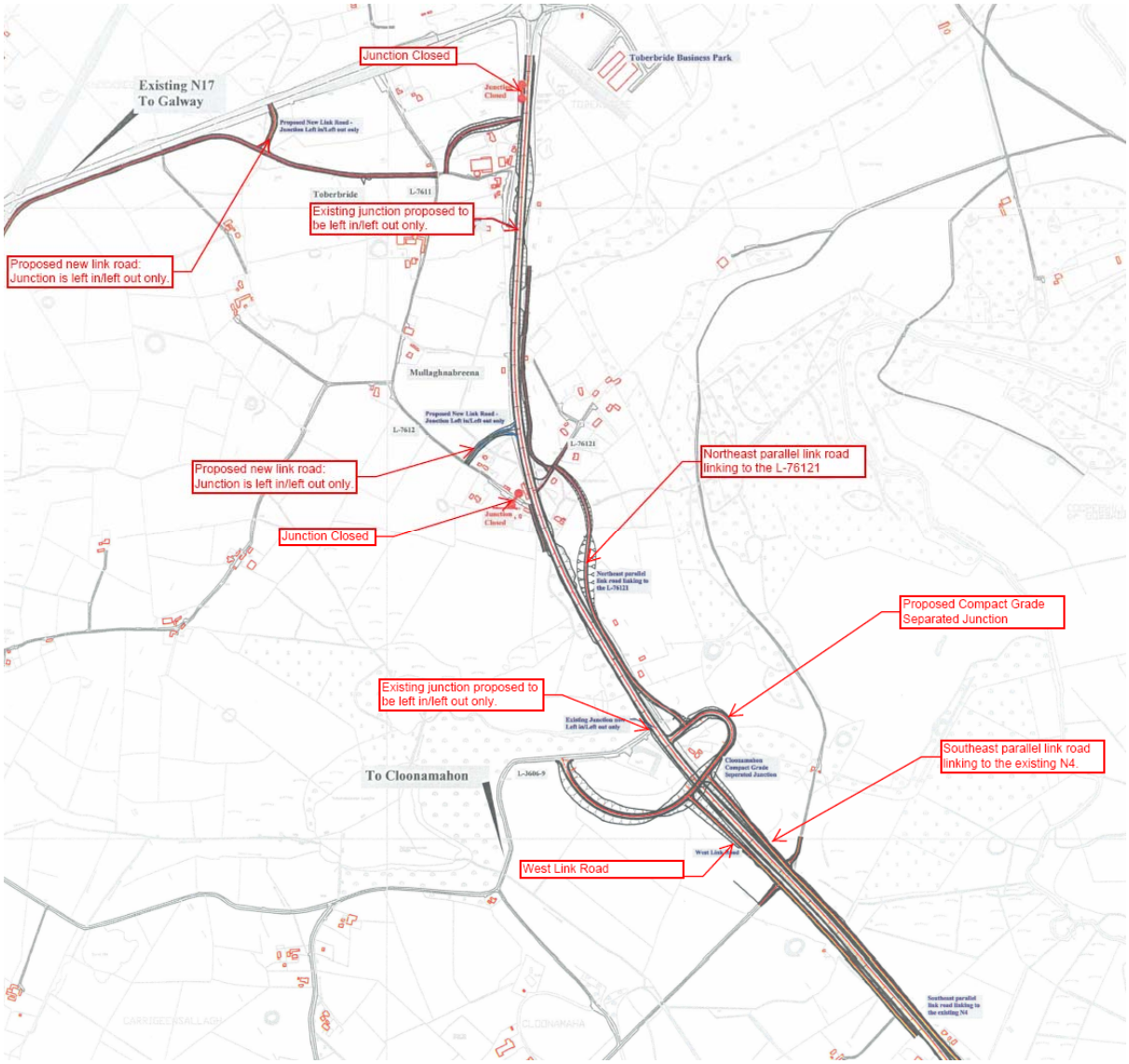
Local access to the townlands of Mullaghnabreena and Toberbride east of the N4 Mainline is provided by an existing junction to the L-76121 which is restricted to left in/ left out movement only. Therefore, a parallel

road to the mainline from the L-76121 to the proposed junction at Cloonamahan is required to provide full movements.

With Option A there would be a likelihood of a direct landtake impact on Markree Demesne.

From a value engineering comparative monetary perspective this option was valued at €7.5 million.

Figure 19-1: Initial Online Option A



19.2.1.2 Option B

Option B considered a link road parallel to the mainline on the east side which runs from Toberbride Business Park at the north end to the existing N4 at the south end. This provides the benefit of removing the aforementioned left in/left out junction at the L-76121 and therefore keeps local traffic separate from the mainline. There is minimal disturbance with regards distances which residents and the cosmetic business are required to travel in order to access the National Network. Community severance still remains an issue however as residents are required to travel an extra 2.4km if they wish to get to the opposite side of the mainline.

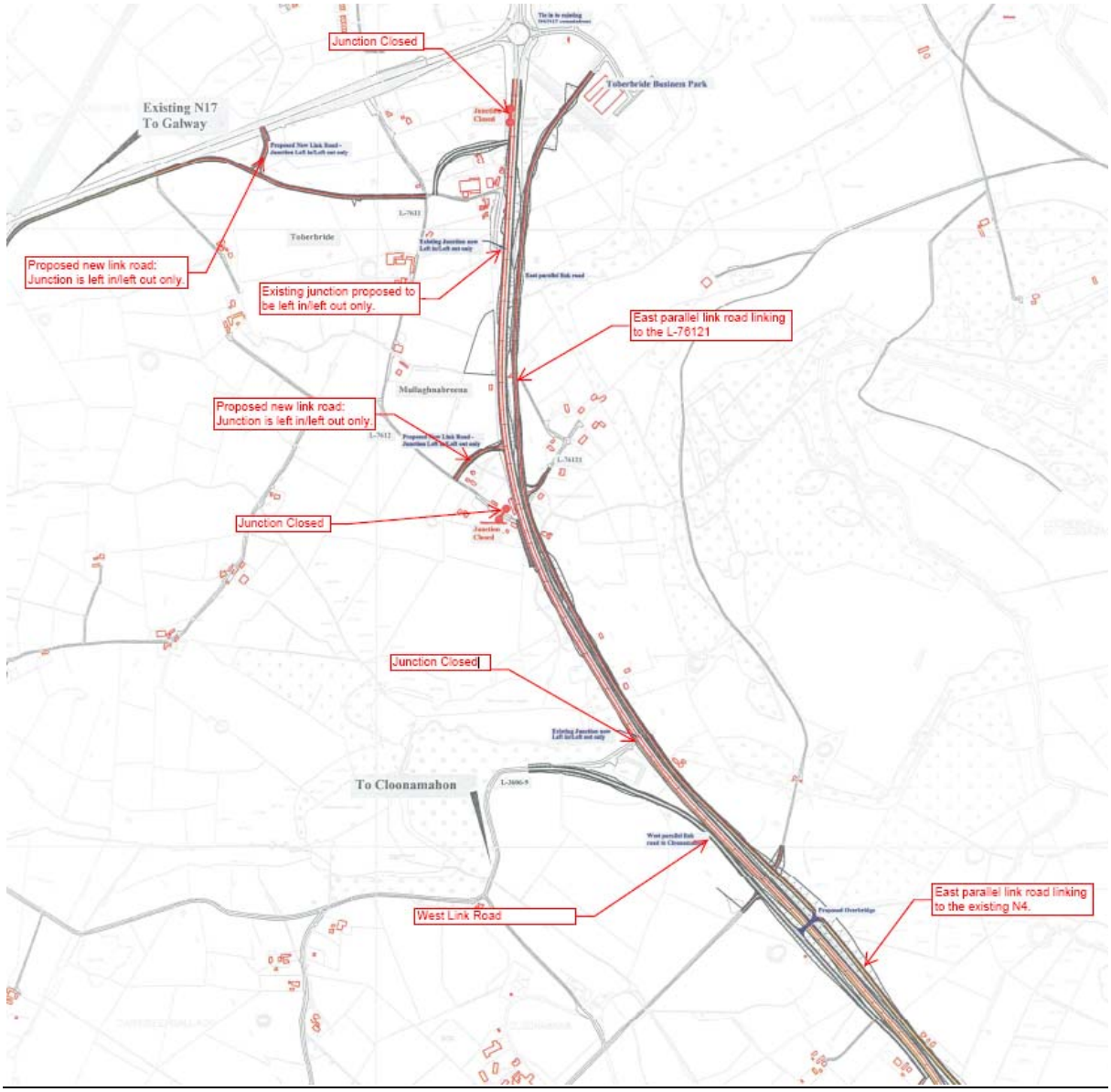
Local access to the townlands of Mullaghnabreena and Toberbride, west of the N4 Mainline is treated the same as with Option A.

Cloonamahan and surrounding areas west of the mainline would be served by an existing junction which would become left in/left out only and also an overbridge which connects the parallel link road on the east side of the mainline as discussed above to a parallel link road which is provided on the west side from the L-

3606-9 northwards to the townland of Doorly. With this arrangement all movements are catered for. However, Cloonamahan traffic coming from a Northerly direction must travel an extra 1.3km to reach its destination.

From a value engineering comparative monetary perspective this option was valued at €7.5 million.

Figure 19-2: Initial Online Option B



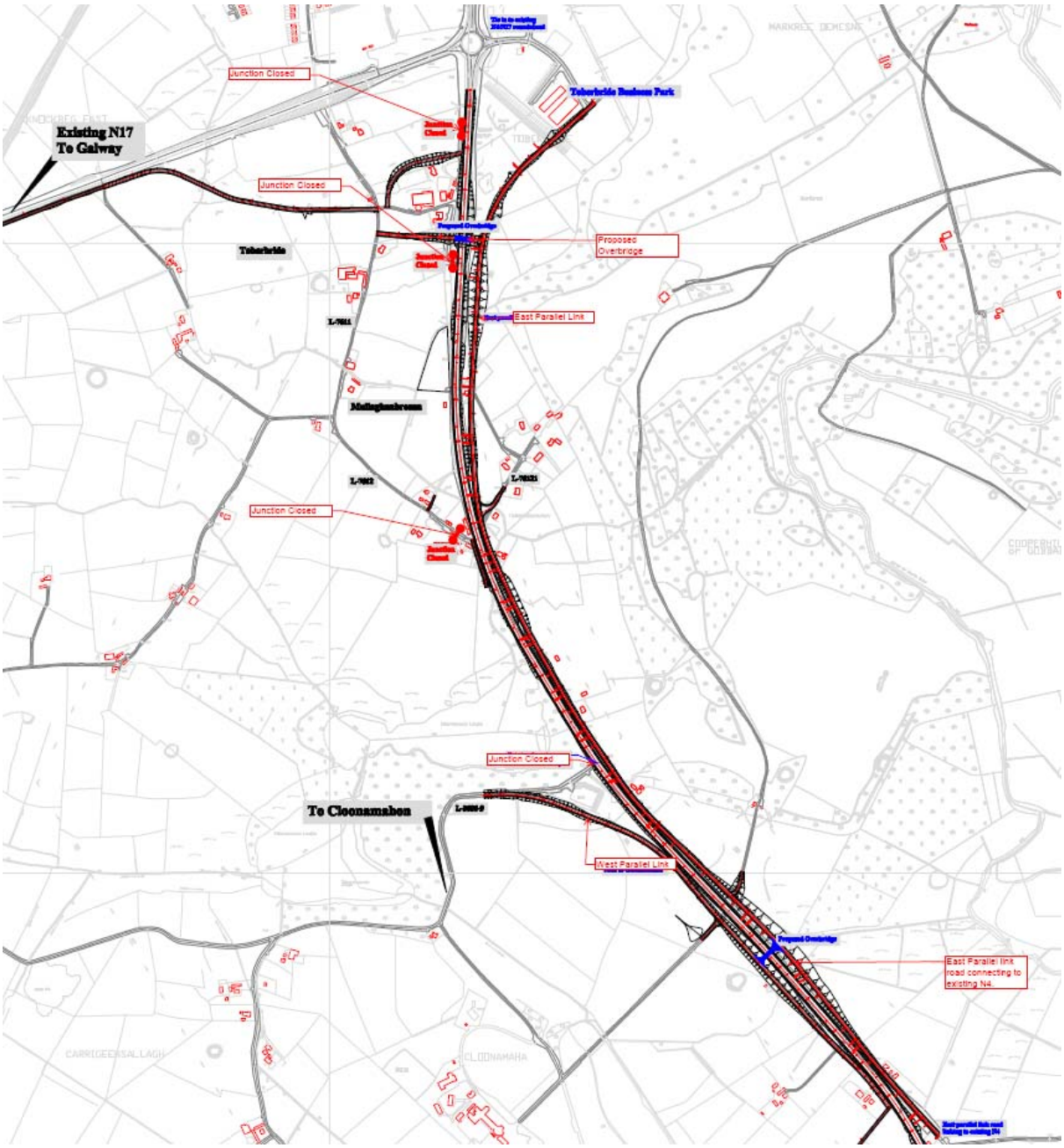
19.2.1.3 Option C

Option C is similar to option B except the townlands of Mullaghnabreena and Toberbride are served by an overbridge which runs from the parallel link road on the east side of the mainline to the L-7611 on the west. The three left in/left out junctions which are provided in both Option 1 and 2 can be removed as this bridge gives full movement to residents in this area. It also mitigates the community severance to some degree as an east west link is provided between the communities. The distance to travel to the opposite side of the mainline is 1.0km as opposed to 2.4km for Option A and B. Journey lengths to and from Sligo remain similar to existing as the link roads provided are for the main part parallel to the mainline.

Cloonamahan and surrounding areas west of the mainline are served in the same manner as Option B.

From a value engineering comparative monetary perspective this option is valued at €8.65.

Figure 19-3: Initial Online Option C



19.3Determination of the Optimum Solution

The determination of the optimum solution considered the foregoing initial assessment. The assessment process is outlined below which allowed the design to evolve iteratively.

19.3.1 Engineering Considerations

In terms of engineering considerations, it was considered given that each of the mainline proposals occur online, similar rankings would be attributable in terms of road geometry, drainage, utilities and ground conditions. Therefore the most significant comparable between each of the options was considered to be the proposal in terms of the network proposed/or the junctions provided. Section 19.3.1.1 below provides the engineering assessment in terms of junctions.

19.3.1.1 Junctions

In terms of the road network proposed; the objective was to achieve a network which would separate the local network from the national network and to provide a layout in accordance with NRA TD10/07 which would minimise the number of junctions.

The option which does this most effectively is Option C, followed by Option B and then Option A.

Table 19-1: Online Upgrade: Road Network Comparison

Option	Comments	Rank/Score
Option A	Option A; requires the provision of 5 no. left in/left out junctions	3
Option B	Option B; requires the provision of 2 no. left in/left out junctions	2
Option C	Option C; requires the provision of 1 no. left in/left out junction	1

Considering the foregoing Option A would require the most number of direct accesses to the national network. However, of the 5 direct accesses proposed on the section, 2 are part of a possible CGSJ in the townlands of *Ardcurley/Mullaghnabreena.* The provision of such a junction would in itself require extensive engineering works which would include an overall link length of nearly 1000m (national to local traffic) to enable traffic on the south bound lane of the dual carriageway to transfer to the north side and *vice versa.* Furthermore, in a base year of 2012 there is only circa 800 AADT estimated to be on the L3609-9. Considering this link alone this is below the recommended 1000 AADT outlined in NRA TD10/07 for the provision of a Compact Grade Separated Junction. Additionally, it was considered that the additional circa 2700 AADT on the eastern side could be catered for with a similar journey pattern via the provision of a parallel link road similar to that shown in options B and C.

19.3.2 Economic Considerations

In economic terms a comparable exercise which is outlined in sections 19.2.1.1 to 19.2.1.3 revealed that Option C would be the most expensive to construct. This is mainly due to the provision of the overbridge in Toberbride and the eastern and western parallel link roads being provided.

Table 19-2: Online Upgrade: Economic Comparison

Option	Rank/Score
Option A	1
Option B	1
Option C	3

19.3.3 Environmental Considerations

Considering the mainline remains online over the length of the upgrade the main comparatives from an environmental perspective relates to those side roads proposed. In this regard the degree of impacts between each of the possible options was considered to be minimal in nature and thus in the main not requiring specialist input. However, as a vast array of baseline information was available from draft EIS studies it was possible to undertake a comparative exercise which is described below and which was useful in determining any negative impacts.

19.3.3.1 Archaeology

Although there is very little difference between each of the options from an Archaeological perspective, it is considered that all options are generally similar as:

- Option A would impact directly on Markree Demesne and numerous sites of cultural heritage potential;
- Option B would impact on recorded monument SL 026-026 and numerous sites of cultural heritage potential ; and

- Option C would impact on recorded monument SL 026-164 and numerous sites of cultural heritage potential.

Table 19-3: Online Upgrade: Archaeological Comparison

Option	Rank/Score
Option A	2
Option B	2
Option C	2

19.3.3.2 Ecology

From an ecological perspective the most sensitive sites in the vicinity of the online upgrade include the Toberscanavan Loughs undesignated ecological site and its outflow stream (Markree Demesne Stream). As all routes remain online in proximity to the Lough it was considered that there would be little difference in terms of impacts on the loughs. However, as the north eastern link of Option A crosses the sensitive section of the Markree Demesne Stream it is likely that this option would provide a slightly greater impact than the other 2.

Table 19-4: Online Upgrade: Ecological Comparison

Option	Rank/Score
Option A	2
Option B	1
Option C	1

19.3.3.3 Agriculture and Non Agricultural Property

The main difference between each of the options is considered to be the additional agricultural and non-agricultural landtake potentially required in Ardcurley and Toberbride. This additional land take would be required for the provision of a possible CGSJ.

Table 19-5: Online Upgrade: Agriculture and Non-Agriculture Comparison

Option	Rank/Score
Option A	2
Option B	1
Option C	1

19.3.3.4 Air Quality and Climate

There would be expected to be little or no difference between each of the route options in terms of Air Quality Impacts.

19.3.3.5 Noise and Vibration

Impacts from a noise and vibration perspective are generally similar with the exception of differing impacts in the vicinity of Toberbride Business Park and in the townland of Mullaghnabreena. In the case of Option A it is expected that there would be greater impacts as a result of the increased proximity of the adjacent parallel link to a cluster of residential properties to the north. Similarly options B and C provide for the introduction of circa 3000 AADT to the Toberbride Business Park which will increase noise impacts in this area. Considering the increased night time sensitivity of residential properties the impact of Option A is considered to be slightly greater than that introduced to the Business Park.

Table 19-6: Online Upgrade: Noise & Vibration Comparison

Option	Rank/Score
Option A	3
Option B	2
Option C	2

19.3.3.6 Landscape

Generally as each option would introduce relatively modest sections of new cuts and fills to the proposed new side roads it is considered that there is relatively little difference between each option.

19.3.3.7 Soils and Geology

Similar to other sections earthworks impacts resulting from each of the various options are considered to be similar.

19.3.3.8 Hydrology, Hydrogeology & Flooding

Similar to other sections earthworks impacts resulting from each of the various options are considered to be similar.

19.3.3.9 Socio economic/ Community

The main Socio Economic impacts arising from each of the proposals would generally relate to community severance and changes to journey times. Due to the fact the Type 2 Dual Carriageway by its nature will not allow traffic to cross means that community severance is unavoidable in each of the various options.

19.3.3.9.1 *Option A*

19.3.3.9.1.1 *Properties currently served by the L7611 and the L7612*

Properties in this area would connect to the north bound lane in a similar fashion to their current points of access albeit with a small deviation in the access points. However; they would have to travel north to the exiting N4/N17 roundabout to access the southbound lane of the Dual Carriageway (additional trip of 300m for the L7611-0 and 1800m for the L7612-0. Similarly to access the L3606-9 they would have to travel north to the N4/N17 roundabout and then south to the CGSJ where they would have to travel through an additional link of c. 800m.

19.3.3.9.1.2 *Properties currently served by the L76121*

Properties in this area would via a left in /left out access continue with their existing southbound trip patterns, however in order to access the L3606-9 they would have to travel around the link of the CGSJ.

For north bound movements they would similarly have to travel south to the possible CGSJ in Ardcurley/Cloonamahan to access the N4, an additional trip length of c. 1650m.

19.3.3.9.1.3 *Properties currently served by the L3606-9 and L14019-0*

Properties in this area would be served by a CGSJ with traffic from the L14019-0 having to travel north to connect with the N4. The main impact would be to traffic on the L14019-0 which would have an additional trip of c. 890m to travel north bound and c. 690m to travel south bound.

Traffic travelling south from the L3606-9 would have to travel across the proposed N4 via a new Compact Connector Road which would add circa 600m to their journey.

19.3.3.9.2 *Option B*

19.3.3.9.2.1 *Properties currently served by the L7611 and the L7612*

Properties in this area would connect to the north bound lane in a similar fashion to their current points of access albeit with a small deviation in the access points. However; they would have to travel north to the exiting N4/N17 roundabout to access the southbound lane of the Dual Carriageway (additional trip of 300m for the L7611-0 and 1800m for the L7612-0. To access the L3606-9 they would have to travel north to the N4/N17 roundabout, through the Toberbride Business Park, then south via the parallel link to an overbridge in Cloonamahon, followed by a northern movement south on the western parallel link representing a total additional trip of c. 2150m.

19.3.3.9.2.2 *Properties currently served by the L76121*

Properties in this area would via the provision of an eastern parallel link continue their journey patterns in the wider sense in a fashion to what they currently undertake (i.e. utilising the existing N4). They would however have increased journey times to reach communities on the western side of the proposed N4 (additional trip of c. 1600m for the L3606-9 and c. 400m for the L7611-0).

19.3.3.9.2.3 *Properties currently served by the L3606-9 and L14019-0*

Properties in this area would be served by a possible overbridgebridge in the townland of Cloonamahan. They would have to undertake a journey of 1km southbound to connect to the eastern parallel link which would allow them to continue their southbound journeys as they currently do. North bound journeys would be similar to current patterns.

19.3.3.9.3 *Option C*

19.3.3.9.3.1 *Properties currently served by the L7611 and the L7612*

Properties in this area would connect to the north bound lane in a similar fashion to their current points of access albeit with a small deviation in the access points. Southbound trips would be similar to their current pattern of travel as they could utilise the overbridge in Toberbride and the eastern parallel link, alternatively they could travel north to the existing N4/N17 roundabout and then travel south.

To access the L3606-9 they would have to utilise the overbridge in Cloonamahon to connect with the western parallel link, an increased trip of c. 800m

19.3.3.9.3.2 *Properties currently served by the L76121*

Properties in this area would via the provision of an eastern parallel link continue their journey patterns in the wider sense in a fashion to what they currently undertake. They would however have increased journey times to reach communities on the western side of the proposed N4 (total increase of c. 1200m).

19.3.3.9.3.3 *Properties currently served by the L3606-9 and L14019-0*

Properties in this area would be served by a possible overbridge in the townland of Cloonamahan. They would have to undertake a journey of 1km southbound to connect to the eastern parallel link which would allow them to continue their southbound journeys as they currently do. The total increase in north bound journeys would be circa 2km.

19.3.3.9.4 *Ranking*

Ranking in terms of Socio Economic impacts is described below.

Table 19-7: Online Upgrade: L7611/L7612 Community Severance/Journey Time

Option	Rank/Score
Option A	3
Option B	3
Option C	2

Table 19-8: Online Upgrade: L76121 Community Severance/Journey Time

Option	Rank/Score
Option A	3
Option B	2
Option C	2

Table 19-9: Online Upgrade: L3606-9/L14019-0 Community Severance/Journey Time

Option	Rank/Score
Option A	2
Option B	3
Option C	3

19.3.4 Consultation

During the assessment described above, informal consultation was undertaken as far as was practicable between the project liaison officer and the adjacent properties. This resulted in considerations such as the following:

- In the case of Option A Residents and a cosmetic business to the east of the proposed route in the townland of Mullaghnabreena expressed grave concerns regarding the extra distance (2.4km) which they would be required to travel if they wished to go in a Northerly direction and have also suggested it would cause large community severance;
- A number of residents signed a petition stating their preference for an overbridge in the townland of Toberbride. They also requested the potential for a footbridge be examined across the existing N17, although 1 residential property had grave concerns in relation to privacy issues which this would create;
- A equestrian centre in Toberbride has raised ongoing concerns in relation to direct impacts associated with the road upgrade.

19.3.5 Establishment of the optimum design

19.3.5.1 Junctions and Parallel Links

19.3.5.1.1 *Overview*

From the initial options described the design evolved based on the information gathered during the progressive assessment undertaken. This revealed that certain aspects of each option as described above lent themselves to more viable solutions. In this regard the optimum design was established by dividing each of the aforementioned Options (A to C) into segments.

As the main considerations in establishing the optimum design relate primarily to the access of and the network proposals for the local road network; the options were assessed initially in terms of the strategy to be adopted. This indicated that the provision of junctions should be limited considering that their provision comprises the safety objectives of the Proposed Road Development. Additionally it was noted during the assessment that many of the direct accesses considered in the initial stages which although providing access to one direction of travel on the proposed N4 would in most cases require considerable additional journey lengths in the opposite sense. In this regard the optimum proposal was established to be one which separates the national traffic from the local traffic comprising western and eastern parallel links.

19.3.5.1.2 *Junctions*

On the basis of the conclusion made in section 19.3.5.1.1 the independent left in/left out junctions were deemed more appropriate to be closed with alternative links provided.

The proposed CGSJ was examined separately and was generally not considered viable considering the:

- The low volume of traffic on the L3606-9;
- The fact that in the event of an eastern parallel road being proposed the traffic to be accommodated from the exiting N4 could be catered for via the proposed link into the existing N4/N17 roundabout. For this traffic this represents a shorter and more straight forward trip than utilising any such proposed CGSJ;
- The lands required for the Compact Connector link of the proposed junction would impact directly on the lands of Markree Demesne and would require a considerable engineering link which would require a considerable cut into an adjacent drumlin.

19.3.5.1.3 *Parallel links and reconnection of the road network*

The provision of independent parallel links will mostly impact on properties wishing to traverse from the east to the west side of the proposed road development. However, considering the divided nature of the road proposed and the convoluted nature of the alternative CGSJ, it was considered that the proposal is no greater a community severance issue than the alternative. In addition positive benefits are demonstrative insofar as traffic will be diverted from direct isolated access points to a concentrated point at the existing N4/N17 at Collooney/Toberbride.

19.3.5.2 Local Road Network

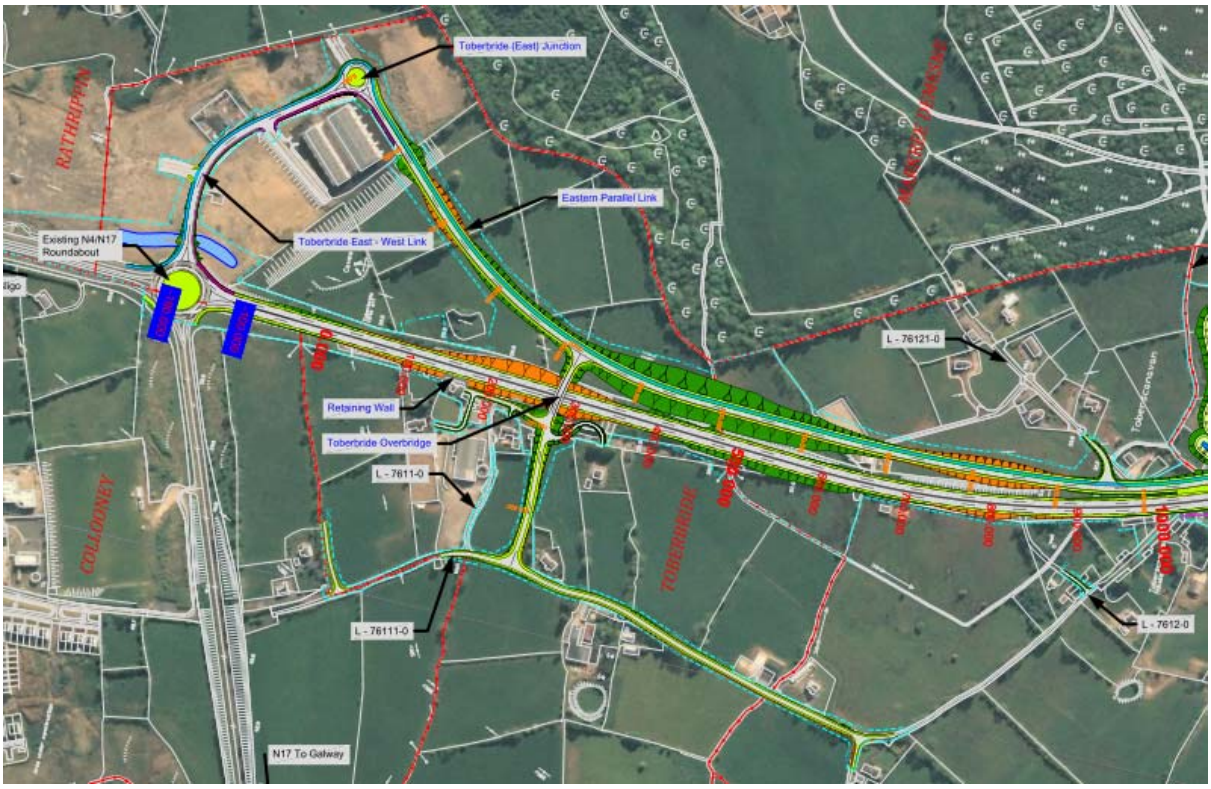
19.3.5.3 L7611-0/L7612-0

In terms of dealing with the journey patterns and direct access to the L7611-0, Option C of the initial options was considered to be the optimal choice, this was considering a direct left in/left out access was provided for north bound traffic while an overbridge in the townland of Toberbride would provide access to the east bound link which would in turn provide access to the existing N4 hinterland and that traffic on the L3606-9. Considering that the direct left in/left out accesses are not now being proposed (section 19.3.5.1.1) at the L7611-0 and the L7612-0, the overbridge will act as the main link to the national and local road network. Although this will create additional journeys for some traffic it will have the benefit of reducing two number direct accesses to the national primary route.

19.3.5.1 L76121-0

In terms of dealing with the journey patterns and direct access to the L76121-0, Options B and C of the initial options were considered to be the optimal choice. In this regard considering the eastern parallel road is being proposed, this arrangement was incorporated into the design.

Figure 19-4: Proposed Treatment of the L7611-0, L7612-0 and the L76121-0



19.3.5.1 L3606-9 and L14019-0

The arrangement for the L-3606-9 and the L14019-0 were dictated again by the preference to provide independent parallel links and to close existing left in/left outs. The sweeping curved realignment of the L3606-9 was also re-examined as this:

- Would impacted directly on a possible upgrade to the adjacent transient site;
- would create a dangerous point on the local road to the west where a newly designed section would tie into an existing very poor horizontal section of the local road;

It was felt considering the low speed nature of the local that a compact roundabout north of the aforementioned transient site would adequately cater for movements from the L3606-9 onto the proposed western parallel link. The L14019-0 would be collected as part of the western parallel link arrangement. These roads would then be reconnected to the local network via an underbridge proposed at circa Ch. 2500m. This underbridge replaces the previously proposed overbridge which was been inverted due to a change to the vertical alignment further south.

Figure 19-5: Proposed Treatment of the L3606-9 and the L14019-0.

v. Appendices

20 Appendix 1: Figures