N4 Mullingar to Longford (Roosky)

Route Corridor Selection Report

Volume I

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Glossary

Amber Listed species	Amber Listed species meet at least one of the following criteria: ▪ A breeding decline of 25-50 per cent has been experienced within the last 25 years. ▪ The species has been identified as a rare breeding species or sporadically breeding. ▪ The breeding and/or wintering population of the species has been recognised as internationally important and/or localised. ▪ In Europe, their conservation status is important.
Appropriate Assessment	Appropriate Assessment is a requirement of the European Habitats Directive. Its purpose is to assess the impacts of the plans and projects of a development on internationally designated nature conservation sites.
Archaeological Constraint Area	The archaeological constraint area is an area outlined in black on the accompanying RMP maps, which hypothetically encloses each site. This area is deemed by the National Monuments Service to have archaeological potential.
Arterial Drainage Scheme	River which has been drained by the OPW and whoce maintenance for drainage purposes rests with the OPW.
Bailey	Defended courtyard of a castle, whether of earth or timber or of stone.
Barony/Paris/Townland	These terms refer to land divisions in Ireland. The barony is the largest land division in a County, which is formed from a number of parishes. These parishes are in turn made up of several townlands, which are the smallest land division in the county. The origins of these divisions are believed to be in the Early Medieval/Christian Period (AD500-AD1000), or may date earlier in the Iron Age (500BC-AD500)
Barrow	A bronze age burial mound, often of varying shape and size, sometimes characterised by an inner FOSSE and exterior bank.
Bawn	BAILEY or WARD, defended courtyard of castle, fortified house or abbey. In an Irish context used mainly for late medieval tower houses and fortified houses.
Benefiting Land	Land which has benefited from a drainage scheme.
Bronze Age	Period of Irish Prehistory dating to between (c. 2500 – c. 500BC).
Cairn	A mound of stones.
Cashel	Monument similar in type to an earthen ringfort (see below) but enclosed by walls of drystone construction; usually referred to as cashels, although cahir and dun are also used popularly and in placenames. While some stone built circular enclosures have been dated to the late bronze age (1000 – 600 BC), the bulk of these monuments are probably merely the stone equivalents of the earthen ringforts and date to the same period.

Catchment	The land area contributing to flow at a point in a river.
Catchment Area	Area of land over which all water drains into a river, reservoir or other water body.
Cist	A stone-lined grave, usually built of slabs set upright to form a box-like construction and capped by a large slab or several smaller lintels. Use of cists for burial begins during the Bronze Age (2400 – 600 BC).
CLÁR	Programme designed to tackle the problem of depopulation, decline and lack of services in rural areas.
Coarse fish	Freshwater fish other than salmonids.
Confluence	The point where a tributary meets the main stream of a river.
Crannóg	A crannog is a lake habitation site, found either on the lake shore or an island, which can be either artificial or natural, Lacey et al, (1983, 104). These sites have been known to date to the Mesolithic period (c. 7,000-5500BC, Waddell, 1998, 11), and occur in Ireland until at least the 16th century, Lacey et al, (1983, 104). Crannógs are most commonly associated with the early medieval period, although artefacts found during field walking and excavation of Crannógs have revealed occupation as early as the Mesolithic and Bronze Age and as late as the 16th Century in Ireland and post-medieval period in Scotland, Lacey, (1983, 104). Although sometimes located on natural islands, Crannogs are generally constructed on entirely artificial foundations and approached by boat, causeway or wooden bridge (Edwards 1996, 34).
Demesne	The land attached to a manorial house or other landed property.
Designated sites	Nature conservation sites containing important habitats or species may be designated at an international, national or local level. This affords them the appropriate level of protection.
Drainage District	Rivers which are under the control of trustees (usually a local authority) for drainage purposes.
Earthworks	Archaeological site types constructed of earthen material, which cannot be assigned to a classification. Often this is due to an unconventional morphology, as a result of damage or subsequent modification, whilst some may simply be natural features.
Enclosure	Any monument consisting of an enclosing feature, such as a bank or a ditch, usually earthen, such as barrows or ringforts.
Extended Phase 1 walkover survey	Initial ecological survey of a site, encompassing both botanical and protected species elements, to map the habitats and assess the ecological constraints associated with a site.
Flightlines	Linear routes used by birds and bats in flight for migrating, commuting or foraging. Often follow linear features such rivers, treelines, woodland edges or roads.
Floodplain	Any normally dry land area that is susceptible to inundation by water from any natural source.
Fosse	A ditch or moat surrounding a defended or enclosed area.

Fragmentation	The breaking up of habitats or home ranges used by species.
Fulacht Fiadh (singular) / Fulachta Fiadh (plural)	These sites are regarded as ancient cooking places, sometimes referred to as burnt mounds, which date to the Bronze Age (2400 – 600 BC). A fulacht fiadh consists of a horse-shoe or kidney shaped mound of fire cracked stone, surrounding a slight hollow in which either a clay lined pit or wood lined trough is normally found. They are usually located in low-lying areas near a water source, often in clusters.
Holt	Resting place of otters, usually underground in roots of trees, piles of logs, caves or drains. Holts used to rear young are known as 'natal holts'.
Irish Wetland Bird Survey (I-WeBS)	Comprises winter counts of wetland bird species between September and April.
Iron Age	Period of Irish prehistory dating to between c. 500BC – c.400AD.
Medieval Earthworks	Generally, these are earthen monuments, such as a motte, a large flat-topped mound constructed by the anglo-normans to defend their territories. The summit was further enclosed by a bailey, which is a defensive courtyard, whether of earth or timber or stone, that protects a castle or bretasche (a wooden watchtower). See also ringwork.
Mesotrophic	Lake or other water body having moderate nutrient concentrations.
Mitigation	Reduction, making less severe; in the context of this document, lessening the impact of the quarry on the environment.
Natura 2000	Natura 2000 is the centrepiece of EU nature & biodiversity policy. It is an EUwide network of nature protection areas established under the 1992 Habitats Directive. The aim of the network is to assure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs) which are designated under the 1979 Birds Directive.
Natural Heritage Area (NHA)	NHAs are designated under the Wildlife Act 1976, and Wildlife (Amendment) Act 2000. Sites are designated if they are considered to support habitats or species of national importance in Ireland. Sites which have not completed the designation process are known as pNHA, proposed Natural Heritage Area.
Neolithic Period	Period of Irish prehistory dating to between c. 4000BC -c. 2500BC.
Oligotrophic	Lake or other water body having extremely low nutrient concentrations.
Order (Rivers)	The river order is a measure of how often the channel branches upstream.
Post-Medieval Period	After the medieval period, normally accepted as everything post-1600 AD.
Protected species	A species which is afforded protection under national (Irish) or

	international legislation.
Ramsar Sites	Ramsar Sites are designated under the Convention on Wetlands, 1971. The Convention is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
Record of Monuments and Places (RMP)	This is a list of archaeological sites whose precise location is known to the National Monuments Service and are consequently afforded protection by law, through the National Monuments Acts (1994). Back-up files of the Sites and Monuments Record also provide detail of documentary sources and field inspections where these have taken place.
Red Data Book Status – Endangered	The IUCN (World Conservation Union) has categorised species into a number of categories reflecting their conservation status. 'Endangered' species are those in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that may be extinct but have definitely been seen in the wild in the past 50 years.
Red Data Book Status – Vulnerable	The IUCN (World Conservation Union) has categorised species into a number of categories reflecting their conservation status. 'Vulnerable' species are those believed likely to move into the 'Endangered' category in the near future if the causal factors continue operating. Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.
Red Listed species	Bird species of conservation concern are determined by a number of criteria that categorise a species as Red, Amber or Green Listed. Red Listed species have been identified as meeting at least one of these criteria: ▪ More than a 50 per cent decline has been experienced in breeding population range over the last 25 years. ▪ Since 1900, a significant decline in the breeding population has been seen. ▪ The species is recognised as being of global conservation concern.
Revetment	A retaining wall of masonry or timber to support a bank of earth or rubble and avoid erosion.
Ringfort	Roughly circular enclosure delineated by a bank and ditch. Regarded as defended family homesteads and were constructed to protect farmsteads. The extant dating evidence suggests they were primarily built between the 7th and 9th centuries AD. These are the most frequently recorded archaeological site type and c.50, 000 examples are recorded in the Irish landscape.

Ringwork	Earthen enclosures, contemporary with the anglo-norman motte and bailey, yet not as common. Their remains consist of a raised platform, usually circular, but occasionally subrectangular, enclosed by a bank and fosse and could easily be mistaken as a ringfort or some other type of Early Christian Enclosure. They often have a causewayed entrance, which was stone-lined. The banks are frequently stone-faced and in some instances are topped with low walls, which were probably the foundations for a wooden wall or palisade. A strong timber gate-tower would have guarded the entrance and a bretasche (wooden watchtower) would have occupied the interior.
Souterrain	Artificial underground structures, usually built of dry stonewalling and containing passages and chambers. They are most commonly found in association with early medieval habitation sites.
Spawning	Spawning is the term used to describe the laying and fertilising of eggs by fish, amphibians and molluscs.
Special Area for Conservation (SAC)	SACs are designated under the EU Habitats Directive (92/43/EEC), as transposed into Irish law in the European Union (Natural Habitats) Regulations of 1997. A cSAC is a site that has been submitted to the European Commission but has not been formally adopted.
Special Protection Area (SPA)	SPAs are designated under the EU Wild Birds Directive (79/409/EEC). Sites are designated for their role in supporting internationally important populations of one or more wild bird species identified under the legislation. Sites may be designated on the basis of being used by breeding, feeding, roosting or over-wintering birds.
Statutory Nature Reserve	Statutory Nature Reserves are designated by Ministerial Order, under legislation contained within the Wildlife (Amendment) Act, 2000 on the basis of containing species of plants and/or animals considered to be of National Importance.
Sub-Basin	The land area directly contributing to flow along a length of river.
Sub-Catchment	A portion of a catchment, usually the area contributing to a tributary of the main river.
Wild Birds Directive	Adopted by the European Community as the 'Council Directive 79/409/EEC on the conservation of wild birds' in response to the 1979 'Bern Convention on the conservation of European habitats and species' and known as the Wild Birds Directive. The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe.

Abbreviations

AADT	Average Annual Daily Traffic (2 way combined flow in vehicles per day)
AAP	Area of Archaeological Potential
AD	Anno Domini
AFT	An Foras Talúntais
AH	Archaeological Heritage
AL	Argillaceous Limestones
AOD	Above Ordnance Datum
ARC	Archaeological Resolution Contract
BA	Ballysteen Formation
BC	Basal clastics
BGL	Below Ground Level
BH	Built Heritage
BMW	Border, Midland and Western
C_6H_6	Benzene
CA	Coronea Formation
CAD	Computer Aided Design
CAF	Common Appraisal Framework
CDP	County Development Plan
CGS	County Geological Sites
CO	Carbon Monoxide
Co.	County
CO_2	Carbon Dioxide
cSAC	candidate Special Area of Conservation
CSO	Central Statistics Office
CT	Carrickateane Formation
DB	Decibels
DB(A)	Decibels (adjusted)
DED	District Electoral Divisions
DMRB	Design Manual for Roads and Bridges (NRA)
DoEHLG	Department of Environment, Heritage and Local Government
DV	Derravaragh Chert
EC	European Community
ED	Electoral Division
EIA	Environmental Impact Assessment

EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPGs	Environmental Planning Guidelines (NRA)
EPRC	Emerging Preferred Route Corridor
ESB	Electricity Supply Board
EU	European Union
FOSD	Full Overtaking Sight Distance
FT	Fearnaght Formation
GIS	Geographical Information System
GP	General Practitioner
GSI	Geological Survey of Ireland
ha	Hectares
HGV	Heavy Goods Vehicle
IFA	Institute of Field Archaeologists
IGI	Institute of Geologists of Ireland
IPPC	Integrated Pollution Prevention Control
I-WeBS	Irish Wetland Bird Survey
Km	Kilometres
LCC	Longford County Council
LI	Locally Important Aquifer which is Moderately Productive only in Local Zones
Lk	Locally Important Karst Aquifer
Lm	Locally Important Aquifer which is Moderately Productive
LU	Lucan Formation (Calp)
M	metres
M^3/sec	Cubic metres per second
ME	Meath Formation
MH	Moathill Formation
NDP	National Development Plan
NHA	Natural Heritage Area
pNHA	Proposed Natural Heritage Area
NIAH	National Inventory of Architectural Heritage
NMI	National Monument Inventory
NMU	Non Motorised User
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrous Oxides

NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NRDO	National Roads Design Office
NSS	National Spatial Strategy
OPT	Operational Programme for Transport
OPW	Office of Public Works
OSi	Ordnance Survey Ireland
PABS	Project Appraisal Balance Sheet
PAH	Polycyclic Aromatic Hydrocarbons
PAG	Project Appraisal Guidelines (NRA)
Pl	Poor Aquifer which is generally unproductive except for Local Zones
PIR	Potential Impact Rating
PRC	Preferred Route Corridor
PMG	Project Management Guidelines (NRA)
PM_{10}	Particulate Material
PRC	Preferred Route Corridor
RAPID	Revitalising Areas through Planning, Investment and Development
RCD	Road Construction Detail (NRA)
RCS	Route Corridor Selection
RIC	Royal Irish Constabulary
Rk	Regionally Important Karst Aquifer
RMP	Recorded Monuments and Places
RPG	Regional Planning Guidance
RPS	Record of Protected Structures
RSA	Route Safety Authority
SAC	Special Area of Conservation
cSAC	Candidate Special Area of Conservation
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SO_2	Sulphur Dioxide
SMR	Sites and Monuments Records
SPA	Special Protection Area
ShRFB	Shannon River Fisheries Board
SIRBD	Shannon International River Basin District
SUDS	Sustainable Urban Drainage Systems
TA	NRA Technical Advice Note
TD	NRA Technical Standard

TRL	Transport Research Laboratory
µm	Micron (1 x 10^{-6} m)
µg	Microgram (1 x 10^{-6} g)
VIS	Visean Limestone (undifferentiated)
WA	Waulsortian Limestones
WCC	Westmeath County Council
WFD	Water Frmework Directive
WWTP	Waste Water Treatment Plant

1 Executive Summary

This Route Corridor Selection Report describes the need for an upgrade of approximately 52km of the existing N4 National Primary Route between Mullingar and Roosky and the identified viable Route Corridor Options. The proposed N4 Mullingar to Longford (Roosky) forms part of the N4 National Primary Route which runs from Dublin generally in a northwesterly direction through Kinnegad, Mullingar, Longford, Carrick-on-Shannon and ends in Sligo Town. The scheme commences at the N4/R394 junction (Castlepollard Road), at the western end of the N4 Mullingar Bypass dual carriageway in the townland of Culleen Beg, County Westmeath and ends at the eastern end of the recently completed N4 Dromod Roosky Bypass, in the townland of Tomisky, County Longford.

This report has been written having regard to the National Roads Authority (NRA) Project Management Guidelines (PMG), 2000. The PMG defines the key phases of the project; Phase 1 comprises Overall Project Planning, Phase 2 Constraints Study and Phase 3 Route Corridor Selection. In Phase 2 the study area for the scheme is defined and the available data is gathered. The findings from the Constraints Study are presented in a separate Constraints Study Report. During Phase 3, initial route sections within the study area were developed using the information gathered during the Constraints Study together with further information gathered subsequently, for example from ground investigations. The initial aim in identifying potential route options was to avoid constraints wherever possible, although it was found that not all constraints could be entirely avoided due to the very high concentration of constraints in some parts of the study area. These potential route options were subject to initial appraisal in terms of their impacts on planning, socio-economics, agronomy, air quality, noise and vibration, cultural heritage, geology and hydrogeology, landscape and visual, hydrology and drainage and the natural environment. Those found to have the least adverse effects were incorporated into ‘end-to-end’ Route Corridor Options for further appraisal.

This report is structured to commence by describing the context of the scheme and its objectives in Chapter 2, followed by a summary of the development of the Route Corridor Options in Chapter 3. Chapters 4, 5 and 6 contain the appraisals of the Route Corridor Options. Chapter 7 describes the overall results of the Route Corridor Option appraisals. Chapter 8 describes how the Preferred Route Corridor (PRC) was

identified, taking into account feedback on the Emerging Preferred Route Corridor (EPRC), and also contains the final conclusions and recommendations.

The NRA Project Management Guidelines (PMG, 2000), Environmental Assessment and Construction Guidelines including Environmental Planning Guidelines (EPGs, issued on various dates) and the Project Appraisal Guidelines (PAG, 2008) outline the requirements for Route Corridor Option appraisals which, together with feedback from the public and consultees, form the basis for recommendations for an Emerging Preferred Route Corridor (EPRC) and the Preferred Route Corridor (PRC).

The need for the scheme can be defined in two ways; firstly by the level of service which this section of the N4 provides at the present time and would provide in the future if it were to remain unimproved (i.e. the Do-Nothing scenario) and secondly through the aims of a range of national, regional and local plans and policies which strive for increased economic development, increased prosperity and improved accessibility. In many of these plans and policies improvements to the N4 route and to the road network in general, are mentioned as being necessary to deliver these aims.

The minimum acceptable level of service for a national primary route is level of service 'D', which generally equates to an average journey speed of 80 kph and an Average Annual Daily Traffic (AADT) flow of up to 11,600 vehicles per day on a single carriageway road. The existing traffic flows on the N4 already exceed 11,600 vehicles per day on sections of the route and by 2035, Do-Nothing forecasts indicate that it is likely that traffic flows will exceed this figure on the majority of the route between Mullingar and Tomisky.

In several places the existing N4 road has a sub-standard alignment for a 100kph speed limit, particularly in terms of the required minimum Full Overtaking Sight Distance, which is the distance of clear visibility ahead which a driver requires to see oncoming traffic and carry out a safe overtaking manoeuvre on a single carriageway road, using the opposing traffic lane. There are many at-grade junctions and direct accesses along the route. Severe and fatal accidents have been recorded at several locations along this section of the N4.

The following transport plans and policies are relevant to this scheme:

- The National Development Plan, 2007 – 2013
- The National Development Plan, 2000 – 2006
- Transport 21 Policy, 2006 - 2015
- The National Spatial Strategy, 2000 – 2020
- The National Roads Needs Study, 1998
- Westmeath County Development Plan, 2008 – 2014
- The Longford County Development Plan 2009 - 2015
- The Border, Midland and Western Operational Programme, 2007 - 2013
- Midland Regional Authority, Regional Planning Guidelines

The overall scheme objectives have been developed from the 5 criteria presented in the Department of Transport's Common Appraisal Framework (CAF), transposed for major road projects through the PAG. The five criteria are:

- **Economy**
- **Safety**
- **Environment**
- **Accessibility and Social Inclusion**
- **Integration**

The scheme will join two existing dual carriageway sections of the N4 route; the Type 1 dual carriageway N4 Mullingar Bypass at the R394 Castlepollard Junction and the recently completed Type 2 dual carriageway N4 Dromod-Roosky Bypass at Roosky. Studies carried out between 2005 and 2007 concluded that a Type 3 dual carriageway (also known as 2+1) would not provide sufficient capacity between Longford and Mullingar. Furthermore, these studies indicated that the severity of constraints was such that upgrading the existing road to the appropriate standard would not be feasible and that any suitable upgrade would be mostly off-line. Further work undertaken and summarised within this report has established that on-line widening is not feasible along the entire length of the route and is feasible along only a few short sections between Mullingar and Roosky due to the frequency and severity of constraints. Consequently, the Route Corridor Options include sections of on-line

widening where feasible, but in most places it is necessary for the Route Corridors to run off-line to avoid the constraints.

Three potential Route Corridor Options (Route Corridor Options 1, 2 and 3) between Mullingar and Roosky were displayed at the public exhibitions in September 2008 together with various alternative links. The feedback from the exhibitions was assessed. Following the exhibitions, three additional Route Corridor Options (Route Corridor Options 4, 5 and 6) were subsequently identified between Mullingar and Roosky, which included parts of the Route Corridor Options and some of the links shown at the public exhibitions. Route Corridor Options 4 and 5 are the two outlying options around Longford Town. Route Corridor Option 6 was assembled from the best performing route sections in the initial appraisals. Appraisals of the Route Corridor Options under the five headline criteria of Environment, Safety, Economy, Accessibility and Integration were carried out in accordance with the PAG, and the results were presented in the Project Appraisal Balance Sheets (PABS), which are provided in detail in Appendix 1 of Volume II and are also summarised in Chapter 7.

The PABS presented in this report indicates that the Route Corridor Option No. 6 gave the best overall performance across the five criteria. Taking this into account together with the available feedback from the public consultations undertaken so far, the intial recommendation put forward was to present Route Corridor Option No. 6 as the Emerging Preferred Route Corridor (EPRC) for comment at a further set of exhibitions. Feedback on the EPRC was received following the exhibitions held in May 2009. This feedback was analysed and was used to inform the final recommendation in relation to the Preferred Route Corridor (PRC), which is given in Chapter 8.

2 Introduction and Scheme Context

2.1 Local Geography and National Road Network

The section of the existing N4 National Primary Route which concerns this proposed scheme is approximately 52km in length. The scheme will link two existing dual carriageway sections of the N4 route; the Type 1 dual carriageway N4 Mullingar Bypass at the R394 Castlepollard Junction and the recently completed Type 2 dual carriageway N4 Dromod-Roosky Bypass at Roosky. The scheme commences at the western end of the N4 Mullingar Bypass at the R394 Castlepollard Road junction, at Culleen Beg, Mullingar, County Westmeath. Mullingar is the administrative capital of County Westmeath and is one of the largest urban centres in the county. Mullingar is located approximately 80 km from Dublin and 46 km from Athlone. The N52 National Secondary Route bypasses the town to the east. The N6 National Primary Route meets the N4 at Kinnegad approximately 20 km to the south-east of Mullingar. Heading west from Mullingar, settlements along this section of the N4 include Bunbrosna, Ballinalack and Rathowen in County Westmeath and Edgeworthstown (where the N55 National Secondary Road crosses the N4), Longford Town (where the N5 National Primary Road and N63 National Secondary Road meet the N4) and Newtown Forbes in County Longford, as well as numerous other smaller settlements. The town of Longford is the administrative capital of County Longford. The N63 National Secondary Route meets the N5 National Primary Route in the centre of Longford Town and the N5 meets the N4 on the north-east side of the town. The town of Roosky in County Roscommon is the nearest settlement to the western end of the scheme, but the scheme termination point is located in County Longford. The scheme terminates at the Tomisky roundabout to the south-east of Roosky which was recently constructed as part of the N4 Dromod-Roosky Bypass scheme and lies in the townland of Tomisky, County Longford.

The National Spatial Strategy (NSS) identified eight Gateway locations in Ireland which have particular importance for regional development. Dublin and Sligo are the two Gateways at either end of the N4 National Primary Route and Mullingar is within a Linked Gateway comprising the towns of Mullingar, Athlone and Tullamore. The NSS and other local, regional and national plans and policies are described in further detail in sections 2.2.3 and 4.1.

2.2 The Need for the Scheme

Figure 2.2-1 N4 near Ballinalack

2.2.1 Capacity

The existing N4 National Primary Route between Mullingar and Roosky is a single carriageway road. The minimum acceptable level of service for a national primary route is level of service 'D', which is equivalent to an average journey speed of 80 kph. Where traffic flows on single carriageway roads exceed 11,600 vehicles per day (average annual daily traffic), average journey speeds tend to fall below 80kph and so the minimum acceptable level of service can no longer be assured. The 11,600 vehicle per day threshold is based on a modern single carriageway road type built with as few at-grade junctions and direct accesses as possible. This section of the N4 currently has numerous at-grade junctions, accesses and driveways along it and several sections with speed limits below 80kph where the road enters or is in proximity to built-up areas. All of these issues have the effect of further reducing the level of service which is provided.

There are three permanent Automatic Traffic Counters on the N4 at Roosky (now bypassed by the Dromod-Roosky Bypass), Longford and Mullingar. The Average Annual Daily Traffic (AADT) flows derived from these counters for 2003 (earliest year for which a 12 month dataset exists for all three sites) and 2007 (latest year for which a 12 month dataset exists for all three sites) are given in Table 2-2-1 below. The

Table shows that considerable growth has taken place along this section of the N4 route within the 5 year period.

Table 2.2-1 Comparison of Annual Average Daily Traffic (AADT) on the N4 for 2003 & 2007

Permanent Traffic Counter	2003 AADT (veh/day)	2007 AADT (veh/day)	% Increase in traffic volumes
Roosky (immediately south-east of Roosky)	6,565	8,083	23%
Longford (eastern end of Longford Bypass)	6,823	10,164	49%
Mullingar (Mullingar Bypass west of N52 Delvin Road junction)	13,221	21,377	62%

Three temporary Automatic Traffic Counters were installed on the N4 between Mullingar and Longford, which operated from 26th February 2008 to the 27th August 2008 at the sites identified in Table 2.2-2 below.

Table 2.2-2 Traffic flows from Temporary Traffic Counters on the N4, February to August 2008

Temporary Traffic Counter	Average Westbound 24 hr flow (veh/day)	Average Eastbound 24hr flow (veh/day)	Average of 2 way 24 hr total flow (veh/day)	Estimated AADT*
Site 1: to the west of the R198 roundabout near Longford Town	5,234	5,157	10,391	10,214
Site 2: to the east of the R393 roundabout near Longford town	8,160	7,671	15,831	15,562
Site 3: to the west of the R394 (Castlepollard Road) Junction near Mullingar	7,584	7,053	14,637	14,242

*Estimated AADT calculated from average total flow from TTC in period, multiplied by seasonality factors derived from 2008 data from nearest available NRA long-term counter.

In addition to the data gathered from the automatic traffic counters mentioned, various types of traffic surveys were carried out across the study area on the N4 and selected local and regional roads, within the period from late February 2008 to mid-May 2008. Neutral dates had to be selected for the surveys and so the Easter holiday period and May bank holiday when atypical traffic flows might be anticipated, were avoided. Further details of the types of traffic surveys carried out are provided in Chapter 6. During calibration and validation of the base model, very low variance between the traffic survey data captured was found.

Table 2.2-3 Summary of Annual Average Daily Traffic (AADT) Flows derived from 2008 Base Model

Link ID*	Road Section	AADT (Vehicles per day)
1	**N4:** between Roosky and Cloonart North	8,019
3	**N4:** between Cloonart North and Carrickmoyragh/Ballagh Bridge	7,963
5	**N4:** between Carrickmoyragh/Ballagh Bridge and Newtown Forbes	9,007
7	**N4:** between Newtown Forbes and L5019-0	10,532
8	**N4:** between L5019-0 and R198 Drumlish Road (Red Cow Roundabout)	10,129
9	**R198 Drumlish Road:** between N4 and L10182	9,013
10	**N4 Longford Bypass:** between R198 Drumlish Road and R194 Ballinalee Road	13,394
11	**N5 Ballinalee Road:** just south of N4	11,437
12	**R194 Ballinalee Road:** between N4 and Carrickglass	5,640
14	**N4 Longford Bypass:** between R194 and R393 (Dublin Road Roundabout)	10,885
17	**N63:** just south of Longford	10,107
18	**N4:** between R393 and Lissardowlan	14,716
19	**N4:** near Lissardowlan	14,485
20	**N4:** near Ballynagoshen	13,989
21	**N4:** just west of Edgeworthstown	13,989
22	**L-1091-0:** just north of Edgeworthstown	2,663
23	**N55 North:** just north of R395	5,031
24	**N55 North:** between Edgeworthstown centre and R395	6,682
25	**N4:** just east of Edgeworthstown	13,087
26	**R395:** near Edgeworthstown	1,663
28	**N55 South:** just south of Edgeworthstown	4,127
29	**N4:** near Rathowen	13,106
30	**N4:** near Ballinalack	13,621
31	**N4:** between Bunbrosna and Ballynafid	13,993
32	**L-1819-0:** just north of N4 at Ballynafid	2,434
33	**N4:** between Ballynafid and Portnashangan	15,568
34	**L-1015-0:** near Portnashangan	767
35	**N4:** near Cullionmore	14,499
36	**R394 Castlepollard Road, North:** near N4, towards Castlepollard	7,520
37	**R394 Castlepollard Road, South:** near N4, towards Mullingar	19,855
39	**N5:** just west of Longford	7,766
40	**R198 Battery Road:** just south of N4	11,970

* For Link ID locations, please refer to Figures RFig 6.1 to 6.7 in Volume III. For details of 2015 and 2035 forecast flows in all scenarios, please refer to Appendix 22, Volume II.

Tables 2.2-2 and 2.2-3 indicate that traffic volumes on the existing N4 in 2008 were already above or approaching 11,600 vehicles per day.

Low and high traffic growth rates have been published by the NRA (Project Appraisal Guidelines, Appendix 7, Table 4.3) and are the basis for forecasting future traffic flows for major road schemes in Ireland. The NRA low and high growth rates comprise two of the three growth scenarios for which this scheme has been assessed and are summarised for the key years of the economic appraisal for this scheme

(survey year 2008, provisional opening year 2015 and end of growth forecast period 2035) in Table 2.2-4 below.

Table 2.2-4 Future Traffic Growth Factors Rebased to 2008

Road Type/Growth Scenario	2008		2015		2035	
	PC	HV	PC	HV	PC	HV
National Primary (NRA High Traffic Growth), per annum	1.00	1.00	1.18	1.20	1.50	1.69
All Roads (NRA Low Growth), per annum	1.00	1.00	1.13	1.15	1.37	1.50

PC = Private Cars, HV = Heavy Vehicles

In the traffic modelling and economic appraisal, the forecasting for a scenario where the N4 is not upgraded (but other committed road improvements are carried out) is defined as the 'Do-Minimum' scenario. As can be seen in Volume II, Appendix 22 and Volume III, Figures 6.1 to 6.7, the NRA Low Growth forecast for the 'Do-Minimum' scenario indicates that by 2015 (the first year of the economic appraisal period) traffic flows on the existing N4 between Mullingar and Newtown Forbes will have exceeded 11,600 vehicles per day.

The NRA High Growth forecast represents the intermediate scenario of the three scenarios applied to this scheme. If the NRA High Growth forecast is applied to the 'Do-Nothing' situation, by 2015 the traffic flows on the existing N4 between Mullingar and Newtown Forbes would have grown to exceed 11,600 vehicles per day.

In 2035 (which is termed the Design Year as it provides the volumes for which the road must be designed to cater and is the end of the period to which traffic growth is applied) traffic flows on the existing N4 between Mullingar and the L5016 north of Newtown Forbes are forecast to exceed 11,600 vehicles per day in all the growth scenarios considered.

Table 2.2-5 Summary of Annual Average Daily Traffic (AADT) Flows for 2035 'Do-Nothing' at NRA High Growth

Link ID*	Road Section	AADT (Vehicles per day)
1	**N4:** between Roosky and Cloonart North	12,213
3	**N4:** between Cloonart North and Carrickmoyragh/Ballagh Bridge	12,124
5	**N4:** between Carrickmoyragh/Ballagh Bridge and Newtown Forbes	13,718
7	**N4:** between Newtown Forbes and L5019-0	16,018
8	**N4:** between L5019-0 and R198 Drumlish Road (Red Cow Roundabout)	15,352
9	**R198 Drumlish Road:** between N4 and L10182	13,874
10	**N4 Longford Bypass:** between R198 Drumlish Road and R194 Ballinalee Road	23,863
11	**N5 Ballinalee Road:** just south of N4	16,596
12	**R194 Ballinalee Road:** between N4 and Carrickglass	8,553
14	**N4 Longford Bypass:** between R194 and R393 (Dublin Road Roundabout)	19,325
15	**Proposed N5 Longford (Western) Bypass**	6,126
17	**N63:** just south of Longford	15,378
18	**N4:** between R393 and Lissardowlan	22,498
19	**N4:** near Lissardowlan	22,150
20	**N4:** near Ballynagoshen	21,402
21	**N4:** just west of Edgeworthstown	21,402
22	**L-1091-0:** just north of Edgeworthstown	4,070
23	**N55 North:** just north of R395	7,694
24	**N55 North:** between Edgeworthstown centre and R395	10,217
25	**N4:** just east of Edgeworthstown	20,078
26	**R395:** near Edgeworthstown	2,542
28	**N55 South:** just south of Edgeworthstown	6,313
29	**N4:** near Rathowen	20,103
30	**N4:** near Ballinalack	20,882
31	**N4:** between Bunbrosna and Ballynafid	21,445
32	**L-1819-0:** just north of N4 at Ballynafid	3,711
33	**N4:** between Ballynafid and Portnashangan	23,821
34	**L-1015-0:** near Portnashangan	1,170
35	**N4:** near Cullionmore	22,217
36	**R394 Castlepollard Road, North:** near N4, towards Castlepollard	11,447
37	**R394 Castlepollard Road, South:** near N4, towards Mullingar	30,152
39	**N5:** just west of Longford	9,400
40	**R198 Battery Road:** just south of N4	16,550

* For Link ID locations, please refer to Figures RFig 6.1 to 6.7 in Volume III. For full details of 2015 and 2035 forecast flows in all scenarios, please refer to Appendix 22, Volume II.

The third growth scenario established for this scheme is the highest growth scenario of the three. It is based on the most likely development proposals for the northern side of Longford Town which would have the greatest potential to increase traffic volumes (based on the proposals within the Longford Northern Environs Local Area Plan 2008-2014 published in 2008 by the Longford Local Authorities in conjunction with RPS Planning & Environment). Further details of the traffic growth forecasting for the scheme are given in Chapter 6, Traffic and Economic Assessment. Economic

results for all six Route Corridor Options have been produced for all three growth scenarios and are also presented in Chapter 6.

Potential Effects of Economic Recession on Traffic Growth

At the time of writing, the latest available long-term traffic count data from the relevant section of the N4 during 2009 is restricted to the first seven months of the year. A comparison against the volumes for the same period of the years 2006, 2007 and 2008 suggests that traffic volumes on this section of the N4 may have reduced slightly, to between 2006 to 2007 levels approximately, although this would have to be verified at the end of 2009. It is not possible to predict a definite downward trend for the future from the available data, because the datasets are very limited in duration and looking ahead, traffic volumes will depend (together with many other factors) on future economic performance which cannot be predicted with certainty. It should be noted that traffic growth forecasts take into account historic trends over long periods such that the effects of economic booms and recessions are averaged out. The NRA traffic growth rates applied to this scheme are based on a report by Transport Research Laboratory (TRL) prepared in June 2003, titled 'Future Year Growth Traffic Forecasts 2002', which was based on analysis of economic growth from 1976 to 2001, thereby taking into account phases of high economic growth and severe recession over that period.

At present,

- the traffic flows at many places along this section of the N4 already exceed or are close to the threshold value of 11,600 vehicles per day,
- the recent reduction in traffic volumes to date is relatively small (equivalent to 2-3 years of growth),
- the traffic growth rates applied to the appraisal of this scheme are derived from long-term averages and the period over which growth is applied in the economic assessment is relatively long (2008-2035),
- consequently it is likely that long term traffic growth rates will be in line with the NRA forecasts.

Therefore, the need for this scheme in terms of traffic demand is unlikely to diminish. Prior to preparation of an Environmental Impact Statement for this scheme, traffic flows will have to be monitored to determine whether any changes need to be made to traffic forecasts.

2.2.2 Road Safety

In terms of road safety, three important issues have been identified:

- In several places the existing N4 road has a sub-standard alignment for a 100kph speed limit, particularly in terms of Full Overtaking Sight Distance,
- There are clusters of recorded accidents along the N4,
- There are many at-grade junctions and direct accesses along the route.

Full Overtaking Sight Distance (as defined in NRA DMRB TD9/07) is the distance of clear visibility ahead which a driver requires to see oncoming traffic and carry out a safe overtaking manoeuvre on a single carriageway road, using the opposing traffic lane. For a single carriageway road with a 100kph design speed the minimum Full Overtaking Sight Distance (FOSD) is 580m and this should be provided for 30% of the route in both directions. For the existing N4 the frequent presence of junctons and vehicular accesses to properties limits opportunities for safe overtaking. Additionally, the relatively high traffic flows on the N4 between Longford and Mullingar reduce the number of viable gaps in oncoming traffic for overtaking opportunities, particularly during peak times. This can lead to a reduced level of service, driver frustration and greater risks being taken, i.e. overtaking when the gap in oncoming traffic may not be sufficient.

Recorded traffic accident statistics within the study area for this scheme for the 5 year period 2003 – 2007 were obtained from the Road Safety Authority (RSA). The accident distribution within the vicinity of the Route Corridor Options is indicated on RFig 1.3.1 – 1.3.4 in Volume III, which distinguish between Fatal, Serious and Minor recorded injury accidents. A review of the recorded accidents indicated that there were clusters along the N4 generally located in or close to villages, where changes in speed limit occur and at junctions.

Of the recorded injury accidents in the vicinity of the route options, during the period analysed:

- 6 fatal accidents occurred on the existing N4 or at junctions along the existing N4
- 14 serious injury accidents occurred on the existing N4 or at junctions along the existing N4
- 71 minor accidents occurred on or at junctions along the existing N4

Of the 6 fatal accidents which occurred on the N4, 2 involved head-on collisions between two vehicles, an accident type which is usually associated with overtaking, 2 involved a collision at an angle although both vehicles were moving in a straight line therefore may also be associated with overtaking, 1 involved a right turn and 1 involved a single vehicle.

Of the 14 serious injury accidents which occurred on the N4, 4 involved head-on collisions between two vehicles, 3 involved pedestrians, 5 involved a single vehicle only and in the case of the remaining 2 serious accidents the accident descriptions were incomplete but from the available information they also appear to have been single vehicle accidents.

Other than head-on collision type accidents resulting from overtaking and single vehicle loss of control accidents, many other types of road traffic accidents occur at junctions. This is primarily because at junctions, drivers have to process a lot of information within a short timeframe and must make decisions in terms of the speed and gaps in oncoming traffic and the speed and direction of their vehicle. Accidents at junctions can also involve pedestrians crossing the road. In rural locations, drivers may not expect many pedestrians and consequently can become less vigilant in looking out for them.

There are numerous local road junctions and unclassified road junctions along the existing N4. West of the R394 Castlepollard Junction, there are no grade separated (i.e. split level) junctions along the section of the N4 under consideration. The principal types of junction along this section of the N4 are identified in the table overleaf.

Table 2.2-6 Number of At-Grade Junctions along the N4 between Mullingar and Roosky

Unclassified Access Points	Classified Local Road T-Junctions	Classified Local Crossroads	At Grade Roundabouts on N4
80	57	2	6

Along this section of the N4, T-junctions and crossroads with local and unclassified roads, private driveways and private field accesses tend to present the greatest safety issues as they allow slow moving vehicles to join or cross fast moving traffic on the N4. Roundabouts tend to be safer than cross roads (typically lower frequency and severity of accidents are recorded) because at all entries to a roundabout traffic has to yield to oncoming traffic and therefore vehicle speeds on the approaches tend to be lower. This is evidenced by the fact that at the existing at-grade roundabouts on the N4 Longford Bypass, the recorded accidents are all minor.

2.2.3 Plans and Policies: Context to the Need for the Scheme

An overview of the principal plans and policies is given here, further appraisal is given in Chapter 4, Section 4.1.

The strategic need for the scheme should be seen in the context of the following plans and policies:

- The National Roads Needs Study, 1998
- The National Spatial Strategy, 2000 – 2020
- Westmeath County Development Plan, 2008 – 2014
- Longford County Development Plan, 2003 – 2009 and Longford County Development Plan 2009 - 2015
- Transport 21 Policy, 2006 – 2015
- The National Development Plan, 2000 – 2006
- The National Development Plan, 2007 – 2013
- The Border, Midland and Western Operational Programme, 2007 – 2013
- Midland Regional Authority, Regional Planning Guidelines, 2004
- Local Area Plans (Various Dates)

The upgrading of the N4 Mullingar to Longford (Roosky) route originates primarily from the National Development Plan (NDP), 2000 – 2006, the national roads element

of which had been developed broadly from the National Roads Needs Study 1998 (NRNS). The NDP 2000 – 2006 identified the need for major road improvements on the N4 between Sligo and Kinnegad. The NDP 2000 – 2006 has since been superseded by NDP 2007 – 2013, one of the key objectives of which is to '*create a road network, in line with the timetable in Transport 21*[see below]*, that will see the completion of the major inter-urban routes and will upgrade links generally between the National Spatial Strategy Gateway Centres and improve the non-national road network'.* See also 2.2.8 below.

This objective is reinforced within the Economic Infrastructure Priority chapter of the NDP, which identifies that some €13.3 billion will be invested in national roads through the Roads Sub-Programme. Investment will be particularly focussed on major upgrades to the key routes impacting on National Spatial Strategy (NSS) Gateways, Hubs and County Towns. Sligo is defined as one such Gateway with Mullingar forming part of the Midlands Gateway. Therefore the upgrade of the N4 between Dublin and Sligo, of which the scheme forms part, is instrumental in achieving the transport objectives of the NDP 2007 – 2013. Further detail of plans and policies which have a potential interaction with the scheme and in particular the County Development Plans and Local Area Plans, is given in Chapter 4.1. The national and regional studies, strategies, plans and policies relevant to the scheme are summarised in the following sections.

2.2.4 National Road Needs Study 1998

Section 3.5 of the National Road Needs Study 1998 reiterated the overarching objective for National Primary Roads originally put forward in the Operational Programme for Transport 1994 – 1999 (OPT);

"..in the OPT 1994 – 1999, the objective was that the network would provide an average inter-urban speed of 80kph across the National Primary Road Network by the year 2005," The Needs Study further recommends: ".. that this minimum objective of 80kph inter-urban travel speed be maintained on all 2-Lane single carriageway roads in the National Network. The inter-urban speed on divided roads (dual carriageways and motorways) would be higher. Associated with this journey speed objective are characteristics such as provision of overtaking opportunity and maintenance of stable flow in reasonable safety."

Paragraph 4.3 of the Needs Study sets out the following level of service objective: "Studies of international practice indicated that many countries design new Primary road facilities with an objective level of service C. Generally, level of service D, equivalent to an average inter- urban journey speed of 80kph, would be regarded as the minimum acceptable standard. The overall target objective in the National Roads Needs Study is to maintain the level of development of the National Primary Road Network to ensure that all sections of the network will provide an inter-urban travel speed of 80kph. This level of service is to be sustainable over the full route by improving the inter town sections and eliminating urban bottlenecks by constructing bypasses."

2.2.5 The National Spatial Strategy (NSS)

Section 3 of **The National Spatial Strategy for Ireland, 2002 – 2020** deals with the future spatial structure of Ireland.

In Section 3.1 it states that the strategy sets out how Ireland can be spatially structured and developed over the next twenty years in a way that is internationally competitive, socially cohesive and environmentally sustainable. By targeting strategic centres with the potential to be drivers of development at national level and within their own regions and by including county towns, smaller towns, villages and rural areas in this process, a dynamic urban and rural structure can be achieved.

Along with the existing gateways of Cork, Limerick/Shannon, Galway and Waterford the NSS has identified four new national gateways: Dundalk, Sligo, and two linked gateways Letterkenny/Derry and Athlone/Tullamore/Mullingar.

The N4 Mullingar to Longford (Roosky) scheme will provide improved road access between the Gateway Towns of Sligo and Mullingar and improve access between the county towns of Carrick-on-Shannon, Longford and Mullingar, and Sligo and Longford and Mullingar.

Section 3.7 of the NSS deals with key infrastructure requirements: "Achieving spatial balance by developing the potential of areas will depend on enhancing capacity for the movement of people, goods, energy and information between different places. Improvements in terms of time and cost can reduce the disadvantages of distance.

Physical networks of infrastructure such as roads, public transport, energy and communications are of particular relevance to the NSS, since they themselves have a spatial impact and also influence the location, timing and extent of development."
"To support balanced regional development, Irelands transport network must build on Irelands radial transport system of main roads and rail lines connecting Dublin to other regions, by developing an improved mesh or network of roads and public transport services."

In achieving this objective, the NSS identifies three principal types of transport corridors, namely radial corridors, linking corridors and international access points.

The N4 Dublin - Mullingar - Sligo has been identified as a Strategic Radial Corridor, specifically one of three Corridors to the West defined as "Good quality road and public transport connections between Dublin, Galway, Mayo and Sligo."

In regard to the existing Road Network, the NSS states that " Improvements will be needed in the quality of connections between cities and towns which are developing as linked-centre gateways or development hubs."

2.2.6 Westmeath & Longford County Development Plans

The current Westmeath County Development Plan 2008 - 2014 sets out the following policy objective for National Routes in the county:
"P-IF3- It is the policy of the Council to improve the standards and safety of the public roads and to protect the investment of public resources in the provision, improvement and maintenance of the public road network."

The CDP lists in its Specific Road Objectives the upgrade of the N4 Mullingar Bypass north westwards to the county boundary.

Objective	Route	Proposal
O-IFR12	N4 Mulllingar Bypass northwestwards to County Boundary	Dual carriageway re-alignment improvement, largely off line, including by passes of Rathowen and Ballinalack villages

The Longford CDP 2009 - 2015 states among its General Road Policy and Objectives:

"Roads 4: To maintain and improve the capacity of existing arterial routes of national importance within the County in the context of the National Spatial Strategy and Regional Planning Guidelines, including the relief of bottlenecks at strategic locations"

With reference to its Specific Road Policy the CDP states that;
"Roads 10: It is the policy of the council to reserve lands in appropriate areas for the improvement, maintenance and management of road traffic systems throughout the County.
Lands shall be reserved on proposed route corridors for the following schemes

- N5 By-Pass to the West of Longford
- N4-N63-N5 By-Pass to the South of Longford
- N4 from the Westmeath County boundary to the Leitrim County Boundary to facilitate the N4 Mullingar to Longford Road Improvement Scheme including the Newtown Forbes By-Pass
- N5 Granard By-Pass
- N63 Killashee By-Pass
- N55 Edgeworthstown By-Pass
- N55 Ballymahon By-Pass

Where these corridors have been identified they will be protected from further development prior to the establishment of a final route. Where corridors have not yet been developed the Council shall pursue the development of these corridors and shall protect corridors from development once established. Where route selection corridors exist, it is the policy of Longford County Council, in consultation with the NRA, to ensure that the final route is identified within a reasonable time"

2.2.7 Transport 21

Transport 21, announced in November 2005, sets out a 10-year transport capital investment framework, including investment for national roads, from 2006 to 2015. The major economic, social and demographic changes in Ireland over the past decade, the impact of these changes on transport demand, the strategic policies developed for areas relating to and impacting on transport, the NSS for Ireland 2002 – 2020: People, Places and Potential, and the need to provide a modern transport network for the future, have been considered in the development of the framework.

Enhancing connectivity at national, regional and local levels is a core aspect of Transport 21. The availability of an efficient, predictable and sustainable national transport network is recognised as a key factor underpinning economic growth and competitiveness and in improving quality of life. The transport investments set out in the NDP are derived from, and form part of, the overall investment framework under Transport 21. The development of the N4 to provide a high quality link between Sligo and Dublin is one of the routes specifically targeted for completion by 2015 within the current 2006-2015 Transport 21 framework and as stated by the Minister for Transport in his speech at the launch of Transport 21 " We will improve our strategic road links with Northern Ireland and to the west and northwest by upgrading the N2, N3, **N4** and N5"

2.2.8 National Development Plan

In January 2007, the Irish Government published the **National Development Plan (NDP) 2007 – 2013** which superseded the NDP 2000 – 2006. The NDP 2000 – 2006 identified the strategy for major road improvements on the N4 between Sligo and Kinnegad and this was reaffirmed in the current plan. In relation to the National Road Network, the NDP 2007 - 2013 seeks to achieve the objectives set out in relation to the National Roads in both the National Spatial Strategy and Transport 21.

Amongst its general goals, the NDP 2007 - 2013 sets out to decisively tackle structural infrastructure deficits that continue to impact on competitiveness, regional development and general quality of life and to meet the demands of the increasing population and integrate regional development within the National Spatial Strategy

Framework of Gateway cities and Hub towns to achieve the goals of economic growth in the regions and provide major investment in the rural economy.

With particular regard to Transport, the NDP 2007 - 2013 states that “Investment in transport infrastructure over the Plan period will total nearly €33 billion of which €13.3 billion will be invested in upgrading and building new national roads” and that “The plan provides for some €32.9 billion investment in transport generally. National and international access will be central to the competitiveness of the Gateways. Key priorities will be the completion of the major inter-urban access routes, the upgrade and enhancement of the public transport network, improved port and airport access and investment in key secondary and non-national roads between and within the Gateway regions. By the end of the Plan, all inter-urban routes between Dublin and the Gateways will have been completed and many of the key inter-urban routes between Gateways such as the Atlantic Corridor, will also have been significantly upgraded.”

The NDP 2007 - 2013 states that the key outputs under the Economic and Social Infrastructure Investment Priorities will be “To create a road network, in line with the timetable in Transport 21, that will see the completion of the major inter-urban routes, will upgrade links generally between the National Spatial Strategy Gateways and will improve the non national road network”.

With reference to Balanced Regional Development the NDP 2007 - 2013 states that “The promotion of regional development will aim to ensure that each NSS Gateway region maximises its potential for economic and social development; that a better balance is achieved in the economic and social development of the regions; and that there is enhanced co-ordination in the development of the Gateways and their regions and between planning and investment at local, regional and national levels. This will be achieved by a major programme of investment in infrastructure with a particular focus on addressing deficits within and linking the various National Spatial Strategy Gateways”.

With particular reference to the Sligo Gateway the NDP 2007 - 2013 states that “Key development issues and investment requirements over the period of the plan include completion of the remaining sections of the N4 requiring upgrades”. The construction of this scheme will be consistent with the key objectives of this plan as it will:

i. Directly improve a significant section of the existing road transport link between the Gateway towns of Sligo and Mullingar.
ii. Provide improved road access from Sligo to Dublin
iii. Upgrade a National Primary Route, one of the key priorities of the NDP
iv. Upgrade one of the Strategic Spatial Corridors identified in the NSS

2.2.9 All Island Infrastructure Co-operation

Although the N4 Mullingar to Longford (Roosky) will improve access to the North-West and Border Regions, particularly Sligo which is located on a key strategic cross-border route, the scheme itself is not under the umbrella of the All Island Infrastructure Co-operation.

2.2.10 Border, Midland and Western Operational Programme 2007-2013

The Government's stated objective for regional policy is to ''achieve balanced regional development in order to reduce the disparities between and within the two regions (South East and Border, Midland and Western (BMW) Regions) and to develop the potential of both to contribute to the greatest possible extent to the continuing prosperity of the country''[1]. The Border Midland and Western Region covers a total of thirteen counties including Westmeath and Longford.

The agreed vision for the BMW Region is to develop "An innovative knowledge based and competitive region, with a high quality environment, first class infrastructure, visionary leadership and a quality of life for its citizens that is among the highest in the world"

One of the five components of this vision is stated as "A Region where infrastructure networks provide access to 21st century resources". Amongst its Priority Objectives the BMW Operational Programme sets out to "strengthen the spatial structuring of the BMW Region by investing in integrated sustainable initiatives in order to enhance the

[1] The National Development Plan 2000-2006, p 58

competitiveness, accessibility and social cohesion of the region's growth centres and to modernise the regions transport infrastructure.

Interventions will include:

- Urban Regeneration
- Key Linking Routes
- Public Transport

With particular reference to Key Linking Routes the BMW Operational Programme states that " Taking account of the dispersed settlement pattern within the BMW Region and the importance of connectivity within the region, this intervention will support a limited number of key linking routes, particularly aimed at improving accessibility to and between growth centres within the BMW region and extending the functional area of the designated growth centres."

The Border, Midland and Western Operational Programme 2007-2013 identified that the National Primary Route Network, of which the Scheme is part, will be one principal means to reduce peripherality, enhance the competitive position of the region and promote inward investment. The Programme recognises in particular that the development of a regional transport infrastructure with economically vital road links and enhanced access to public transport is economically vital for the BMW Region.

2.2.11 Midland Regional Authority, Regional Planning Guidelines

The Regional Planning Guidelines (RPG) for the Midlands Region identifies both the strategic development and planning vision for the midlands region and the framework for implementing that vision through the functions of a wide range of public and private interests including the local authorities, development agencies, infrastructure providers and private development interests. Essentially, the RPG promotes the competitiveness and attractiveness of the midlands region.

The RPG emphasises the importance of relating land use with transportation improvements, and consistent with the objectives of this scheme, promotes the importance of the strategic location of the midlands within the national road network and its inter-connectivity with other regions.

2.3 Previous Studies and History of the Scheme

Studies have been carried out on several sections of the N4 between Mullingar and Roosky in recent years but until now, no study has examined the section between Mullingar and Roosky as a single continuous scheme.

The Roscommon National Roads Design Office, on behalf of Longford County Council, examined the improvement of the N4 between Drumsna and the Longford Bypass. The title for the scheme was the N4 Drumsna to Longford Road Improvement Scheme. It was divided into three sections as follows:

Section 1 Dromod Roosky Bypass
Section 2 Tomisky - Deerpark and
Section 3 Newtown Forbes Bypass (terminating at Longford Town).

Section 1, the Dromod Roosky Bypass was opened to traffic in December 2007 as a Type 2 Dual-Carriageway. A Preferred Route Corridor was selected for Sections 2 and 3 (Tomisky to Longford Bypass). The basis of the selection process was for a single carriageway improvement. However this scheme did not proceed beyond the Route Selection Phase (Phase 3 of the NRA Project Management Guidelines).

In 2005 Westmeath County Council engaged Roughan & O'Donovan, Consulting Engineers, to develop the design of a Type 3 Dual Carriageway road improvement scheme (also known as 2+1 because this road type provides alternating sections of two lanes in one direction to allow overtaking and one lane in the other direction). This study focussed on a section of the existing N4 between Portnashangan at the western end of the Mullingar Bypass and the Longford County Boundary. The title of this scheme was the N4 Portnashangan to the County Boundary Road Improvement Scheme. Roughan & O'Donovan's Preliminary Design Report identified physical limitations in upgrading the existing road to 2+1 cross-section.

In 2006, Roughan & O'Donovan were requested to undertake a preliminary traffic study on the N4 between the Mullingar Bypass and the Longford Bypass and to consider also the retro fitting of the 2+1 cross section between the Westmeath/Longford County Boundary and the Longford Bypass. The Preliminary Traffic Report identified significant limitations for the 2+1 upgrade proposal, that the

capacity level for a 2+1 upgrade would be exceeded well in advance of the design year and that long delays could be expected in the villages of Rathowen and Ballinalack.

In 2007 a Feasibility Study Report (Roughan & O'Donovan 2007) concluded that given the constraints of a 2+1 improvement scheme, a standard dual carriageway would be a more appropriate road type and such a dual carriageway would likely need to be largely off-line.

After consideration of the different studies carried out in these areas and further to discussions with the National Roads Authority, it was determined that it would be necessary to procure engineering consultancy services to assist with the development of a National Primary Road Scheme commencing east of the Castlepollard Road Junction on the N4 Mullingar Bypass dual carriageway in the townland of Culleen Beg, County Westmeath and ending north of the roundabout on the N4 Dromod Roosky Bypass scheme, in the townland of Tomisky, County Longford. A section 85 agreement with Longford County Council was put in place and Westmeath County Council was appointed as the Lead Local Authority on the scheme.

In August 2007 Hyder Tobin Consultants were appointed as engineering consultants for the provision of services for feasibility study, constraints study, route corridor selection, preliminary design, environmental impact statement, land acquisition mapping and the statutory process including the oral hearing.

In September 2007 the title of the project was changed to "N4 Mullingar to Longford (Roosky)" in order to fully illustrate the extent of the works. The First Public Consultation (Constraints Study) took place in September 2007 in Longford and Mullingar. A summary of this consultation is provided in Section 3.2. A summary of the second set of public exhibitions at which Route Corridor Options and Links were displayed is described in Section 3.4 and further details are provided in Appendix 3 in Volume II.

2.4 Scheme Objectives

The objectives of this scheme have been developed to take into account the national, regional and local government plans and policies described previously. In addition, the five principal appraisal criteria from the Department of Finance Common Appraisal Framework for Transport Planning have also been taken into account, which are Economy, Safety, Environment, Accessibility and Integration. These criteria are transposed for the appraisal of major road schemes through the NRA Project Appraisal Guidelines (PAG). Route Corridor Options have been appraised in terms of the five criteria and their elements, as described in the following chapters, and the results are presented in the detailed Project Appraisal Balance Sheets (PABS) in Appendix 1 of Volume II. For ease of reference a summary table containing the scaling statements from the PABS is provided in Chapter 7.

Economy the proposed scheme aims to promote sustainable national economic and employment growth and also strengthen and improve Ireland's international competitiveness. The scheme should provide value for money.

Safety to improve safety for all road users using this section of the N4 National Primary Road.

Environment to minimise the impacts on the receiving environment.

Accessibility and Social Inclusion to minimise severance within local communities. To provide an improved access to the region in order to distribute economic benefits and assist in providing a balanced regional development.

Integration

- To provide a high quality road and optimise journey times for strategic traffic travelling between the Gateways of Dublin, Mullingar and Sligo on the N4 National Primary route.
- To provide a means of access to the N55 National Secondary route at Edgeworthstown and the N5 National Primary route and N63 National Secondary route at Longford.
- To meet objectives identified in the NDP 2007-2013 and in the NDP 2000-2006, Transport 21 and specific objectives of the Westmeath County

Development Plan 2008-2014 and Longford County Development Plan 2009-2015.

3 Route Corridor Options

3.1 Introduction

The development and appraisal of the Route Corridor Options has been carried out in accordance with the NRA Project Management Guidelines (2000) and the NRA Project Appraisal Guidelines (2008). Prior to the commencement of development and appraisal of Route Corridor Options, it was necessary to set a Study Area Boundary and undertake a Constraints Study to gather the available recorded data for the Study Area. Following the identification of the constraints within the Study Area an aerial survey, environmental surveys, traffic surveys and geotechnical investigations were carried out in 2008 to gather further information from the study area.

3.2 Constraints Study

The Constraints Study (Phase 2 of the NRA Project Management Guidelines) began in September 2007, shortly after Hyder Tobin Consultants' appointment. The Constraints Study phase primarily comprises desk studies to collate the known constraints information which is readily available from statutory and non-statutory consultees. This information is then presented in a Constraints Study Report. A public consultation was carried out in September 2007 at which the Constraints Study boundary was presented for comment. The Study Area covered 33,323 hectares and the boundary is shown in RFig 1.1 in Volume III.

During the Constraints Study Stage, information was gathered on potential constraints within the Study Area, which could affect the design and location of the scheme. Studies covered topics such as plans and policies, ecology, landscape, cultural heritage, geology, hydrology and agriculture. The studies involved consultation, desktop investigations and site visits to undertake roadside surveys. Details of the constraints information collected are provided in the Constraints Study Report Volumes I and II.

The first public consultation for the scheme related to the Constraints Study Area and was held on the 27th September 2007 at the Aras an Chontae, Great Water Street, Longford and the 28th September 2007 at the Mullingar Park Hotel, Mullingar. The aim

of the consultation was to inform the public of the extent of the Study Area and the constraints identified to date. The objective was also to give the public the opportunity to highlight aspects of local concern or special interest to be taken into account in the planning and design of the scheme. The exhibitions were attended by approximately 150 people in total at Longford and Mullingar. Comments typically related to perceived problems with long columns of slow moving traffic along the N4 at peak times due to a shortage of safe overtaking opportunities, the current impacts of large volumes of traffic passing through small towns and villages along the N4 and difficulty of access along the N4 from side roads and driveways at peak times.

3.3 The "Do-nothing" and "Do-minimum" Options

The initial aim of the route selection process is to identify all realistic ways of achieving the scheme objectives set out in Section 2.4. An essential element of the process is the consideration of both the "do-nothing" and the "do-minimum" options. Details of the process carried out to identify other Route Corridor Options are set out in Section 3.4. These feasible options have then been assessed against the Government's five key criteria of Economy, Safety, Environment, Accessibility and Social Inclusion and Integration. This assessment is summarised in the Project Appraisal Balance Sheets (PABS) contained in Appendix 1, Volume II.

3.3.1 The "Do-nothing" Option

Previous studies as outlined in Section 2.3 found that the existing N4 between Mullingar and Longford (Roosky) does not have the capacity to cater for future traffic flows. This has been confirmed by this study as detailed in Section 2.2.1 – Capacity. Additionally Section 2.2.2 – Safety, highlights the problems with the existing road in terms of accidents. It is clear that the 'do-nothing' option does not meet the Scheme Objectives of Economy, Safety, Accessibility and Social Inclusion and Integration as set out in Section 2.4.

3.3.2 The "Do-minimum" Option

The feasibility of upgrading the existing N4 carriageway by means of on-line widening was considered as the "Do-minimum" Option. On-line widening was suggested by many people who attended the public exhibitions for the Route Corridor Options in September 2008 (see analysis in Volume II, Appendix 3).

In addition to running on-line along the existing bypasses around Longford and Edgeworthstown, this option would include local bypasses of Ballinalack, Rathowen and Newtown Forbes.

One of the major difficulties with on-line widening is the need to provide parallel access on both sides to serve local properties and land. Along an improved national road, the number of direct accesses and junctions must be kept to a minimum for safety reasons and, as a result, it is necessary to provide extensive access roads or tracks on both sides of the national road to connect local properties to the nearest junction. Along many sections it would be necessary to provide a continuous through road in parallel with the N4 (potentially to a reduced single carriageway standard on one side of the national road) to minimise the number of junctions along the N4 and yet also ensure that local journeys would not be excessively long or difficult to make. Across the other side of the national road from the parallel through-road it would be necessary in many places to provide additional access roads, each of which would serve a number of properties and would not be continuous. Bridges, underpasses or at-grade roundabouts would be required at frequent intervals along the N4 to connect up the access tracks and through access road. The access road and access track could together add up to 20m to the overall cross-section.

The environmental Route Options Assessment includes consideration of the do-minimum option. Where improvement of the existing N4 is feasible, taking into account the issues outlined above, the on-line route would be used where possible.

Section 5.2.1 describes the selection of Road Type in further detail. A Type 3 Dual Carriageway road (also known as 2 + 1) is pictured below in Figure 3.3-1 and would be the preferred choice for on-line widening where forecast traffic flows are between 11,600 and 14,000 vehicles per day.

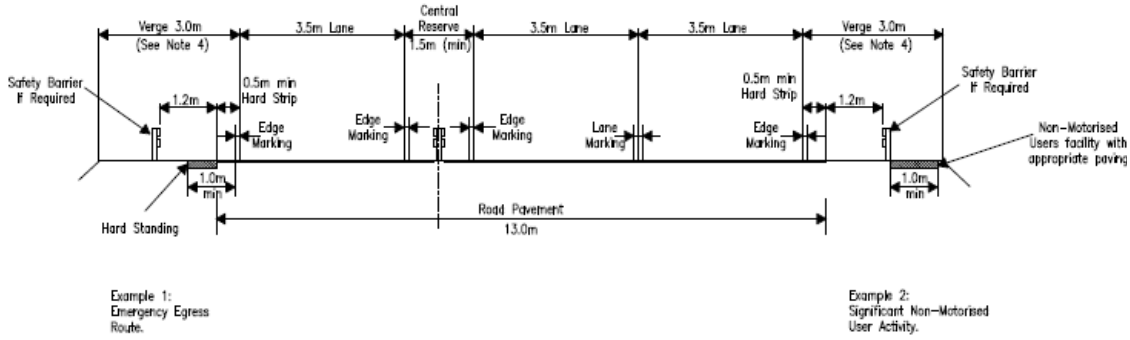

Figure 3.3-1 Type 3 Dual Carriageway (Note: Cutting and embankment slopes not shown)

However, recorded traffic volumes between Longford and Mullingar between February and August 2008 exceeded 14,000 vehicles per day. Also between Newtown Forbes and Mullingar, the forecast traffic flows in 2035 in all growth scenarios would exceed 14,000 vehicles per day. A Type 3 dual carriageway therefore would not provide capacity to cater for the predicted traffic flows other than on the section between Newtown Forbes and Roosky. A Type 3 dual carriageway is not recommended for off-line sections and it would be necessary to go off-line in several places, including a local bypass of Newtown Forbes.

It would be inconsistent in terms of standard along the N4 route to provide a Type 3 road between Roosky and Newtown Forbes, given that a Type 2 dual carriageway providing two lanes in both directions has been recently built from Dromod to Roosky and that for the forecast traffic flows a two lane dual carriageway (Type 1 or Type 2)would be required from Longford to Mullingar. From Mullingar to Dublin the N4 route is a two lane dual carriageway; with the section from McNeads Bridge, approximately 4km east of Mullingar, to Dubliln classified as motorway.

As with all dual carriageway road types, the number of junctions and private accesses to the Type 3 road should be minimised and consequently parallel access roads or tracks would be required to collect together the numerous junctions and accesses, adding up to 20m to the cross-section.
For these reasons it was concluded that a Type 3 dual carriageway would not be feasible for any section of this scheme.

NRA DMRB Standard TD 10/07 states that a Type 2 Dual Carriageway is not suitable for the on-line upgrading of an existing single carriageway road, which points to a Type 1 Dual Carriageway being the only acceptable option.

Table 3.3-1 details the estimated numbers of built properties within distance bands from the centreline for an On-Line Widening upgrade which, incorporates the existing bypasses of Longford and Edgeworthstown and new bypasses of Newtown Forbes, Rathowen and Ballinalack. This On-Line Widening Upgrade is shown on RFig 1.4-1 to 1.4-4 in Volume III of this report. For comparison purposes, built property counts for the six Route Corridor Options are also given in the Table.

Table 3.3-1 Number of Built Properties in Vicinity

	Number of Built Properties in vicinity				
	Up to 25m from corridor centreline	25m to 75m from corridor centreline	75m to 100m from corridor centreline	100m to 150m from corridor centreline	Total
Online Widening	66	218	100	180	564
Route Corridor Option 1	4	57	48	91	200
Route Corridor Option 2	6	62	55	79	202
Route Corridor Option 3	5	36	36	71	148
Route Corridor Option 4	3	40	36	77	156
Route Corridor Option 5	5	52	41	123	221
Route Corridor Option 6 (EPRC)	2	44	41	76	163

The Table indicates that there would be more than double the number of built properties in close proximity to an On-Line Widening scenario than there would be along any of the six Route Corridor Options. The overall road cross-section (excluding any allowance for cut/fill slopes) for an on-line widening upgrade would have to comprise the basic 21.5m for aType 2 dual carriageway (not preferred) or 25.6m for a Type 1 cross-section, plus widening of verge or central reserve to allow for sight lines through horizontal curves where necessary, plus up to 20m for parallel access roads & tracks. It is not always possible for parallel access roads and tracks to run immediately alongside in all places. For example on the approaches to an underpass or overbridge, the parallel access road or track must diverge from the main road, in

order to provide an alignment that complies with design standards. Therefore additional land take would be necessary where structures are located. It is therefore likely that most of the 66 properties within the 50m distance band (i.e. 25m either side of the centreline) would face a severe impact from on-line widening, ranging from loss of substantial areas of land to total demolition of buildings. It can be seen from Table 3.3-1 that there would be more than three times as many properties in the distance band 25m to 75m in the case of the on-line upgrade than in any other option.

At the Longford Bypass the existing alignment in the vicinity of the R198 junction (the Red Cow Roundabout), has a horizontal radius of approximately 380m which is almost two steps below the desirable minimum radius given in the current NRA DMRB standard (TD9/07) for a 100kph design speed road. It would be impracticable to purchase land to increase the horizontal radius to meet the design standards, due to the extents of the developments which have taken place in the vicinity.

At Edgeworthstown development has taken place on both sides of the recently constructed bypass. The land take for a dual carriageway would affect high-density accommodation alongside the bypass.

In summary the review of an on-line widening scenario identified the following issues. Although these issues may also occur on off-line Route Corridors, it was apparent from the property count that they would occur to a lesser extent along off-line Corridors;

- A large number of properties would have to be demolished to accommodate the increased carriageway width along the existing N4;
- Extensive parallel access roads and tracks would be required, together with large numbers of bridges, underpasses or at-grade roundabouts which would be needed to maintain access to properties and land;
- There would be less scope for lowering the vertical alignment (vertical alignment would be largely dictated by existing road levels) therefore it would be more difficult to mitigate noise and visual intrusion, particularly impacts generated by side road structures such as overbridges;

- Access for communities located in the vicinity of the N4 would be severely affected by restricting access to the new route. Local journeys and journeys to and from the new route would be forced to use alternative lower standard roads;
- Landtake effects would be significant for properties and land adjacent to the N4; and,
- The works would take longer to complete, arising in greater potential for additional delays to traffic on the existing N4 during construction, and increased disruption to local residents.

The severe adverse impacts on properties and people adjacent to the existing N4 that would result from upgrading the N4 to dual carriageway along its entire length are considered to be unacceptable. An on-line widening would not offer any reduced impacts compared with other route corridor options when assessed against other criteria and could result in potential effects on environmentally designated sites. Following careful consideration of the above issues, it was concluded that the "do-minimum" option of a complete on-line widening upgrade was not feasible.

However sections of the existing N4 offer opportunities for upgrading as part of route corridor options and where appropriate have been incorporated into the options assessed. These sections are:

- At the south-eastern end of the scheme, where it is necessary to tie into the R394 Castlepollard Road junction,
- Through Portnashangan where some road widening has already taken place in the past, and in order to minimise impacts on major constraints such as Lough Owel and Scragh Bog,
- Through Ballynafid where some road widening has been carried out in the past,
- Through Bunbrosna where the topography and the high number of constraints in the surrounding area could result in high environmental impacts for off-line options,
- Along the eastern section of the Longford Bypass between the R194 and the R393 roundabouts, where there are few constraints immediately adjacent to the existing road,
- At the north-western end of the scheme, where it is necessary to tie into the existing roundabout at Tomisky, near Roosky.

3.4 Development of Route Corridor Options

Route Option Development Process

The identification of feasible Route Corridor Options has been carried out using a process whereby all possible corridors were systematically assessed against the Scheme Objectives. Consideration of the alternatives in the light of known constraints resulted in some alternatives being found to be not feasible. The process was carried out in accordance with the NRA's Project Management Guidelines, Project Appraisal Guidelines and Environmental Assessment and Construction Guidelines.

The process began with the identification of all possible Route options at a workshop attended by all engineering and environmental specialists. The options were developed to minimise the potential impacts on the constraints identified in the initial Constraints Study. Major constraints included designated sites such as cSACs, SPAs, NHAs, archaeological sites, areas of bog and properties.

For example, a major constraint to the development of an alignment northeast of Longford Town between Route Corridor Option 4 and 6 was Carrickglass Demesne which is considered to be of significant architectural heritage merit (RFig 40.1 and 60.1). Carrickglass Demesne comprises a walled parcel of land of 263 hectares (650 acres) approximately 4km to the northeast of Longford Town. The lands contain several listed structures, protected stands of trees and archaeological monuments, all of which are identified in the Longford County Development Plan, 2009-2015. The Demesne which is the oldest operating estate in County Longford, was established in the seventeenth century. Some of the buildings and structures within the demesne walls pre-date this substantially. Carrickglass Demesne is designated as a pNHA (001822) for its mixed woodland (mature oak and other broadleaved trees and planted conifers)

Furthermore, the Demesne House is a protected structure (RPS 2.1/NIAH 13401414), and, as such, under Part IV of the Planning and Development Act, 2000, all structures within the curtilage of the house are also protected. The stables, courtyards and gateways at Carrickglass Demesne (RPS 2.2-2.11 and RPS 3.1-3.4) are included on the Longford list of protected structures and the Longford NIAH (13400912,

13400913, 1341409 -1341418, 13401422- 14301423 and 13401435). Additionally any Route Corridor proposed in this area would have significantly adverse landscape and visual impacts.

Initial options considered included a route running closely in parallel with the Dublin to Sligo railway line. This was seen as a way of reducing environmental impacts by using the embankments or vegetation which has grown up alongside the railway as means of reducing the landscape and visual impacts and of reducing adverse agricultural effects of the new road.
There were however a number of difficulties:

- The presence of buildings alongside the railway line including historic buildings recorded in the Records of Protected Structures and National Inventory of Architectural Heritage and archaeological sites in the Record of Monuments and Places,
- The fact that the Dublin-Sligo railway line does not always follow a direct route e.g. between Edgeworthstown and Clonhugh, the railway line heads north of the existing N4, up to 3km north of Ballinalack. In the past a railway junction, Inny Junction, was located to the north of Ballinalack, at which the former line to Cavan diverged. If the new road were to follow the railway this would make the road approximately 1km longer than Route Corridor Options closer to the existing N4,
- The railway line passes through areas of bog, particularly north of Ballinalack, which would add substantial costs particularly as the new road could have approximately twice the landtake of the railway line. It could also affect the stability of the railway,
- The railway line is in cutting in some places, which means its potential to screen the new road is negated,
- The road could not follow the railway through Longford Town, due to the development which has taken place on both sides of the railway,
- There would be an increase in landtake in some places, due to the creation of a narrow strip of land between the railway and the road (as it may not be possible to run exactly alongside the railway in all places due to different geometric standards, constraints or the need to connect with other roads) which would not be viable for farming,

- The need to tie-in to the N4 at Roosky and the N4 at the R394 Castlepollard Road Junction, at either end of the scheme.

Running parallel and close to the railway line was found to be feasible along two sections where there are fewer constraints:

- Between Longford Town and Edgeworthstown,
- Between Clonhugh/Ballynafid and Portnashangan.

These are incorporated into the Route Corridor Options where possible.

Subsequent to the first workshop the large number of identified possible options were assessed in terms of engineering and environmental effects to establish their feasibility. This involved further site visits and data collection. The results of this assessment were discussed at a second workshop, again attended by the team of environmental and engineering specialists. Many of the options were rejected due to their unacceptable adverse environmental effects. The outcome of the workshop was the identification of a number of feasible options that potentially achieved the Scheme Objectives and which could form the basis of a presentation to the public and other key stakeholders at the second public consultation.

These Route Options were developed further after completion of preliminary environment surveys and ground investigations. Initial traffic modelling for various combinations of route sections was carried out to establish their operational efficiency. Many iterations were necessary in the refinement of route sections to take into account new data emerging from the surveys, investigations, initial appraisals and initial traffic modelling.

The large size of the scheme and its study area gave rise to a large number of possible route sections and the majority of these route sections did not converge on any common nodes or sections between Mullingar and Roosky, except at the very ends of the scheme. It is calculated that there were at least 535 different combinations of route sections between Carrickmoyragh, west of Newtown Forbes, and the eastern tie-in to the Mullingar Bypass and 6 combinations between the Tomisky Roundabout near Roosky and Carrickmoyragh, giving a total of 3210 possible combinations between Mullingar and Roosky. It was possible to appraise all of the individual route sections between nodes for four out of the five appraisal criteria, i.e. Environment, Safety, Accessibility and Integration. However, the

appraisal for the Economy criteria is different in that the economic appraisal (COBA) can only be carried out on continuous corridors which start and finish at each end of the scheme, not on individual sections. Clearly it was not practicable to undertake economic appraisals on all of the possible combinations between Mullingar and Roosky and was limited to the identified end-to-end corridor options .

Route Corridor Options Identification

In an attempt to simplify the presentation of the Route Corridor Options to the public and other stakeholders at the second public consultation held in September 2008, some of the route sections were combined to form three end-to-end Route Options, the Red, Orange and Green, options (subsequently renamed Options 1, 2 and 3). These were selected to represent the main end-to-end choices. The remaining sections were shown as additional links (Link A to I) which could be combined with sections of the end-to-end options to create alternative options. The identification of these Corridors and links was the first step in identifying the Route Corridor Options for appraisal. At the time it was not possible to know how many more Route Corridor Options might arise as the appraisals had not yet been carried out. These three Route Corridor Options and the links were presented to the public at three exhibitions at the end of September 2008. This second public consultation is additional to the public consultations required by the NRA PMG. It was decided that it would be beneficial to display the current Route Corridor Options and receive feedback from the public and other stakeholders. The brochure, questionnaire and the Route Corridor Options poster (at reduced size) from the exhibitions are included in Appendix 3, Volume II, together with the analysis of the response. Further details of the arrangements for the exhibitions are given in the following section 3.5.

Following the public exhibitions, further appraisal and design work was carried out, which included taking into account the feedback gathered from the public and statutory and non-statutory consultees. It was then possible to identify further end-to-end Route Corridor Options between Mullingar and Roosky, which included parts of the first three corridors and some of the links shown at the exhibitions. Route Corridor Options 4 and 5, north and south of Longford Town, were identified for further appraisal. These two Route Corridor Options follow the same alignment from Roosky to Carrickmoyragh and again the same alignment between Longford and Mullingar (the same alignment as Option 2 for this latter section) in order that their traffic and economic performance could be directly compared with each other.

Another Route Corridor Option, Option 6, was assembled from the best performing route sections and links (between the various nodes) from the appraisals for Environment, Safety, Accessibility and Integration. A matrix table which records how Route Corridor Option 6 was identified is included in Appendix 24 in Volume II. The matrix contains 10 steps to the identification of Route Corridor Option 6, starting from Roosky and working towards Mullingar. Those sections which start and finish at the same nodes are compared in order to determine which combination of sections is the best, on balance, in terms of the four criteria. This matrix was subject to several iterations and takes into account feedback received following the exhibitions.

It is important to note that the matrix in Appendix 24, Volume II was a tool used in the route identification process and does not contain the final scaling statements for Route Corridor Option 6 from the final appraisals, which are available in the Project Appraisal Balance Sheets in Appendix 1 of Volume II. In the matrix the impacts from preceding sections are rounded up and carried forward into following sections, so this tends to produce a more severe impact appraisal than is the case when a route corridor is appraised as a whole and the full length of the scheme is taken into account.

Once all six Route Corridor Options had been identified, traffic modelling and option cost estimates were prepared for all of them, in order to determine their performance in terms of the Economy criterion. This enabled completion of the Project Appraisal Balance Sheets (PABS) presented in Appendix 1, Volume II.

All six Route Corridor Options are shown together on Figures 3.2.1-3.2.8 in Volume III. In addition, for clarity each of the six Route Corridor Options is shown on a separate set of figures as referenced below, which are also located in Volume III;

- Route Corridor Option 1: Figure RFig10.1 to 10.4
- Route Corridor Option 2: Figure RFig 20.1 to 20.4
- Route Corridor Option 3: Figure RFig 30.1 to 30.4
- Route Corridor Option 4: Figure RFig 40.1 to 40.4
- Route Corridor Option 5: Figure RFig 50.1 to 50.4
- Route Corridor Option 6: Figure RFig 60.1 to 60.4

A brief summary description of the six Route Corridor Options is given in the following paragraphs. The six Route Corridor Options are all shown as being 300m wide and the final route alignment will be located within the corridor.

Section 3.5 describes the Public Consultation on route corridor options held in September 2008. A further set of public exhibitions was held in May 2009, at which the Emerging Preferred Route Corridor (EPRC) was presented, together with indicative alignments for side roads and junctions. Further comments from members of the public and consultees were invited. The results of this consultation are reported on in Chapter 8.

The following Chapters 4, 5 and 6 of this report describe the appraisals of the six Route Corridor Options which have been undertaken. The PABS for the Route Corridor Options are available in Appendix 1, Volume II. The final results of the appraisals are summarised in Chapter 7 of this report, where the scaling statements and orders of preference are presented in a summary Table.

Route Corridor Option 1 (Refer to Figures RFig10.1 to 10.4 in Volume III)

From Roosky the Corridor runs online or close to the existing N4 through to Carrickmoyragh, travelling south of the existing N4 at Cloonart North to continue towards Lismoy. The Route Corridor does not follow the same alignment as the existing N4 Longford Bypass, instead the Corridor passes Longford further to the north east. Between Longford and Edgeworthstown the Corridor crosses over the N4 near Ballynagoshen and bypasses to the south of Edgeworthstown, Rathowen and Ballinalack. Route Corridor Option 1 runs online or close to the existing N4 through Bunbrosna, Ballynafid and Portnashangan and ends at the R394 junction near Mullingar.

Route Corridor Option 2 (Refer to Figures RFig 20.1 to 20.4 in Volume III)

From Roosky the Corridor runs online or close to the existing N4 through to Carrickmoyragh, travelling north of the existing N4 at Cloonart North. From Carrickmoyragh the Corridor passes to the north side of Lismoy to the R198. Between the R194 and the R393 the Corridor runs along the alignment of the existing N4 Longford Bypass. From the R393 the Corridor runs to the south of the existing N4, bypassing Edgeworthstown, Rathowen and Ballinalack on the south side. Route Corridor Option 2 runs close to the existing N4 through Bunbrosna, south of

Ballynafid Lake and Fen rejoining the existing N4 from Portnashangan to the R394 near Mullingar.

Route Corridor Option 3 (Refer to Figures RFig 30.1 to 30.4 in Volume III)

From Roosky, the Corridor runs online or close to the existing N4 through to Carrickmoyragh, travelling to the north of the existing N4 at Cloonart North. From Carrickmoyragh the Corridor passes to the north side of Lismoy to the R198. This Route Corridor does not follow the same alignment as the existing N4 Longford Bypass, instead the Corridor passes Longford further to the north east. Between Longford and Edgeworthstown the Corridor runs to the north of the existing N4 and bypasses the north side of Edgeworthstown. The Route Corridor bypasses Windtown, Rathowen and Ballinalack to the north. Route Corridor Option 3 also bypasses Bunbrosna, Ballynafid and Portnashangan to the north-east, rejoining the existing N4 on the approach to the R394 junction at Mullingar.

Route Corridor Option 4 (Refer to Figures RFig 40.1 to 40.4 in Volume III)

From Roosky the Corridor runs online or close to the existing N4 through to Carrickmoyragh, travelling south of the existing N4 at Cloonart North. From Carrickmoyragh it is the northernmost of the Corridors, passing north of Creenagh, Carrickglass Demesne and Corboy. Route Corridor Option 4 then crosses over the existing N4 bypassing Edgeworthstown, Rathowen and Ballinalack on the south side. Route Corridor Option 4 runs close to the existing N4 through Bunbrosna, south of Ballynafid Lake and Fen rejoining the existing N4 from Portnashangan to the R394 near Mullingar.

Route Corridor Option 5 (Refer to Figures RFig 50.1 to 50.8 in Volume III)

From Roosky the Corridor runs online or close to the existing N4 through to Carrickmoyragh, travelling to the south of the existing N4 at Cloonart North. From Carrickmoyragh the Corridor follows a south easterly dirrection towards Lismoy. Route Corridor Option 5 then heads south crossing the existing N4 to follow the line of the proposed N5 Longford Bypass before bypassing Longford to the south side of the town. The Corridor runs to the south of the existing N4 between Longford and Edgeworthstown, bypassing Edgeworthstown, Rathowen and Ballinalack on the south side. Route Corridor Option 5 runs close to the existing N4 through Bunbrosna, south of Ballynafid Lake and Fen rejoining the existing N4 from Portnashangan to the R394 near Mullingar.

Route Corridor Option 6 (Refer to Figures RFig 60.1 to 60.4 in Volume III)

From Roosky the Corridor runs online or close to the existing N4 through to Carrickmoyragh, travelling to the south of the existing N4 at Cloonart North. From Carrickmoyragh the Route Corridor passes to the north side of Lismoy to the R198. The Corridor does not follow the same alignment as the existing N4 Longford Bypass, instead it passes Longford further to the north. From the R198 the Corridor runs in a south-easterly direction, crossing the R194 to the north of the Longford Bypass, near Clooncoose. Route Corridor Option 6 crosses the existing N4 between Sraid and Lissardowlan, crosses the railway line east of Freehalman and runs approximately in parallel with the railway line to bypass Edgeworthstown on the south side. From Edgeworthstown, the Corridor runs to the south of the existing N4 approximately in parallel bypassing Rathowen on the south side and then Ballinalack on the south side. Route Corridor Option 6 runs south of the existing N4 through Bunbrosna, south of Ballynafid Lake and Fen rejoining the existing N4 from Portnashangan to the R394 near Mullingar.

3.5 Public Consultation for Route Corridor Selection

Public exhibitions were held in September 2008, at which the Route Corridor Options were presented. These were additional to the requirements of the PMG, which requires only one consultation towards the end of Phase 3 to present the Emerging Preferred Route Corridor, but it is recognised as good practice to hold an additional earlier consultation as soon as the Route Corridor Options are available, so that the public and consultees may comment on them. The public exhibitions to present the Emerging Preferred Route Corridor were held in May 2009.

A brochure was produced for the September 2008 Public Exhibitions which summarised the need for the scheme and the scheme objectives, presented the Route Corridor Options on an indicative map background and also explained what would happen next, in terms of the process which has to be followed.

At the exhibitions, a questionnaire was provided with the brochure. The brochure and questionnaire are included in Appendix 2, Volume II.

The public exhibitions for the Route Selection stage were held at the following locations:

- Thursday 18th September: Aras an Chontae, Great Water Street, Longford from 2pm to 8pm
- Friday 19th September: Green Community Centre, Edgeworthstown from 2pm to 8pm
- Saturday 20th September: Mullingar Park Hotel, Mullingar from 10am to 4pm

The Route Corridor Options were displayed at the exhibitions on several copies of a large poster which presented the options on a OSi Discovery Map background. A reduced size version of this poster was made available at www.wccprojectoffice.ie and www.longfordcoco.ie for ease of downloading and printing (see Appendix 2, Volume II). Copies of the full size Route Corridor Options poster from the exhibitions remain available to view at the Longford County Council offices, Great Water Street, Longford and the Westmeath National Roads Design Office (NRDO), Culleen Beg, Mullingar.

Publicity for the public consultation and the exhibitions was multi-faceted and included distribution of information to the media and across the local area. In advance of the exhibitions, the indicative map and information regarding the exhibitions was provided at the following websites: www.wccprojectoffice.ie, www.westmeathcoco.ie and www.longfordcoco.ie. Advertisements for the exhibitions were placed in local newspapers: Westmeath Examiner, Longford Leader and Longford News. Posters were put up on local notice boards in public places. In addition, broadcasts were made on the Shannonside Northern Sound and Midlands Radio 3 local radio stations.

3.5.1 Response to the Public Consultation held in September 2008

Of the many attendees at the exhibitions, 492 persons entered their names in the visitors book: 169 in Longford, 151 in Edgeworthstown and 172 in Mullingar. Staff from Westmeath County Council, Longford County Council and Hyder Tobin Consultants were available at the exhibitions to discuss the scheme with the public and answer any questions. All attendees were invited to respond formally to the proposed Route Corridor Options by writing in or completing the questionnaire and returning it to their local County Council office or the Westmeath National Roads Design Office. A total of 420 questionnaires and letters were returned by the public. The response information gathered from these questionnaires and letters was assessed and is reported in detail in Appendix 3, Volume II.

The main responses to the specific questions contained in the questionnaire are summarised as follows:

- 'Impacts on the communities near the corridors' was ranked as the most important issue. In support of this, concerns regarding homes and land were the most frequent concerns raised within general comments received,
- 'Effect on Archaeological and Historical sites' and 'Impact on landscape' were ranked as being the next two most important aspects respectively,
- 32% expressed a preference for the Orange Route (Option 2),
- 27% expressed a preference for the Red Option (Option 1),
- 24% expressed a preference for the Green Option (Option 3),
- Widening the existing N4 was the most popular suggested alternative to these Route Corridor Options.

Feedback from public consultation is very important and has been taken into account in the development and appraisal of route corridor options. The feasibility of widening the existing N4 was examined at an early stage in the route corridor development process and is reported in the preceding Section 3.3.1. The impacts on communities near the corridors, the effects on archaeological and historical sites and the impacts on landscape (identified as the main areas of concern in the public consultation) are appraised together with all of the other issues raised during the public consultation, in Chapters 4, 5, 6 and 7.

The public consultation for the Emerging Preferred Route Corridor (EPRC) was held in May 2009 and is summarised in Chapter 8. Details of this consultation are contained in Appendices 25 and 26 in Volume II.

3.6 Introduction to the Appraisal Chapters

The following chapters contain the appraisals of the six Route Corridor Options. Chapter 4 contains the Environmental Appraisal, which contributes under the criteria of Environment, Accessibility and Integration. Chapter 5 contains the Engineering Appraisal, which describes the principal design standards which apply to this scheme and contributes under the criteria of Safety, Economy and Integration. Chapter 6 contains the Traffic and Economics Appraisal which contributes under the criteria of

Economy and Safety. Chapter 7 presents the main conclusions and recommendations arising from the appraisals

4 Environmental Appraisal

The following Environmental Appraisals have been undertaken using NRA Environmental Planning Guidelines (EPGs), where they exist for the environmental specialism or element in question, and the recently published NRA Project Appraisal Guidelines (PAG). EPGs exist for Environmental Impact Assessment, Air Quality, Architecutral Heritage, Archaeological Heritage, Conservation of Bats, Ecology, Surveying of protected Flora and Fauna, Geology, Hydrology, Hydrogeology Landscape and Noise & Vibration. The EPGs are the guidelines for the Environmental Impact Assessment process which includes Phase 3 (Route Selection) and Phase 4 (the design of the Preferred Route and the preparation of an Environmental Impact Statement). The impact/scaling statement terminologies of the EPGs and PAG are not identical, for example an EPG for a particular specialism may make reference to "Major Negative" impact whereas the relevant PAG scaling statement terminology to describe the same impact might be "Highly Negative". However the translation is not necessarily straightforward in all cases. At present there is no "Bridging Document" available to give an agreed translation between the EPG terminology and the PAG terminology. Therefore, in each of the following appraisal sections, where an EPG exists for the specialism in question, the EPG terminology takes precedence. In such cases, the specialist has then made a judgement as to how to best translate the EPG terminology into a correct PAG scaling statement for the Project Appraisal Balance Sheet. Where an EPG does not exist for the relevant specialism, then the PAG terminology can be adopted. In the Project Appraisal Balance Sheets in Appendix 1, Volume II, the PAG scaling statement terminology is adopted consistently throughout. The Environmental Appraisals in this chapter feed into the PABS criteria of Environment, Accessibility and Integration. The remaining two PABS criteria are addressed in Chapters 5 and 6.

The Route Corridor Options are 300m wide. However the EPGs sometimes specify that a particular corridor width should be assessed for the environmental specialism in question; for example for Archaeological Heritage the relevant EPG requires a 500m corridor to be assessed, (i.e. 250m either side of the centreline) whereas the EPG for Architectural Heritage requires a 200m wide corridor to be assessed. Occasionally for those specialisms where no EPG exists, the appraisal may only be meaningful if a corridor narrower than 300m is adopted. In all cases where a 300m corridor cannot

be adopted for the appraisal then the relevant corridor width is defined under the sub-heading of Methodology in each section.

At the end of each section an overall Order of Preference is given to the Route Corridor Options, from the perspective of that particular specialist area/element. These orders of preference are summarised together with the overall PABS scaling statements in tabular form in Chapter 7.

Whilst the Route Corridor Selection Report is written on the basis of assessing a 300 metre impact corridor, it is difficult to carry out an environmental assessment without reference to the anticipated vertical and horizontal road alignments, as these can greatly affect the significance of impact on both the surrounding receptors and features. Therefore, where reference is made to vertical and horizontal alignment in the impact appraisal text, it should be noted that this is not based on final engineering proposals and is included, without prejudice, to fully explain anticipated impact conclusions.

4.1 Land Use: Planning

This section assesses the likely impacts on land use and planning policies for each of the Route Corridor Options. The assessment is based largely on information contained in the Constraints Report, which included a detailed review of land uses within the study area as well as a review of the following key policy and strategy documents:

- The National Spatial Strategy for Ireland (NSS), 2002–2020;
- The National Development Plan, 2000-2006
- The National Development Plan (NDP), 2007-2013;
- Border, Midland and Western Regional Operational Programme, 2007-2013;
- Midland Regional Authority, Regional Planning Guidelines(RPG), 2004;
- Westmeath County Development Plan (WCDP), 2008-2014;
- Longford County Development Plan (LCDP), 2009-2015;
- Longford Northern Environs, Local Area Plan, 2008-2014;
- Longford Town Development Plan, 2009-2015;
- Multyfarnham Village Plan, 2007;
- Edgeworthstown Local Area Plan, 2008-2014;
- Newtown Forbes Local Area Plan, 2006-2012;
- Carrickglass Local Area Plan, 2004-2010.

4.1.1 Methodology

The methodology employed in completing the Route Corridor Options Appraisal comprises a desk study of each of the Route Corridor Options and the utilisation of information contained within the Constraints Report. Whilst NRA Guidelines for other EIA disciplines exist in order to set a corridor width within which to undertake Route Corridor assessments, for the purposes of this Route Corridor Options study, a 300 metre corridor width has been adopted. It is this bandwidth, which forms the basis of assessments to determine the land-use allocations, planning policies and planning

applications, which may be directly or indirectly affected by the Route Corridor Options.

In terms of land use, the assessment explores only the impacts on allocated land and the associated planning policy. Further consideration is given to the impact of Route Corridor Options on current land uses within the study area within both the socio-economic and agricultural and agronomy assessments.

In assessing the impacts of the various Route Corridor Options, the following significance criteria have been applied:

Table 4.1-1 Significance Criteria for Planning and Land Use

Impact	Significance Criteria
Highly Negative	Directly contravenes national or regional planning policies or designations.
Moderately Negative	Directly contravenes county policies or designations.
Slightly Negative	Conflicts with county or directly contravenes local policies or land use designations.
Neutral	No conflict with policies, or land use designations.
Slightly Positive	In accordance with lo cal / county policies, or land use designations.
Moderately Positive	Directly supports county / local policies or designations.
Highly Positive	In accordance with national and regional policies or designations

4.1.2 Existing Planning Policy Context

The following section provides an overview of the existing environment in relation to planning policies and land use allocations at the national, regional, county, and local levels. The information presented summarises the findings of the earlier Planning and Land Use section of the Constraints Report.

National Spatial Strategy, 2002-2020 (NSS)

The National Spatial Strategy is designed to deliver more balanced social, economic and physical development between regions. The Strategy identifies the N4 as a strategic radial corridor and views improved access to Sligo as a key priority.

Mullingar is identified in the Strategy as a new national level 'Linked Gateway' together with Athlone and Tullamore. These towns are to work in partnership to promote economic and social development in the region.

National Development Plan, 2000-2006

Whilst this document has since been superseded by the National Development Plan 2007-2013, it is important to note that it heralds the first national level commitment to N4 road improvements. The Plan identifies a strategy for developing the national primary road network to include "…major road improvements…" on the N4 between Sligo and Kinnegad.

National Development Plan, 2007-2013 (NDP)

The NDP re-affirms the planned investment in the upgrading and improvement of the national road network as a major priority. The Plan pays particular attention to the upgrading of road networks within and between Gateways identified within the NSS.

Border, Midland and Western Regional Operational Programme, 2007-2013

The Operational Programme outlines that provision of key infrastructure is the main issue for the region if it is to meet its potential, and that access to the BMW region has been one of the major barriers affecting its development. The Programme aligns to the priorities identified under Transport 21.

Midland Regional Authority, Regional Planning Guidelines, 2004 (RPG)

These Regional Planning Guidelines generally promote the competitiveness and attractiveness of the Midlands region. The Plan emphasises the importance of relating land use with transportation improvements and promotes the importance of the strategic location of the midlands within the national road network and its inter-connectivity with other regions.

Specifically, the plan refers to a need to combine the strengths of the linked gateway of Mullingar-Tullamore-Athlone identified within the NSS, with the strengths of the County Towns of Longford and Portlaoise.

Westmeath County Development Plan, 2008-2014 (WCDP)

The Westmeath County Development Plan recognises the importance of the N4 strategic road network; however, it also recognises the challenges in striking a balance between exploiting the benefits from the N4 whilst preserving road capacity. The plan generally supports the enhancement of strategic transportation

infrastructure in the County, along with a view to reduce volumes of traffic and discourage heavy goods vehicles in town centres. The plan refers to planned improvements between Mullingar and Longford, which are viewed as necessary to accommodate projected traffic growth. Policies and objectives for consideration in the Route Corridor selections will include the following ('P' for policy and 'O' for objective):

P-EY1 (Economy) It is the policy of the Council to facilitate enterprise and employment, and to cooperate with other agencies including the private sector in order to provide employment, support opportunities and in the promotion of the County as an attractive location for business which operates in a manner consistent with the NSS and the County Development Board Strategy.

P-EY5 It is policy of the Council to encourage and facilitate in a sustainable way, the growth and diversification of the County's tourist product/base, enabling an increase in the overall capacity and long-term development of the industry, through the use of its statutory powers where appropriate. The Council will seek to promote County Westmeath as a tourist destination in co-operation with other agencies, such as Westmeath Tourism, Fáilte Ireland (East and Midlands Region) and Waterways Ireland.

P-EY8 Other policies and development control objectives outlined in this Plan, in particular relating to the protection of Areas of High Amenity and the management of development in rural areas, play an important role in conserving the natural amenities of the County and therefore, in the development of the tourist industry.

P-EY9 To continue to protect the landscape, in particular High Amenity Areas, from the adverse effect of development, and thereby protect the primary tourism product.

O-EY22 Promotion of Mullingar, Athlone, Castlepollard and other towns and villages as tourism centres.

O-EY26 Encourage increased usage of the Royal Canal for barges, walkers etc.

O-EY39 Develop a programme of controlled access to sites in public ownership such as Scragh Bog, Rahugh Ridge, etc.

P-IF3 (Infrastructure) It is the policy of the Council to improve the standards and safety of the public roads and to protect the investment of public resources in the provision, improvement and maintenance of the public road network.

O-IF11 To seek the reduction of through-traffic entering town centres.

O-IFR12 N4 Mullingar Bypass northwestwards to the county boundary. Dual carriageway improvement, largely off-line, including bypasses of Rathowen and Ballinalack villages.

O-EH2 (Environment and Heritage) To protect, manage and enhance the natural heritage, biodiversity, landscape and environment of County Westmeath in recognition of its importance as a non-renewable resource, unique identifier and character of the County and as a natural resource asset.

O-EH3 It is a key objective to ensure as far as possible that development does not impact adversely on wildlife habitats and species. In the interests of sustainability, biodiversity should be conserved for the benefit of future generations.

P-EH7 To protect and conserve wild bird species and their habitats, especially rare or vulnerable species and regularly occurring migratory species.

P-EH8 To protect and conserve proposed candidate Special Areas of Conservation (cSAC).

P-EH12 To protect and conserve Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA).

O-EH27 To protect and preserve existing hedgerows and seek their replacement with new hedgerows with native species of local provenance where their removal is necessary during the course of road works or other works.

O-EH28 To ensure that development is appropriately managed in the vicinity of the Royal Canal and does not cause significant adverse impacts on the built and natural heritage or to the recreational potential of the canal.

P-EH24 To protect the distinctiveness of County Westmeath's landscapes and to recognise their capacity to sustainably integrate development within them.

P-HS24 (**Housing**) It is the policy of the Council to restrict development not related to farming practices and tourism in all high amenity areas, with the exception of housing for the immediate family (son/daughter) of established residents living on landholdings, who demonstrate a housing need and have long-term intrinsic links with the area.

P-RDE 1 (Rural Development/Economy) It is the policy of the Council to protect the viability of farms and best quality land for agricultural and related uses, whilst at the same time finding alternative employment in or close to rural areas to sustain rural communities.

Lough Owel – Specific Objectives

LO1 Westmeath Way; Enhance and link the Westmeath Way through Mullingar via the Royal Canal Feeder and further along the waterside via Tullaghan and to the north-eastern side of the lake. Cycle and pedestrian routes should be provided as part of an overall recreation link from Lough Owel to Lough Ennel.

LO2 Lough Owel Sailing Club/Access point/bathing area; Potential for upgrading of facilities at this location. Possibilities for compatible and sustainable further uses could be explored.

LO7 Consider further enhancing views of Lough Owel from this location.

LO8 Explore possibility of negotiated recreational link from Tormey's Pub (Bunbrosna) to lakeside.

LO9 Establish future recreational links at this location in consultation with Coillte.

LO10 Develop Ballinafid lake and surrounding lands as an amenity facility in the area incorporating links through lands in ownership of the National Parks and Wildlife Service (NPWS) and Coillte. Exploration of a recreational link to lands on the western side of the rail line should also be investigated.

LO11 Protected view from Lake to N4 should be preserved and enhanced where possible.

LO12 Viewing point from N4; Upgrading and redevelopment of the bathing area is necessary at this location.

LO13 Potential for a landmark gateway link/bridge for pedestrian/cyclists to Scragh Bog along northern route of Westmeath Way. Further develop the concept 'Gateway to the 'lake county'.

LO14 Link route of Westmeath Way through Coillte owned lands and lands in the ownership of National Parks and Wildlife Service.

LO15 Examine possibilities for an informal lakeside shore walk along the eastern perimeter of the lake.

LO16 Explore possibility for recreational links through former cowparks.

Longford County Development Plan, 2009-2015 (LCDP)

Under the Planning and Development Act, 2000, each Planning Authority is obliged to prepare a development plan every six years, the review of which should commence four years after its adoption. The Longford County Development Plan was formally adopted in March (2009) and the following strategic aims and policies have been identified as relevant to the Route Corridor Options:

SET 1 (Settlement Policy 1) "The Council shall continue to support the strengthening of the urban and village network throughout the County in accordance with the hierarchy outlined… and supported by the Regional Planning Guidelines, Sustainable Rural Housing Guidelines and Sustainable Residential Development in Urban Areas, issued by the DoEHLG." The settlement hierarchy includes:

- Longford Town, which is recognised as the Principal Town of the County, of regional importance and where 'the majority of industrial, commercial, business and retail development will be channelled'.
- Edgeworthstown, which is identified as a Service Town in terms of services and accommodation where major transport Nodes are present and it is envisaged that the settlement will continue to act in this role.

SET 2 Functional roles of the larger towns shall be maintained and supported by the promotion of appropriate development in these areas and through the Development Management process.

ENV 1 (Environmental Policy 1) To encourage and promote environmental awareness and environmentally friendly practices, particularly in industry, agriculture and all other activities.

NHB 1 (Natural Heritage and Biodiversity 1) It is an objective of the Council to protect, conserve and enhance the County's biodiversity and natural heritage. This includes wildlife (flora and fauna), habitats, landscapes and/or landscape features of importance to wildlife or which play a key role in the conservation and management of natural resources such as water.

NHB 3 It is an objective of the Council to encourage and promote access to and understanding of the natural heritage of the County.

NHB 5. The Council, in consultation with the National Parks and Wildlife Service, shall pursue the preparation, establishment and implementation of Habitat Mapping and a Wetland Survey for the County.

ROADS 1 (Roads Policy 1) To provide the highest quality road access and capacity on routes of economic importance to the County, thereby capitalising on the central location of Longford in a national context, increasing its attractiveness as a destination in itself and a location for settlement and industrial, commercial and business development.

ROADS 2: To provide a road network which is safe and efficient for all road users, cognisant of the requirements of all traffic, including motorised vehicles, pedestrians and cyclists.

ROADS 3: Promote sustainability in road use and the reduction of negative impacts on the environment, including carbon emissions, where possible through good design practice.

ROADS 4: To maintain and improve the capacity of existing arterial routes of national importance within the County in the context of the National Spatial Strategy and Regional Planning Guidelines, including the relief of bottlenecks at strategic locations.

ROADS 10: It is the policy of the Council to reserve lands in appropriate areas for the improvement, maintenance and management of road traffic systems throughout the County. Lands shall be reserved on proposed Route Corridor Options for the following scheme:

- "N4 from the Westmeath County boundary to the Leitrim County Boundary to facilitate the N4 Mullingar to Longford Road Improvement Scheme including the Newtown Forbes By-Pass. Where these corridors have been identified they will be protected from further development prior to the establishment of a final route. Where corridors have not yet been developed the Council shall pursue the development of these corridors and shall protect corridors from development once established.
- Where route selection corridors exist, it is the policy of the Council, in consultation with the NRA, to ensure that the final route is identified within a reasonable time."

PED 1 (Pedestrians and Cyclists Policy 1) The Planning Authority aims to improve the attractiveness and usability of the pedestrian environment of the County, particularly in residential areas, designated settlements and in areas of high amenity.

PED 5 The Council shall investigate the provision of dedicated cycle routes along routes of high amenity and along the Royal Canal.

BUS 1 (Bus Policy 1) To facilitate and promote the provision of an efficient and user-friendly bus service which maximises the economic and social potential of County Longford and recognises its strategic location within the Country.

ECON 4 (Industrial, Commercial and Business Development Policy 4) It is the policy that where a need is established, land may be zoned for industrial and commercial purposes to facilitate appropriate development in the medium to long term. It is further the policy that, should the need arise, and where resources permit, the Council will acquire and develop suitable sites and actively encourage industry to locate at such selected centres through the provision of serviced land banks for the development of industrial/business parks.

AGR 2 (Agriculture Policy 2) It is the policy of the Council to promote the agricultural industry and appropriate rural development and diversification, balanced with the natural architectural and archaeological heritage of the County. In this regard, proposed developments should consider potential heritage impacts and identify mitigating measures where required to ameliorate negative impacts.

Longford Northern Environs Local Area Plan 2008-2014

This Local Area Plan is in recognition of the strategic importance of the the Town as a principal Town within the county. The Plan is required to support the economic development of Longford, building on the strength of the existing industries which have recently located and expanded in this section of the Town. This Plan supports a sustainable landuse pattern through the prevention of development leakage to peripheral areas and consolidating existing development with a range of appropriate development types. The following policy is considered relevant:

LAP 2 To support the appropriate growth and development of Longford Town, in line with its role identified in the Midland Regional Planning Guidelines 2004 as a principal town in the polycentric model for the region.

Longford Town Development Plan, 2009-2015

This Plan specifically refers to the important role of the N4 Dublin-Sligo road to further increase the accessibility of the Town. The plan anticipates the N4 improvement works to be introduced in 2015. In addition, the Plan generally seeks enhanced pedestrian priority throughout Longford Town. Policies for consideration in the route corridor selections will include the following:

ROADS 1: To provide the highest quality road access and capacity on routes of economic importance to the Town, thereby capitalising on the central location of Longford in a national context, increasing its attractiveness as a destination in itself and a location for settlement, industrial, commercial and business development.

ROADS 2: To provide a road network which is safe and efficient for all road users while being cognisant of the requirements of all traffic, including motorised vehicles, pedestrians and cyclists.

ROADS 12: It is the policy of the Council to reserve lands in appropriate areas for the improvement, maintenance and management of road traffic systems throughout the town. This policy specifically references the N4 Mullingar to Longford (Roosky) Scheme.

Multyfarnham Village Plan, 2007

This Village Plan recognises that road infrastructure improvements over recent years have attracted commuting residents to Multyfarnham; however, the Plan remarks that the road infrastructure is generally good. Policies for consideration in the route corridor selections will include the following:

Mixed Use / Village Centre - To facilitate the sensitive expansion of commercial functions in the village in order to ensure a range and level of service appropriate to cater for the demand of both residents and visitors alike, taking Multyfarnham's position in the County retail strategy into account.

Edgeworthstown Local Area Plan, 2008-2014

This plan refers to the considerable volumes of traffic, in particular heavy good vehicles passing though Edgeworthstown due to its strategic position and location along main transport routes. Despite this, the plan also recognises that this volume has reduced following the completion of the Edgeworthstown By-pass in 2006. Each Route Corridor Option will be considered in terms of its position in relation to Edgeworthstown and the extent to which one Route Corridor Option may enhance or inhibit the future development of the Town. RFig 4.1.2 and 4.1.3, Volume III indicate the proximity of the defined settlement boundary and the Route Corridor options. Land allocated for the future development of Edgeworthstown has been distributed around the entire existing built environment. The Local Area Plan has zoned the south-western and south-eastern areas for predominantly industrial/commercial/warehousing, to the north predominantly residential and, towards the centre of the town land parcels have been allocated for social/community/education.

Relevant policy includes:

OS3 Protect views, prospects and settings of amenity value through appropriate land use zoning.

Newtown Forbes Local Area Plan, 2006-2012

This Plan recognises the strategic importance of the N4 but observes that at present the road experiences a considerable amount of heavy traffic. Policies for consideration in the Route Corridor Options will include the following:

Roads & transportation - A line for the bypass shall be identified and the Council shall reserve lands along this route to facilitate the future development of this bypass.

Amenity, Environment & Heritage - The Planning Authority shall promote the protection and conservation of heritage sites, monuments, artefacts and monuments and the integrity of their setting, as listed and illustrated in the Record of Monuments and Places.

Carrickglass Local Area Plan, 2004-2010

This Plan recognises the potentially supportive role of Carrickglass Demesne as a development cluster within proximity of Longford Town. The development area assumes main access via the R194 from the west and Creeve from the east. The Route Corridor Options deliberately avoid the land-use allocations within this plan and as such no impact on the contents of this Local Area Plan is anticipated.

4.1.3 Route Corridor Option Appraisal

Prior to discussing the effects of the various Route Corridor Options on planning policy and land use allocations within the study area, it is important to note that all routes are in general accordance with policies and the strategic direction of the NSS, NDP, Transport 21 and the RPGs for the Midlands Region. All Route Corridor Options therefore bring a **highly positive** impact in relation to policies at a national and regional level.

Given this highly positive impact in relation to compliance with national and regional policies, the Route Corridor Option assessments below concentrate on impacts in relation to County and local level planning policies and land use allocations. In general, it is important to note that with the exception of the periphery of Longford Town, all identified Route Corridor Options lie outside zoned land (defined as white land) on land which, as the County Development Plans for both Longford and Westmeath identify, is assumed for agricultural use. Further details can be found in the detailed assessment of impact on this sector in Section 4.3, Land Use: Agriculture of this report.

The majority of policy documents promote environmental awareness and environmentally friendly practices and the selected Route Corridor Options should result in a reduction in congestion and local carbon emissions. However, it is important to note the proposed road improvements will encourage the use of the motor car and other carbon emitting vehicles, resulting in a **slightly negative impact**. In contrast, economic development is another recurring priority within planning policy and it is likely that a new Route Corridor would facilitate medium to long term growth within the two counties, resulting in a **moderately positive impact**. Where a Route Corridor Option considered has both positive and negative impacts on policies and land use allocations, the worst-case scenario is assumed.

At this stage, the focus of the assessment will be in relation to land use planning policies and allocations contained in the policy documents and strategies above. A systematic approach has been used to assess each Route Corridor Options relationship with existing (adopted) and emerging planning policy/guidance.

The Node points referred to in each of the Route Corridor Options descriptions reflect the key points within each route corridor identified in RFig 10.1-10.4; RFig 20.1-20.4; RFig 30.1-30.4; RFig 40.1-40.4; RFig 50.1-50.4 and RFig 60.1-60.4 of Volume III of this report. RFig 4.1.1 to 4.1.4, Planning and Socio-Economic Overview should also be referenced.

Following a review of each Route Corridor Option and the relevant planning policies, an overall impact is presented for each Route Corridor. This overall impact is judged as a compilation of all policy and land use allocation impacts for the Route Corridor.

Route Corridor Option 1

At the westerly extent, Route Corridor Option 1 falls within a number of statutory designated sites of environmental importance. Between Nodes 01 and 2A, the Route Corridor Option passes through the southern end of the Aghnamona Bog Natural Heritage Area (NHA) although not extending beyond the existing N4 boundaries. It also passes through the north-eastern extents of the Clooneen Bog proposed Natural Heritage Area (pNHA) and candidate Special Area of Conservation (cSAC). Work has already been undertaken in these areas to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 02A and 04, the Route Corridor runs within the boundaries of north-eastern extents of the Ballykenny-Fishertown Bog Special Protection Area (SPA), and the Lough Forbes Complex pNHA and cSAC, although not extending beyond the existing N4 boundaries. Within this area, the Route Corridor also runs within the south-westerly extents of the Rinn River NHA.

To the east of Node 04, the Route Corridor crosses the Dublin to Sligo railway before passing the northern and eastern edges of the Longford Town Council area. Between Nodes 06 and 08B, the Route Corridor passes within close proximity of twelve land-use allocations outside the Longford Town Council area, to the north and

north east of the town (see RFig 4.1.1 and RFig 4.1.2). These areas are zoned for either residential, social/community, or residential/commercial, high tech/light industrial/employment generating. The Route Corridor is considered to provide a strong link with identified land-use zones without hindering the potential for further northerly and easterly expansion of the town. Between Nodes 08B and 16, the Route Corridor takes a path through predominately agricultural land, crossing the existing N4 at Node 10A, and the Dublin to Sligo railway again at Node 14.

From Node 16 to Node 22, the Route Corridor again falls within the boundaries of a number of areas protected for their environmental quality. At Node 17A, the Route Corridor runs within close proximity to the Lough Garr NHA and close to Node 17 the Route Corridor runs through the north-eastern tip of Lough Iron pNHA and SPA. Work has already been undertaken at Lough Iron to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 19 and 20 the Route Corridor runs through the northern tip of the Lough Owel pNHA, cSAC and SPA. Lough Owel is recognised as a High Amenity Area. To the west of Node 20, the Route Corridor once again crosses the Dublin to Sligo railway Line.

Between Nodes 20 and 21A, the Route Corridor runs within the boundary of Ballynafid Lake and Fen pNHA and skirts the eastern boundary of Lough Owel pNHA, cSAC, and SPA. This area is also recognised as a High Amenity Area in the Westmeath County Development Plan (CDP).

Route Corridor Option 1 affects the following policies:

Table 4.1-2 Route Corridor Option 1: Planning and Land Use Impacts

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	SET 1 SET 2	Maintenance of viable communities and in accordance with the established hierarchy of the county's settlements.	Moderately Positive	Investment in infrastructure which will increase viability of communities.This route is considered to be well placed within sufficient proximity to the Longford and Edgeworthstown settlements, balancing regional connectivity without inhibiting the outward expansion of the settlements.
Longford Northern Environs LAP (2008-2014)	LAP2			

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	ROADS1 ROADS2 ROADS4 ROADS10	Road Infrastructure, Access and Capacity Improvements.	Moderately Positive	Planned improvements to road infrastructure.
Longford Town Development Plan	Roads and Transportation			
Newtown Forbes LAP	Roads and Transportation			
Longford CDP (2009-2015)	BUS1	Efficient and user friendly bus service.	Slightly Positive	Reduced congestion on existing bus routes and improved regional connectivity.
Longford CDP (2009-2015)	NHB1 NHB3 NHB5	Protecting environmentally designated sites, biodiversity and natural heritage.	Moderately Negative	Route Corridor incorporates Aghnamona Bog (NHA), Clooneen Bog (pNHA / cSAC), River Rinn (NHA), Ballykenny-Fishertown Bog (SPA) and Lough Forbes Complex (pNHA / cSAC).
Longford CDP (2009-2015)	PED1	Town/Village environment.	Slightly Positive	Congestion reduced from N4 route through existing settlement centres.
Westmeath CDP	P-IF3 O-IFR12	Road Infrastructure, Access and Capacity Improvements.	Moderately Positive	Planned improvements to road infrastructure.
Westmeath CDP	P-EY9 P-EH7 P-EH8 P-EH12 P-EH24 O-EH2 O-EH3 LO11 LO12	Protecting environmentally designated sites, landscape, biodiversity and natural heritage.	Moderately Negative	Route Corridor incorporates Lough Iron (pNHA / SPA), Lough Owel (pNHA / SPA / cSAC), Lough Garr (NHA), and Ballynafid Lake & Fen (pNHA).
Westmeath CDP	P-HS24	Restricted development in areas of high amenity	Slightly Negative	Route Corridor covers an area of High Amenity surrounding Lough Owel. Whilst the route contributes infrastructure likely to facilitate tourism development, the route has the potential to detract from local amenity value.
Westmeath CDP	LO8 LO9 LO10	Bunbrosna to lakeside, land West of railway line: possibility of negotiated recreational link.	Slightly Negative	Potential to temporarily restrict this proposed recreational link.
Westmeath CDP	O-IF11	Town/Village environment.	Slightly Positive	Traffic congestion eased from existing N4 route through settlement centres.

Route Corridor Option 2

At the westerly extent, Route Corridor Option 2 falls within a number of statutory designated sites of environmental importance. Between Nodes 01 and 2A, the Route Corridor Option passes through the southern end of the Aghnamona Bog Natural Heritage Area (NHA) although not extending beyond the existing N4 boundaries. It also passes through the north-eastern extents of the Clooneen Bog proposed Natural Heritage Area (pNHA) and candidate Special Area of Conservation (cSAC). Work has already been undertaken in these areas to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 02A and 04, the Route Corridor runs within the boundaries of north-eastern extents of the Ballykenny-Fishertown Bog Special Protection Area (SPA), and the Lough Forbes Complex pNHA and cSAC, although not extending beyond the existing N4 boundaries. Within this area, the Route Corridor also runs within the south-westerly extents of the Rinn River NHA.

Between Nodes 04 and 06 the Route Corridor follows a path through predominantly agricultural land. From Node 6 to 9B the route turns further south to join the alignment of the existing N4 Longford Bypass. The route is in close proximity to the Longford Town Council area and conflicts with land zoned for the expansion of Longford Town, specifically for commercial/light industrial/employment generating uses. In addition, the proximity of the Route Corridor to the existing settlement boundary is considered a significant restriction to any future potential expansion of the town. The alignment of the Route Corridor in relation to the allocated zones is identified in RFig 4.1.1-. RFig 4.1.2, Volume III.

From Node 9B the Route Corridor runs roughly in parallel to the existing N4, along the southern side, crossing the Dublin to Sligo railway Line at Node 14 and the existing N55 just west of Node 14A. At Node 17A, the Route Corridor runs within close proximity to the Lough Garr NHA and close to Node 17 the Route Corridor impinges slightly onto the northern tip of Lough Iron pNHA and SPA.

Between Node 19 and 21, the Route Corridor skirts the boundary of Lough Owel pNHA, SPA and cSAC and the south-western boundary of Ballynafid Lake and Fen pNHA. The Route Corridor also, in part, follows the line of the Dublin Sligo railway.

Between Node 21 and 21A, the Route Corridor falls slightly within the eastern boundary of Lough Owel pNHA, SPA and cSAC, and this wider area (between Node 19 and 21A) has been identified in the Westmeath CDP as a High Amenity Area.

Route Corridor Option 2 affects the following policies:

Table 4.1-3 Route Corridor Option 2: Planning and Land Use Impacts

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	SET 1 SET 2	Maintenance of viable communities in accordance with the identified settlement hierarchy.	Moderately Negative	The route is considered to directly restrict the long-term role of Longford Town as the principal settlement in the county, conflicting with areas zoned for future business/employment uses but also limiting the potential for land on the periphery of the settlement to be zoned in the future.
Longford Northern Environs LAP (2008-2014)	LAP2			
Longford CDP (2009-2015)	ROADS1 ROADS2 ROADS4 ROADS10	Road Infrastructure, Access and Capacity Improvements	Moderately Positive	Planned improvements to road infrastructure.
Longford Town Development Plan	Roads and Transportation			
Newtown Forbes LAP	Roads and Transportation			
Longford CDP (2009-2015)	BUS1	Efficient and user friendly bus service	Slightly Positive	Reduced congestion on existing bus routes and improved regional connectivity.
Longford CDP (2009-2015)	NHB1 NHB3 NHB5	Protecting environmentally designated sites, biodiversity and natural heritage	Moderately Negative	Route Corridor incorporates Aghnamona Bog (NHA), Clooneen Bog (pNHA / cSAC), River Rinn (NHA), Ballykenny-Fishertown Bog (SPA) and Lough Forbes Complex (pNHA / cSAC).
Longford CDP (2009-2015)	PED1	Town/Village environment	Slightly Positive	Congestion reduced from N4 route through existing settlement centres
Westmeath CDP	P-IF3 O-IFR12	Road Infrastructure, Access and Capacity Improvements	Moderately Positive	Planned improvements to road infrastructure.
Westmeath CDP	P-EY9 P-EH7	Protecting environmentally	Moderately Negative	Route Corridor incorporates Lough Iron

Plan	Policy	General theme	Impact	Justification
	P-EH8 P-EH12 P-EH24 O-EH2 O-EH3 LO11 LO12	designated sites, landscape, biodiversity and natural heritage		(pNHA / SPA), Lough Owel (pNHA, cSAC, SPA), Lough Garr (NHA), and Ballynafid Lake & Fen (pNHA).
Westmeath CDP	P-HS24	Restricted development in areas of high amenity	Slightly Negative	Route Corridor covers an area of High Amenity surrounding Lough Owel. Whilst the route contributes infrastructure likely to facilitate tourism development, the route has the potential to detract from local amenity value.
Westmeath CDP	LO8 LO9 LO10	Bunbrosna to lakeside, land West of railway line: possibility of negotiated recreational link	Slightly Negative	Potential to temporarily restrict this proposed recreational link.
Westmeath CDP	O-IF11	Town/Village environment	Slightly Positive	Traffic congestion eased from existing N4 route through settlement centres.

Route Corridor Option 3

At the westerly extent, Route Corridor Option 3 falls within a number of statutory designated sites of environmental importance. Between Nodes 01 and 2A, the Route Corridor Option passes through the southern end of the Aghnamona Bog Natural Heritage Area (NHA) although not extending beyond the existing N4 boundaries. It also passes through the north-eastern extents of the Clooneen Bog proposed Natural Heritage Area (pNHA) and candidate Special Area of Conservation (cSAC). Work has already been undertaken in these areas to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 02A and 04, the Route Corridor runs within the boundaries of north-eastern extents of the Ballykenny-Fishertown Bog Special Protection Area (SPA), and the Lough Forbes Complex pNHA and cSAC, although not extending beyond the existing N4 boundaries. Within this area, the Route Corridor also runs within the south-westerly extents of the Rinn River NHA.

Between Nodes 04 and 22, the Route Corridor runs through land mainly defined as agricultural land with the following additional observations:

- To the east of Node 04 the Route Corridor crosses the Dublin to Sligo railway Line;
- Between Nodes 6 and 8B, the Route Corridor passes within relative proximity of twelve land-use zones to the north and north east of the Longford Town Council area (RFig 4.1.1 and RFig 4.1.2). These areas are zoned for either residential, social/community, or residential/commercial, high tech/light industrial/employment generating. The Route Corridor is considered to provide a strong link with identified land-use zones without hindering the potential for further northerly and easterly expansion of the town;
- The Route Corridor passes the northerly margin of Edgeworthstown and crosses the existing N55 at Node 13A. Edgeworthstown Local Area Plan (2008-2014) identifies significant expansion of the town with the south-western and south-eastern corners being allocated for Industrial/Commercial/Warehousing, whilst the northerly portion of the town has been zoned for predominantly residential use;
- The Route Corridor crosses the Dublin to Sligo railway line north of Windtown as detailed in RFig 4.1.3;
- The edge of the Route Corridor briefly touches the boundary of Lough Garr NHA as detailed in RFig 4.1.3 and around the boundary of Lough Iron SPA and Ramsar site as indicated in RFig 4.1.4;
- The Route Corridor touches the High Amenity Area around Lough Owel around Node 18A and again between Node 18B and Node 21A as detailed in Figure 4.1.4.
- The Route Corridor is approximately two kilometres from Multyfarnham Village centre.
- The Route Corridor crosses the Dublin to Sligo railway line to the south east of Node 18A; and
- The Route Corridor passes in close proximity to Scragh Bog cSAC, pNHA, and Statutory Nature Reserve.

Route Corridor Option 3 affects the following policies:

Table 4.1-4 Route Corridor Option 3: Planning and Land Use Impacts

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	SET 1 SET 2	Maintenance of viable communities and in accordance with the established hierarchy of the county's settlements.	Moderately Positive	Investment in infrastructure which will increase viability of communities. This route is considered to be well placed within sufficient proximity to Longford and Edgeworthstown settlements, balancing regional connectivity without inhibiting the outward expansion of the settlements.
Lonford Northern Environs LAP (2008-2014)	LAP2			
Longford CDP (2009-2015)	ROADS1 ROADS2 ROADS4 ROADS10	Road Infrastructure, Access and Capacity Improvements	Moderately Positive	Planned improvements to road infrastructure.
Longford Town Development Plan	Roads and Transportation			
Newtown Forbes LAP	Roads and Transportation			
Longford CDP (2009-2015)	BUS1	Efficient and user friendly bus service	Slightly Positive	Reduced congestion on existing bus routes and improved regional connectivity.
Longford CDP (2009-2015)	NHB1 NHB3 NHB5	Protecting environmentally designated sites, biodiversity and natural heritage	Moderately Negative	Route Corridor incorporates Aghnamona Bog (NHA), Clooneen Bog (pNHA / cSAC), River Rinn (NHA), Ballykenny-Fishertown Bog (SPA) and Lough Forbes Complex (pNHA / cSAC).
Longford CDP (2009-2015)	PED1	Town/Village environment	Slightly Positive	Congestion reduced from N4 route through existing settlement centres
Westmeath CDP	P-IF3 O-IFR12	Road Infrastructure, Access and Capacity Improvements	Moderately Positive	Planned improvements to road infrastructure.
Westmeath CDP	P-EY9 P-EH7 P-EH8 P-EH12	Protecting environmentally designated sites, landscape, biodiversity and natural heritage	Slightly Negative	The Route Corridor is in proximity to Lough Garr (NHA), Lough Owel (cSAC / pNHA / SPA) and Scragh Bog (pNHA / cSAC & Statutory Nature

Plan	Policy	General theme	Impact	Justification
	P-EH24 O-EH2 O-EH3 LO11 LO12			Reserve).
Westmeath CDP	P-HS24	Restricted development in areas of high amenity	Slightly Negative	Route Corridor covers an area of High Amenity surrounding Lough Owel. Whilst the route contributes infrastructure likely to facilitate tourism development, the route has the potential to slightly detract from local amenity value.
Westmeath CDP	LO8, LO9 and LO10	Developing recreational linkages.	Neutral	Route Corridor alignment avoids areas that have been allocated for recreational linkages.
Westmeath CDP	O-IF11	Town/Village environment	Slightly Positive	Traffic congestion eased from existing N4 route through settlement centres.

Route Corridor Option 4

At the westerly extent, Route Corridor Option 4 falls within a number of statutory designated sites of environmental importance. Between Nodes 01 and 2A, the Route Corridor Option passes through the southern end of the Aghnamona Bog Natural Heritage Area (NHA) although not extending beyond the existing N4 boundaries. It also passes through the north-eastern extents of the Clooneen Bog proposed Natural Heritage Area (pNHA) and candidate Special Area of Conservation (cSAC). Work has already been undertaken in these areas to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 02A and 04, the Route Corridor runs within the boundaries of north-eastern extents of the Ballykenny-Fishertown Bog Special Protection Area (SPA), and the Lough Forbes Complex pNHA and cSAC, although not extending beyond the existing N4 boundaries. Within this area, the Route Corridor also runs within the south-westerly extents of the Rinn River NHA.

To the east of Node 04, the Route Corridor crosses the Dublin to Sligo railway. The Route Corridor then runs east and passes to the north of the designated Carrickglass

Demesne pNHA. The Route Corridor also passes in close proximity to but not directly impacting on the planned village of Killyfad.

Between Nodes 04 and 17, the Route Corridor runs through predominantly agricultural land, heading due east away from Longford Town. The Route Corridor crosses the existing N4 at Node 10A and the Dublin Sligo railway line at Node 14. The Corridor is not within sufficient proximity to connect with the planned development of Longford Town. The Route Corridor is within close proximity of the Lough Garr NHA north of Node 17A.

Between Nodes 17 and 19 the Route Corridor slightly impinges on the northern tip of Lough Iron pNHA and SPA, and between Nodes 19 and 21, the Route Corridor runs within very close proximity to the eastern boundaries of Lough Owel cSAC, pNHA and SPA. This Route Corridor also runs within the south-western boundary of the Ballynafid Lake and Fen pNHA.

Between Nodes 21 and 21A, the Route Corridor falls slightly within the eastern boundary of Lough Owel pNHA, SPA and cSAC, and this wider area has ben identified in Westmeath CDP as a High Amenity Area. Within this area, the Route Corridor also crosses over the Dublin to Sligo railway line.

Route Corridor Option 4 affects the following policies:

Table 4.1-5 Route Corridor Option 4: Planning and Land Use Impacts

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	SET 1 SET 2	Maintenance of viable communities and in accordance with the established hierarchy of the county's settlements.	Slightly Positive	Investment in infrastructure which will increase viability of communities, but the route is not within sufficient proximity to connect with existing and planned growth of Longford Town.
Longford Northern Environs LAP (2008-2014)	LAP2			
Longford CDP (2009-2015)	ROADS1 ROADS2 ROADS4 ROADS10	Road Infrastructure, Access and Capacity Improvements	Moderately Positive	Planned improvements to road infrastructure.
Longford Town Development Plan	Roads and Transportation			

Plan	Policy	General theme	Impact	Justification
Newtown Forbes LAP	Roads and Transportation			
Longford CDP (2009-2015)	BUS1	Efficient and user friendly bus service	Slightly Positive	Reduced congestion on existing bus routes and improved regional connectivity.
Longford CDP (2009-2015)	NHB1 NHB3 NHB5	Protecting environmentally designated sites, biodiversity and natural heritage	Moderately Negative	Route Corridor incorporates Aghnamona Bog (NHA), Clooneen Bog (pNHA / cSAC), River Rinn (NHA), Ballykenny-Fishertown Bog (SPA) and Lough Forbes Complex (pNHA / cSAC).
Longford CDP (2009-2015)	PED1	Town/Village environment	Slightly Positive	Congestion reduced from N4 route through existing settlement centres
Westmeath CDP	P-IF3 O-IFR12	Road Infrastructure, Access and Capacity Improvements	Moderately Positive	Planned improvements to road infrastructure.
Westmeath CDP	P-EY9 P-EH7 P-EH8 P-EH12 P-EH24 O-EH2 O-EH3 LO11 LO12	Protecting environmentally designated sites, landscape, biodiversity and natural heritage	Moderately Negative	Route Corridor incorporates Lough Iron (pNHA / SPA), Lough Owel (pNHA, cSAC, SPA), Lough Garr (NHA), and Ballynafid Lake & Fen (pNHA).
Westmeath CDP	P-HS24	Restricted development in areas of high amenity	Slightly Negative	Route Corridor covers an area of High Amenity surrounding Lough Owel. Whilst the route contributes infrastructure likely to facilitate tourism development, the route has the potential to detract from local amenity value.
Westmeath CDP	LO8 LO9 LO10	Bunbrosna to lakeside, land West of railway line: possibility of negotiated recreational link	Slightly Negative	Potential to temporarily restrict this proposed recreational link
Westmeath CDP	O-IF11	Town/Village environment	Slightly Positive	Traffic congestion eased from existing N4 route through settlement centres

Route Corridor Option 5

At the westerly extent, Route Corridor Option 5 falls within a number of statutory designated sites of environmental importance. Between Nodes 01 and 2A, the Route Corridor Option passes through the southern end of the Aghnamona Bog Natural Heritage Area (NHA) although not extending beyond the existing N4 boundaries. It also passes through the north-eastern extents of the Clooneen Bog proposed Natural Heritage Area (pNHA) and candidate Special Area of Conservation (cSAC). Work has already been undertaken in these areas to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 02A and 04, the Route Corridor runs within the boundaries of north-eastern extents of the Ballykenny-Fishertown Bog Special Protection Area (SPA), and the Lough Forbes Complex pNHA and cSAC, although not extending beyond the existing N4 boundaries. Within this area, the Route Corridor also runs within the south-westerly extents of the Rinn River NHA.

The Route Corridor crosses the existing Dublin to Sligo railway line to the south east of Node 4.

Between Nodes 04 and 05 the Route Corridor runs through predominately agricultural land, before running to the west and south of the Longford town boundary. This area of Longford Town has not been identified as having potential for future expansion, due to both floodplain restrictions and unsuitable topography therefore the Route Corridor is considered not to adequately connect with the planned development of the settlement.

The Route Corridor crosses the Dublin to Sligo railway Line between Node 5A and 5B, follows the route of the proposed N5 Longford Bypass at Node 5B, and crossed the N63 and the Royal Canal pNHA east of Node 5C. To the south of Longford, the Route Corridor slightly impinges on the Derrymore Bog pNHA,. Within this area, the Route Corridor severs an area of zoning identified to the south east of Longford within the Longford County Development Plan. There are five land-use zones allocated for industrial, industrial/commercial, residential or recreational use.

Around Node 09D to 14, the Route Corridor follows roughly the line of the Dublin to Sligo railway. The Route Corridor then crosses the existing N55 just west of Node

14A and runs through predominantly agricultural land to Node 17A. North of Node 17A, the Route Corridor is in close proximity to Lough Garr NHA.

Between Nodes 17 and 19 the Route Corridor slightly impinges on the northern tip of Lough Iron pNHA and SPA, and between Nodes 19 and 21, the Route Corridor runs within very close proximity to the eastern boundaries of Lough Owel cSAC, pNHA and SPA. This Route Corridor also runs within the south-western boundary of the Ballynafid Lake and Fen pNHA.

Between Nodes 21 and 21A, the Route Corridor falls slightly within the eastern boundary of Lough Owel pNHA, SPA and cSAC, and this wider area has been identified in Westmeath CDP as a High Amenity Area. Within this area, the Route Corridor also crosses over the Dublin to Sligo railway line.

Route Corridor Option 5 affects the following policies:

Table 4.1-6 Route Corridor Option 5: Planning and Land Use Impacts

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	SET 1 SET 2	Maintenance of viable communities in accordance with the identified settlement hierarchy.	Moderately Negative	The route is considered to directly restrict the long-term role of Longford Town as the principal settlement in the county, conflicting with areas zoned for industrial, industrial/commercial, residential or recreational use.
Longford Northern Environs LAP (2008-2014)	LAP2			
Longford CDP (2009-2015)	ROADS1 ROADS2 ROADS4 ROADS10	Road Infrastructure, Access and Capacity Improvements.	Moderately Positive	Planned improvements to road infrastructure.
Longford Town Development Plan	Roads and Transportation			
Newtown Forbes LAP	Roads and Transportation			
Longford CDP (2009-2015)	BUS1	Efficient and user friendly bus service.	Slightly Positive	Reduced congestion on existing bus routes and improved regional connectivity.

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	NHB1 NHB3 NHB5	Protecting environmentally designated sites, biodiversity and natural heritage.	Moderately Negative	Route Corridor incorporates Aghnamona Bog (NHA), Clooneen Bog (pNHA / cSAC), River Rinn (NHA), Ballykenny-Fishertown Bog (SPA), Lough Forbes Complex (pNHA / cSAC) and Derrymore Bog (NHA). The corridor also impacts on the Royal Canal (pNHA).
Longford CDP (2009-2015)	PED1	Town/Village environment.	Slightly Positive	Congestion reduced from N4 route through existing settlement centres
Westmeath CDP	P-IF3 O-IFR12	Road Infrastructure, Access and Capacity Improvements.	Moderately Positive	Planned improvements to road infrastructure.
Westmeath CDP	P-EY9 P-EH7 P-EH8 P-EH12 P-EH24 O-EH2 O-EH3 LO11 LO12	Protecting environmentally designated sites, landscape, biodiversity and natural heritage.	Moderately Negative	The route incorporates Lough Iron (pNHA / SPA), Lough Owel (pNHA, cSAC, SPA), Lough Garr (NHA), and Ballynafid Lake & Fen (pNHA).
Westmeath CDP	P-HS24	Restricted development in areas of high amenity	Slightly Negative	Route Corridor covers an area of High Amenity surrounding Lough Owel. Whilst the route contributes infrastructure likely to facilitate tourism development, the route has the potential to detract from local amenity value.
Westmeath CDP	LO8 LO9 LO10	Bunbrosna to lakeside, land West of railway line: possibility of negotiated recreational link	Slightly Negative	Potential to temporarily restrict this proposed recreational link
Westmeath CDP	O-IF11	Town/Village environment	Slightly Positive	Traffic congestion eased from existing N4 route through settlement centres

Route Corridor Option 6

At the westerly extent, Route Corridor Option 6 falls within a number of statutory designated sites of environmental importance. Between Nodes 01 and 2A, the Route Corridor Option passes through the southern end of the Aghnamona Bog Natural Heritage Area (NHA) although not extending beyond the existing N4 boundaries. It also passes through the north-eastern extents of the Clooneen Bog proposed Natural Heritage Area (pNHA) and candidate Special Area of Conservation (cSAC). Work has already been undertaken in these areas to mitigate the impact of the Route Corridor and is referred to in more detail in Section 4.10 of this report, Natural Environment. Between Nodes 02A and 04, the Route Corridor runs within the boundaries of north-eastern extents of the Ballykenny-Fishertown Bog Special Protection Area (SPA), and the Lough Forbes Complex pNHA and cSAC, although not extending beyond the existing N4 boundaries. Within this area, the Route Corridor also runs within the south-westerly extents of the Rinn River NHA.

The Route Corridor crosses the existing Dublin to Sligo railway line to the east of Node 04 before passing the northern and eastern edges of Longford Town Council area. Between Nodes 6 and 9B, the Route Corridor passes within relative proximity of twelve land-use zones to the north and north east of Longford town, outside the Longford Town Council area. These areas are zoned for either residential, social/community, or residential/commercial, high tech/light industrial/employment generating. The Route Corridor is considered to provide a strong link with identified land-use zones without hindering the potential for further northerly and easterly expansion of the town. At Node 9A the Route Corridor crosses the existing N4, then the Dublin to Sligo railway Line at Node 09D and the N55 just west of Node 14A, following a path through predominately agricultural land. The Route Corridor is also in close proximity to Lough Garr NHA at Node 17A.

Between Nodes 17 and 19 the Route Corridor slightly impinges on the northern tip of Lough Iron pNHA and SPA, and between Nodes 19 and 21, the Route Corridor runs within very close proximity to the eastern boundaries of Lough Owel cSAC, pNHA and SPA. This Route Corridor also runs within the south-western boundary of the Ballynafid Lake and Fen pNHA.

Between Nodes 21 and 21A, the Route Corridor falls slightly within the eastern boundary of Lough Owel pNHA, SPA and cSAC, and this wider area has been identified in Westmeath CDP as a High Amenity Area. Within this area, the Route Corridor also crosses over the Dublin to Sligo railway line.

Route Corridor Option 6 affects the following policies.

Table 4.1-7 Route Corridor Option 6: Planning and Land Use Impacts

Plan	Policy	General theme	Impact	Justification
Longford CDP (2009-2015)	SET 1 SET 2	Maintenance of viable communities and in accordance with the established hierarchy of the county's settlements.	Moderately Positive	Investment in infrastructure which will increase viability of communities. This route is considered to be well placed within sufficient proximity to the Longford and Edgeworthstown settlements, balancing regional connectivity without inhibiting the outward expansion of the settlements.
Longford Northern Environs LAP (2008-2014)	LAP2			
Longford CDP (2009-2015)	ROADS1 ROADS2 ROADS4 ROADS10	Road Infrastructure, Access and Capacity Improvements.	Moderately Positive	Planned improvements to road infrastructure.
Longford Town Development Plan	Roads and Transportation			
Newtown Forbes LAP	Roads and Transportation			
Longford CDP (2009-2015)	BUS1	Efficient and user friendly bus service.	Slightly Positive	Reduced congestion on existing bus routes and improved regional connectivity.
Longford CDP (2009-2015)	NHB1 NHB3 NHB5	Protecting environmentally designated sites, biodiversity and natural heritage	Moderately Negative	Route Corridor incorporates Aghnamona Bog (NHA), Clooneen Bog (pNHA / cSAC), River Rinn (NHA), Ballykenny-Fishertown Bog (SPA) and Lough Forbes Complex (pNHA/ cSAC).
Longford CDP (2009-2015)	PED1	Town/Village environment	Slightly Positive	Congestion reduced from N4 route through existing settlement centres.

Plan	Policy	General theme	Impact	Justification
Westmeath CDP	P-IF3 O-IFR12	Road Infrastructure, Access and Capacity Improvements.	Moderately Positive	Planned improvements to road infrastructure.
Westmeath CDP	P-EY9 P-EH7 P-EH8 P-EH12 P-EH24 O-EH2 O-EH3 LO11 LO12	Protecting environmentally designated sites, landscape, biodiversity and natural heritage.	Moderately Negative	The Route Corridor incorporates Lough Iron (pNHA / SPA), Lough Owel (pNHA, cSAC, SPA), Lough Garr (NHA), and Ballynafid Lake & Fen (pNHA).
Westmeath CDP	P-HS24	Restricted development in areas of high amenity	Slightly Negative	Route Corridor covers an area of High Amenity surrounding Lough Owel. Whilst the route contributes infrastructure likely to facilitate tourism development, the route has the potential to detract from local amenity value.
Westmeath CDP	LO8 LO9 LO10	Bunbrosna to lakeside, land West of railway line: possibility of negotiated recreational link.	Slightly Negative	Potential to temporarily restrict this proposed recreational link.
Westmeath CDP	O-IF11	Town/Village environment.	Slightly Positive	Traffic congestion eased from existing N4 route through settlement centres.

4.1.4 Conclusion

The above Route Corridor Options assessment has illustrated that within the planning policy context set by national, regional and local planning policy and guidance, all Route Corridors have the potential to bring both positive and negative impacts. Due to the illustrated impact on planning policy across Route Corridor Options being so similar, it is at the local level where distinctions can begin to be drawn between options. The text and Tables presented below seek to compare each of the Route Corridor Options at both a national/regional, and local level, drawing where possible, distinctions between options.

National / Regional

Due to the broad scale of policy guidance at both the national and regional level it is considered that the construction and operation of any of the Route Corridor Options proposed, would bring a **highly positive** impact with all Route Corridors being in accordance with policies for infrastructure and access improvements within national and regional planning policy.

All proposed Route Corridor Options would improve the current road infrastructure between the settlements of Mullingar and Longford, assisting in the wider distribution of economic benefits of growth, whilst improving access and communication infrastructure.

Table 4.1-8 Summary of Impacts: National / Regional Policy

Route Corridor	Impact
Route Corridor Option 1	Highly Positive
Route Corridor Option 2	Highly Positive
Route Corridor Option 3	Highly Positive
Route Corridor Option 4	Highly Positive
Route Corridor Option 5	Highly Positive
Route Corridor Option 6	Highly Positive

Local

Despite the contribution at a national and regional level, the policy Tables 4.1-2 to 4.1-7 show that due to the extent of Route Corridor Options, all routes presented will bring some adverse policy impacts at a local level at some point along their entirety.

The policy Tables illustrate that in both the Longford and Westmeath administrative areas, Route Corridor Options bring some beneficial impacts (slight and moderate in scale) when considering the potential objectives and policies that relate to the creation of viable communities / town environment, transportation / public transport, and road infrastructure. Route Corridor Option 2 and 5 as identified in RFig 4.1.2, do however significantly restrict the planned expansion of Longford Town and adversely affect the potential to develop land.

Route Corridor Options 1, 3 and 6 are considered particularly well placed to accommodate the planned growth of the settlements of Longford and

Edgeworthstown whilst maximising the potential to further connect the towns with the wider region.

Route Corridor Option 3 in particular succeeds in avoiding the majority of areas of environmental constraint and any planned recreational development within and around Lough Owel.

At the local level therefore, the following impact assessments summarise each Route Corridor assessment:

Table 4.1-9 Summary of Impacts: Local Planning and Land-Use Policy

Route Corridor	Overall Assessment of Impact	Order of Preference
Route Corridor Option 1	Slightly Positive	=2
Route Corridor Option 2	Moderately Negative	=5
Route Corridor Option 3	Moderately Positive	1
Route Corridor Option 4	Slightly Negative	4
Route Corridor Option 5	Moderately Negative	=5
Route Corridor Option 6	Slightly Positive	=2

4.2 Land Use: Socio – Economics

This chapter assesses the impacts on the existing socio-economic environment for each of the Route Corridor Options. The Corridor for each option is 300m wide. A significant proportion of the identified Route Corridors are located on agricultural land and it is important to refer to Section 4.3 of this report which focuses on the impact on local agriculture and local agronomy. The core socio-economic components covered in this chapter include the impact of each identified Route Corridor Option on demography, areas of employment, and the connectivity and location of existing community facilities such as churches, schools and healthcare facilities.

4.2.1 Methodology

In assessing the impacts of these selected Route Corridor Options, the following significance criteria have been used:

Table 4.2-1 Significance Criteria

Impact	Significance Criteria
Severely Negative	Separation of many small communities in the area from facilities and services. Severance and potential demolition of major residential areas and facilities within urban settlements. Isolation/severance of many businesses. Splitting of many discrete communities. Significant adverse impact on established tourist attractions/facilities.
Highly Negative	Separation of a number of small communities and scattered residential properties from facilities and services. This will include isolation, severance and/or potential demolition of businesses and a number of residential properties. A number of discrete communities split. Adverse impact to a large number of tourist attractions/facilities.
Moderately Negative	Separation of a small number of communities, scattered residential properties from facilities and services and/or potential demolition of some residential properties. Reduction in passing trade for a large number of businesses. Adverse impact on some tourist attractions/facilities.
Slightly Negative	Separation of a small number of residents from facilities and services and the potential for minimal demolition of residential properties. Increase in distance and travelling time to access facilities and services. Reduction in passing trade for a number of businesses. Impact on a small number of tourist attractions/facilities.
Neutral	No change in the current situation.
Slightly Positive	Promotes inward investment locally. Improved access to facilities and services for a small number of communities and scattered residential properties. Some improvement in access for businesses from reduced traffic congestion. Improved road safety in towns. Improved access to tourist attractions.

Impact	Significance Criteria
Moderately Positive	Meets national and regional objectives to promote inward investment. Improved access to facilities and services for urban investment. Improved access to facilities and services for urban areas, small communities and scattered residential properties. Improved access for businesses from reduced traffic congestion.

4.2.2 Existing Environment

The information provided within this section has been gathered from the Constraints Report but also includes references from the following relevant county development plans:

- Longford County Development Plan 2009-2015;
- Westmeath County Development Plan 2008-2014.

Demography

Population characteristics have been derived from the available Central Statistics Office (CSO) data including the most recent Census conducted in 2006. Whilst the populations of both Counties Westmeath and Longford have increased (by 13 percent and 28 percent respectively) within the last 15 years, certain settlements within the Study Area, as detailed in Table 4.2-2, have experienced more population growth than others.

Table 4.2-2 Population Statistics 1991 – 2006

	1991	1996	2002	2006	% Change 1991-2006
Co. Westmeath	**61,880**	**63,314**	**71,858**	**79,346**	**+28.2**
Mullingar	N/A	N/A	8824	8940	+1.3 (2002-2006)
Co. Longford	**30,296**	**30,166**	**31,068**	**34,391**	**+13.5**
Longford Town	6393	6444	6831	7622	+19.2
Rural Longford	631	540	726	1214	+92.4
Newtown Forbes	429	470	561	668	+55.7
Edgeworthstown	801	737	726	1221	+52.4

* Source: Census of Population 1991, 1996, 2002, 2006

At the Electoral Division (ED) level, the rural areas of County Longford witnessed a population increase of between 12 and 30 percent between 2002 and 2006. In County

Westmeath, Ballinalack has experienced a 17.6 percent increase in population within this period; Rathowen has experienced a decline in population of 2.5 percent. Full details of the population data for the main settlements within the Study Area are included in Appendix 4, Volume II.

An appraisal of projected population growth included within the superseded Westmeath County Development Plan, 2000-2008 (CDP) indicates that the population of County Westmeath has increased more rapidly than expected: projected population for the year 2020 (79,343) reflects the actual population in 2006 (79,346) (CSO 2006). The Westmeath CDP largely attributes the popularity of the Westmeath region to its proximity to the Dublin Metropolitan Region and recently improved access via road (M4 and M6) and rail.

County Longford also experienced population growth, 13.5 percent between 1991 and 2006. Longford Town is the largest settlement which would be affected by the Scheme. The town has experienced a 19.2 percent increase in population in the same 15 year period. Pertinent to the proposed Scheme are the significant population increases seen in the hinterland of Longford town and the settlements of Newtown Forbes and Edgeworthstown, with an increase of 55.7 percent and 52.4 percent respectively over the same period. Due to the rural nature of these settlements, the private car is the dominant mode of transport, although the Dublin to Sligo railway line and Bus Eireann also provide significant transport infrastructure in the region.

The Longford CDP (2003-2009) identified that the level of growth experienced prior to the plan period would be maintained through to 2009. The CSO 2006 data also includes population projections between 2006 and 2026. For the Midlands region, the average annual increase is predicted to be 1.2%, anticipating a net increase in the region's population of 69,000 people over the next 17 years.

Economic Activity

According to 2006 Census Data, whilst the level of unemployment nationally was 7.2 percent, this figure is as much as 9.9 percent in County Longford and 6.8 percent in County Westmeath. For settlements within the Study Area, unemployment varies between 4.1 percent in Multyfarnham and 13.3 percent in Rathowen and 13.4 percent

in the rural areas of County Longford. Further details on unemployment figures are detailed in Appendix 4, Volume II.

There is a significantly greater proportion of people from within the study area working in the agriculture, forestry and fishing sectors than the national average. Similarly, a greater proportion than the national average is working in the building, construction, and manufacturing sectors. Conversely, there is a smaller proportion of the populations of Counties Westmeath and Longford employed in commerce and trade, and transport and communications.

CSO data (2006) indicates that a significantly greater proportion of people in both Counties Longford and Westmeath travels for shorter periods to work than the average for Ireland as a whole, as shown in Table 4.2-3. However, a greater proportion of the population of County Westmeath travels for more than an hour to get to work. This may reflect the popularity of County Westmeath for commuting to the Dublin metropolitan region, the relative strength in local labour supply in County Longford and perhaps the relative distance of County Longford from the Dublin metropolitan region.

Table 4.2-3 Travel Time to Work

Geographic area	Time travelling					
	<¼ hour	¼ - ½ hour	½ - ¾ hour	¾ - 1 hour	1 - 1½ hours	>1½ hours
Longford (%)	41.1	26.4	11.9	2.8	2.6	2.8
Westmeath (%)	41.0	27.0	10.1	3.5	4.7	4.2
State (%)	34.2	27.7	15.1	5.6	5.8	2.5

(Source, CSO data 2006)

In terms of mode of travel to work, the proportions shown in Table 4.2-4 for both Counties seem to reflect the average for Ireland as a whole, with the private motorcar being the most common form of transport. The Dublin to Sligo railway line passes through both counties and stops in both Edgeworthstown and Longford. Nonetheless, figures indicate a much smaller proportion of people from both Counties use the train to travel to work in comparison to Ireland as a whole.

Table 4.2-4 Means of Travel to Work

Geographic area	Means of Travel to Work						
	On foot	Bicycle	Bus	Train	Motorcycle/ scooter	Car driver	Car passenger
Longford (percent)	12.3	1.0	12.3	0.6	0.2	40.0	18.2
Westmeath (percent)	13.6	1.2	9.3	0.8	0.2	42.1	19.8
State (percent)	15.5	1.9	11.7	2.6	0.5	40.0	16.4

(Source, CSO data 2006)

4.2.3 Route Corridor Option Assessment

It is important to note that severance to communities will occur to some extent on all of the six Route Corridor Options. However, in the regional and national context, construction of the road scheme, whichever Route Corridor Option is progressed, would result in beneficial impacts for the area as it supports strategies developed to improve quality of life and distribute economic growth and its benefits throughout the region.

In the description of impacts, 'severance' is the term used to describe the cutting or splitting of an existing road by the proposed new route corridor. In the context of this Route Corridor Selection Report, the assumption is that any issue regarding severance of a community, a specific facility or service, may be resolved by way of underbridges, overbridges or junctions, such that access to existing facilities or services is retained where possible. It is recognised that there would, in some cases, be an increase in distance and journey time for vehicle users on those roads affected. It is also taken into account that whilst the operational phase of the proposed route will enable access to the existing road network, there is potential for adverse impacts to local access routes during the construction phase. The identification of the number of existing residences and businesses within each route corridor option has been included in terms of their potential to be directly affected. Generally, however, for those properties not directly affected, relative proximity of residences and businesses to the new N4 route will improve the accessibility and connectivity of local communities to the wider region.

For some businesses that are reliant on passing trade, diversion of traffic away from the existing N4 may undermine the viability of their businesses.

Lough Owel and its surroundings is an area of particular recreational interest and amenity value. All of the Route Corridor Options unavoidably encroach upon the High Amenity Area as allocated within the Westmeath CDP 2008-2014 and indicated on RFig.4.1.4, Volume III. Whilst there is the potential for short-term adverse impacts on how both the local community and tourists are able to connect with this amenity area, once the route is established the improved strategic linkages will connect a greater proportion of the population to areas of recognised amenity value. The objective must therefore be to minimise the short-term construction related impacts and ensure the scheme is designed to maximise the amenity value of this area. In addition, appropriate mitigation measures would be identified in the EIS to minimise these potential adverse effects on amenity.

The following is a systematic assessment of each identified Route Corridor Option. Consideration has been given to community facilities and services (either a school, church or other community facility) which are close to each route corridor option (identified in RFig 4.1.1- RFig 4.1.4, Volume III), and those residential and commercial buildings which are located within each Route Corridor Option. Where in some instances buildings are both residences and businesses (in most instances a farmstead) these have been identified as a 'dual premises'. The 300 metre Route Corridor represents the area within which, depending on the detailed design stage, the buildings identified have the potential to be directly affected. Whilst the emphasis at this stage is on the number of buildings and facilities within each Route Corridor Option which have the potential to be directly affected, it is important to highlight that any Route Corridor will, wherever possible, be routed to avoid properties being directly affected.

Consideration has also been given to the location of identified CLÁR and RAPID areas, assessing the potential for the proposed routes to connect with areas of relative deprivation and areas experiencing disproportionate levels of out-migration. These are explained as follows and identified in RFig 4.1.1- RFig 4.1.4, Volume III.

CLÁR is a programme designed to tackle the problem of depopulation, decline and lack of services in rural areas. The majority of the rural area within the study area is an identified CLÁR area, to the extent that all Route Corridor Options have the potential of improving the socio-economic conditions of these areas.

RAPID stands for Revitalising Areas through Planning, Investment and Development (RAPID). As the name implies, it is about prioritising in a coherent, targeted and accelerated way to provide new and improved services and infrastructural investment to the communities living in RAPID areas. Longford Town is the only identified RAPID area in the study area and as a consequence, Route Corridor Options which connect well with this area will have the potential to induce greater socio-economic benefits for its residents.

The node points referred to in each of the Route Corridor Option assessments reflect the key points within each route corridor identified in RFig 10.1-10.4; RFig 20.1-20.4; RFig 30.1-30.4; RFig 40.1-40.4; RFig 50.1-50.4 and RFig 60.1-60.4 of Volume III of this report. RFig 4.1.1 to 4.1.4, Volume III, Planning and Socio-Economic Overview should also be referenced.

Route Corridor Option 1

There are a total of 146 residences, 11 business premises and 43 dual premises within Route Corridor Option 1. Properties identified are spread fairly evenly along the Route Corridor with the greatest concentration adjacent to Lough Owel.

The proposed route has the potential to adversely impact on surrounding areas popular for tourism and recreation including Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and castles.

Melview National School is located north east of Node 06. There is the potential for disruption to school access from the surrounding communities during construction of the proposed route. However, once the Route is established it is likely to improve the access to the school for people travelling from the wider area due to the improved strategic links this Route would provide.

South east of Node 16 is Rathowen Community Centre. The facility is well used by the community of Rathowen and the surrounding area. Route Corridor Option 1 has the potential to limit access to the community from the surrounding rural areas during the construction period but could potentially attract additional centre users once the Route is established.

South east of Node 20 at Ballynafid is the 'Old School', a local community centre which also houses Ballynafid Social Services. There is the potential for temporary community severance from this facility during construction. However, the proximity of the centre to the Route is likely to improve access for users of the building once the Route is established due to the relative ease of access along the existing N4 post construction.

Other facilities within relative proximity to this Route Corridor Option include two churches – St. Michael's in Coleeny and Corboy Church of Ireland. Both of these have important community functions. The access to these facilities may be temporarily disrupted during the construction stage.

Route Corridor Option 1 is expected to improve connectivity for the population of a number of identified CLÁR areas in both Westmeath and Longford Counties, and is within relative proximity to the Longford RAPID area.

Route Corridor Option 2

There are a total of 156 residences, 14 business premises and 32 dual premises within the Route Corridor Option. This Route significantly restricts the social and economic development potential of Longford Town through limiting development of identified or future employment and/or residential sites. Route Corridor Option 2 has the potential to severely restrict the potential growth of the Longford Town Council area. The area where the Route Corridor crosses the fringe of the existing Longford Town area is where there is the greatest proportion of properties that have the potential to require demolition.

The proposed route has the potential to adversely impact on surrounding areas popular for tourism and recreation including Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and castles.

Melview National School is located north east of Node 06. There is the potential for disruption in school access from the surrounding communities during construction of the proposed Route. However once the Route is established it is likely to improve the access to the school for people travelling from the wider area.

St. Michaels Church is located within the Route Corridor, just south east of Node 08, just off the existing N4 in Cooleeny. There is the potential to restrict access to the church during the construction period. However once the Route is operational, the proximity of the church to the Route is likely to improve access for the wider congregation and other users of the church building.

South east of Node 16 is Rathowen Community Centre. The facility is well used by the community of Rathowen and the surrounding area. The proposed Route has the potential to limit access to the community from the surrounding rural areas during the construction period but could potentially attract additional centre users once the Route is established.

South east of Node 20 at Ballynafid is the 'Old School', a local community centre which also houses Ballynafid Social Services. There is the potential for temporary traffic disruption from this facility during construction. However, the proximity of the centre to the Route is likely to improve access for users of the building once the Route is established due to the relative ease of access along the existing N4 post construction.

Route Corridor Option 2 is expected to improve the connectivity for members of a number of identified CLÁR areas in both Counties Westmeath and Longford. The Route also connects with the Eastern Edge of the Longford RAPID area.

Route Corridor Option 3

There are a total of 115 residences, 4 business premises and 29 dual premises within the Route Corridor. These properties are spread relatively evenly along Route Corridor Option 3, with the greatest concentration east of Newtown Forbes.

The proposed route has the potential to adversely impact on surrounding areas popular for tourism and recreation including Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and castles.

Melview National School is located just north east of Node 06. There is the potential for the disruption in school access from the surrounding communities during construction of the proposed Route. However once the Route is established it is likely to improve the access to the school for people travelling from the wider area.

Adjacent to Route Corridor Option 3 in Rathowen Village is Rathowen Community Centre. The facility is well used by the community of Rathowen and the surrounding area. The proposed Route has the potential to limit access to the community from the surrounding rural areas during the construction period but could potentially attract additional centre users once the Route is established due to the improved regional connectivity resulting from the proposed Route Corridor.

Wilson's Hospital School is located south west of Node 18A. The school is the only Church of Ireland School of its kind in the country and is set in approximately 200 acres approximately two kilometres from Multyfarnham. This Route Corridor Option runs closest to the school premises and its proximity has the potential to adversely impact on the character and appeal of the education facility.

Other facilities within relative proximity to this Route Corridor Option include two churches – St. Michael's in Coleeny and Corboy Church of Ireland. Both of these have important community functions, the access to which may be temporarily disrupted during the construction stage.

Route Corridor Option 3 is expected to improve the connectivity for the population of a number of identified CLÁR areas in both Westmeath and Longford Counties and is in relative proximity to the defined Longford RAPID area.

Route Corridor Option 4

There are a total of 110 residences, 4 business premises and 42 dual premises within the Route Corridor. Properties are spread along Route Corridor Option 4 with the greatest concentration adjacent to Lough Owel.

The proposed route has the potential to adversely impact on surrounding areas popular for tourism and recreation including Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and castles.

Melview National School is located south east of Node 04A. There is the potential for the disruption in school access from the surrounding communities during construction of the proposed Route. However once the Route is established it is likely to improve the access to the school for people travelling from the wider area.

North of Ballynagoshen and south west of node 4C is the small community of Corboy containing a local church approximately 200 metres from the proposed Route Corridor. The church was established in the middle of the 17th century and is apparently the oldest surviving congregation in the Irish Midlands and the oldest Presbyterian church in continual use outside Ulster (http://iol.ie/~longcomm/corboy.htm). The church primarily serves the local community, and whilst there is the potential for access to this facility to be affected during the construction phase, once operational, this Route is likely to improve access to this amenity.

South east of Node 16 is Rathowen Community Centre. The facility is well used by the community of Rathowen and the surrounding area. The proposed Route Corridor has the potential to limit access to the community from the surrounding rural areas during the construction period but has to potential to have a wider catchment area as a result of improved strategic links once the Route is established.

South east of Node 20 at Ballynafid is the 'Old School', a local community centre which also houses Ballynafid Social Services. There is the potential for temporary traffic disruption from this facility during construction. However, the proximity of the centre to the Route is likely to improve access for users of the building once the Route is established due to the relative ease of access along the existing N4 post construction.

Route Corridor Option 4 is expected to improve the connectivity for members of a number of identified CLÁR areas in both Westmeath and Longford Counties. The route is however furthest away from the defined Longford RAPID area.

Route Corridor Option 5

There are a total of 164 residences, 18 business premises and 39 dual premises within Route Corridor Option 5. The greatest concentration of properties are located on the section of the Route Corridor, southwest of Longford Town, primarily in housing estates.

The proposed route has the potential to adversely impact on surrounding areas popular for tourism and recreation including Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and castles.

South east of Node 16 is Rathowen Community Centre. The facility is well used by the community of Rathowen and the surrounding area. The proposed Route Corridor has the potential to limit access to the community from the surrounding rural areas during the construction period but could potentially attract additional centre users once the Route is established.

South east of Node 20 at Ballynafid is the 'Old School', a local community centre which also houses Ballynafid Social Services. There is the potential for temporary traffic disruption from this facility during construction. However, the proximity of the centre to the Route is likely to improve access for users of the building once the Route is established due to the relative ease of access along the existing N4 post construction.

The proposed Route Corridor is expected to improve the connectivity for members of a number of identified CLÁR areas in both Westmeath and Longford Counties. The route also connects well with the west and sourthern edge of of the Longford RAPID area.

Route Corridor Option 6

There are a total of 118 residences, 6 business premises and 39 dual premises within Route Corridor Option 6. The largest concentration of those properties at risk is

located northeast of Newtown Forbes, although the majority are spread out along the Route Corridor.

Melview National School is located north east of Node 06. There is the potential for disruption in school access from the surrounding communities during construction of the proposed Route. However once the Route is established it is likely to improve the access to the school for people travelling from the wider area.

St. Michael's Church in Coleeny is within relative proximity of the proposed Route Corridor. Rathowen Community Centre is a similar distance from the proposed Route Corridor and is a well used facility both by residents of Rathowen and the surrounding community. There is the potential to adversely affect access to both of these facilities during the construction period.

South east of Node 20 at Ballynafid is the 'Old School', a local community centre which also houses Ballynafid Social Services. There is the potential for temporary traffic disruption from this facility during construction. However, the proximity of the centre to the Route Corridor is likely to improve access for users of the building once the Route is established due to the relative ease of access along the existing N4 post construction.

Route Corridor Option 6 is expected to improve connectivity for the population of a number of identified CLÁR areas in both Westmeath and Longford Counties, and is within relative proximity of the Longford RAPID area.

4.2.4 Conclusions

National/Regional

In the regional and national context, construction of this scheme, whichever Route Corridor Option is progressed, would result in positive impacts for the area as it supports strategies developed to improve quality of life and distribute economic growth and its benefits throughout the region. It similarly improves links within and between the main service centres in both Longford and Westmeath Counties, with the rest of the country and internationally.

The N4 Mullingar to Longford (Roosky) scheme would improve communications and access at the strategic level between the settlements of Longford and Mullingar and between the Gateways of Dublin, Mullingar/Athlone/Tullamore and Sligo. At the strategic level, it would clearly contribute towards distributing economic benefits throughout the region. Route Corridor Options 2 and 5 succeed in connecting directly with both CLÁR and RAPID areas. All other Route Corridor Options connect directly with just CLÁR areas. In summary, at the national/regional level, all Route Corridor Options have the potential to have a moderate beneficial impact as indicated in Table 4.2-5:

Table 4.2-5 National/Regional Impact Summary

Route Corridor	Impact
Route Corridor Option 1	Moderately Positive
Route Corridor Option 2	Moderately Positive
Route Corridor Option 3	Moderately Positive
Route Corridor Option 4	Moderately Positive
Route Corridor Option 5	Moderately Positive
Route Corridor Option 6	Moderately Positive

Local

At the local level a significant proportion of the proposed Route Corridor Options are located on agricultural land and the impact on this is discussed in Section 4.3 of this report. Route Corridor Options overlay existing buildings to varying degrees as depicted in Table 4.2-6.

Table 4.2-6 Summary Ranking of Route Corridor Options (Socio-Economics)

Route Corridor	Total Number of Properties within 300m corridor	Additional Considerations	Scaling Statement	Order of Preference
Option 1	200	Whilst a high number of properties with the potential to be directly affected, Route Corridor Option 1 connects well with populated areas, is in relative proximity to a number of community facilities (Mellville School, Rathowen and Ballynafid's Community Centres) and connects with areas of recognised deprivation (CLAR and RAPID). However, there is a potential adverse impact on the tourism and recreational amenity around Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and csstles.	Slightly Negative	1
Option 2	202	Despite this Route Corridor connecting with a number of recognised community facilities, the proposed alignment would be likely constrain the proposed expansion of Longford Town and isolate some of the outlying communities. A high number of properties also have the potential to be directly affected. There is a potential adverse impact on the tourism and recreational amenity around Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and csstles. Route Corridor Option 2 does connect directly with both CLAR and the Longford RAPID areas.	Moderately Negative	6
Option 3	148	A comparatively low number of properties with the potential of being directly affected. The Route Corridor also connects well with populated areas. However, there is a potential adverse impact on the tourism and recreational amenity around Lough Garr, and the River Inny. The proximity of Wilson's Hospital School could also generate adverse socio-economic impacts for this distinctive facility. Route Corridor Option 3 connects directly with CLAR areas and is within relative proximity of the Longford RAPID area.	Slightly Negative	3

Route Corridor	Total Number of Properties within 300m corridor	Additional Considerations	Scaling Statement	Order of Preference
Option 4	156	A compartatively low number of properties with the potenital of being directly affected. Whilst the Route Corridor connects with some local community facilities, the proposed alignment limits connectivity with existing socio-economic centres. There is a potential adverse impact on the tourism and recreational amenity around Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and csstles. Connects directly with CLAR area but routes away from the Longford RAPID area.	Slightly Negative	4
Option 5	221	The greatest number of properties with the potential to be directly affected. There is a potential adverse impact on the tourism and recreational amenity around Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and csstles. Despite connecting directly with both CLAR and the Longford RAPID areas, the Route Corridor alignment around Longford avoids the proposed growth points of the Town.	Slightly Negative	4
Option 6	163	A relatively low number of properties with the potential to be directly affected. Route Corridor Option 6 connects well with populated areas and connects with more rural community facilities (Melview School, Rathowen and Ballynafid's Community Centres, St Michael's Church). There is a potential adverse impact on the tourism and recreational amenity around Lough Garr, Lough Owel, Lough Forbes, the River Inny and several surrounding mottes and csstles. The Route Corridor also connects directly with CLAR areas and is within relative proximity of the Longford RAPID area.	Slightly Negative	1

Table 4.2-6 also identifies the overall impact assessment for each Route Corridor Option and related preference. In terms of the overall local impact of Route Corridor Options, all options have the potential to directly affect existing properties because of the significant number of identified buildings within the 300 metre Route Corridor.

In terms of alignment, Route Corridor Options 1, 3 and 6 have the strongest potential to connect with populated areas and important community facilities, due to their close proximity to higher residential densities and established businesses. Whilst the alignment of Route Corridor Option 2 is in closest proximity to Longford town, this Route Corridor constrains the planned growth of the settlement.

Finally, it is important to note that the existing N4 would be retained (wherever it is not utilised as part of the proposed new road link) and will therefore provide access for local traffic. Reducing the large volumes of through traffic within the towns would ease congestion and facilitate improved access to amenities in the towns. Reducing traffic, particularly fast moving cars and heavy goods vehicles from the existing N4 will re-prioritise the centre of settlements to encourage pedestrian usage and social interaction in public spaces. It is important to note the potential for some businesses to lose trade as a result of a loss in the critical mass of passing trade. However this is considered to be outweighed by improvements to the town centre environment which can, if properly managed, serve to attract visitors from the wider region.

4.3 Land Use: Agriculture (Soils, Intensity of Farming, Land Take and Severance)

This section outlines the methodology, baseline environment and results of the appraisal for agriculture, comprising the relevant aspects of soils, intensity of farming, land take and severance.

4.3.1 Methodology

From November 2007 to January 2008, an agricultural Constraints Study was carried out to collect information relating to agriculture in the study area. In line with the Environmental Protection Agency's (EPA) guidelines for environmental assessment, the Constraints Report sought to identify the issues that are likely to be important at an early stage of the environmental assessment process. The information available for the constraints assessment was based on a desktop study of the 2000 Census of Agriculture data, EPA soils data, aerial photography and a roadside survey. The Constraints Report considered possible agricultural constraints such as the location of high quality soils, farmyards and intensive farm enterprises within the study area. This report presents the agronomy Route Corridor Option appraisal.

The six Route Corridor Options assessed in the agronomy section are described in Chapter 3 of this report and are detailed on RFig 10.1-10.4; RFig 20.1-20.4; RFig 30.1-30.4; RFig 40.1-40.4; RFig 50.1-50.4; RFig 60.1-60.4, Volume III. A Route Corridor of 100 metres wide was used as this width would best represent the land take and severance impacts of the Route Corridor Options and therefore provide a meaningful appraisal, RFig 4.3.1-4.3.4 presented in Volume III of this report should be referenced for this appraisal.

The information sources referred to in this section of the route selection report are;

- Aerial photography: Aerial photography was used in conjunction with map notes from the roadside survey to map forestry and scrub lands and map farmyard locations.
- Land registry data: Folio maps from the land registry office were used to determine landowner boundaries. These boundaries are detailed on RFig 4.3.1 to RFig 4.3.4, Volume III.

- Roadside assessment: Fields and farmyards where either dairy cows, horses, non-dairy livestock or tillage were located were noted and recorded on maps. Similarly, features such as bogs, woodlands, horse and dog tracks were noted on maps.
- Land owner consultation: Approximately 100 landowners were interviewed to map farm boundaries and determine farm enterprise types.

The analysis of the Route Corridor Options is based on assessing the following criteria:

Qualitative Criteria

- Soil type appraisal along each Route Corridor Option;
- Intensity of farming and land use along each Route Corridor Option;
- Agronomy corridor preferences identified from field observations and farmer interviews

Quantitative Criteria;

- Land take (ha) of each Route Corridor Option ;
- Length of Route Corridor Option which is on line (kms);
- Area of sensitive enterprises (dairy and equine farms) affected (ha) by each Route Corridor Option;
- Number of farmyards within 50 metres of the centre line of each Route Corridor Option;
- Severance impact appraisal of each Route Corridor Option.

Qualitative Criteria

Qualitative criteria are criteria which are subject to a qualitative assessment made by the agronomist (aided in some instances by the measured criteria and mapping).

- ***Soil type appraisal along each route***

The EPA soil mapping data used in this section may not reflect that soil can vary within a small area (e.g. within a single field). Therefore, these data are indicative and should be interpreted with caution. Referring to EPA data and field notes from the roadside survey there are six main soil types along each of the Route Corridor Options:

I. Code 41 – This soil type is a poorly drained mineral soil with peaty topsoil and is indicative of mainly poor quality land.

II. Code 65 – This soil type is a Basin Peat which is indicative of mainly poor quality and some medium quality land.

III. Code 32 – This soil type is a deep poorly drained mineral soil which is indicative of mainly medium to good quality land (derived mainly from basic parent materials).

IV. Code 31 – This soil type is a deep poorly drained mineral soil which is indicative of mainly medium to good quality land (derived mainly from acidic parent materials).

V. Code 51 – This soil type is an Alluvium soil which is indicative of mainly good quality land with some medium and poor quality land where drainage is not possible.

VI. Code 11 – This soil type is an Acid brown earth which is a deep well-drained soil and is indicative of mainly good quality with some medium quality land.

The area of each of these soil types along each route is shown in Table 4.3-1 and has been calculated using computer mapping software. The poor quality soil types make up 25.5 – 38 per cent of the land take and the good quality soils make up 40.5 – 60 per cent of the land take. The topography of the study area is relatively uniform and not a significant factor as there are very few areas with steep slopes. The results in Table 4.3-1 indicate that Route Corridor Options 3 and 5 have the highest proportion of poorer quality land at 34.5 percent and 38 percent (which is desirable from an agronomy point of view). Route Corridor Options 1, 2, 4 and 6 have similar amounts of poor quality land. The figures also indicate that Route Corridor Options 4 and 5 have the lowest proportion of good quality land at 42 per cent and 40.5 percent respectively (which is desirable from an agricultural point of view). Route Corridor Options 1, 2 and 6 have similar proportions of good land, which are in the mid range compared to the other routes. Route Corridor Option 3 has the highest proportion of good land, 60 per cent. Although these figures are indicative they indicate that Route Corridor Option 5 has the poorest quality land and Route Corridor Option 3 has the best quality land.

Table 4.3-1 Types of Soils within the Landtake of each Route Corridor Option [1]

Route Corridor	% Soil type (code) in the land take					
	Mainly poor quality soils		Mainly medium & good quality soils		Mainly good with some medium quality soils	
	41	65	31	32	51	11
Option 1	5.5%	20%	21%	3%	7%	43.5%
Option 2	6%	22.5%	21.5%	3%	5.5%	41.5%
Option 3	0.5%	34%	0%	5.5%	1.5%	58.5%
Option 4	7%	21%	27%	3%	4%	38%
Option 5	7%	31%	18.5%	3%	3.5%	37%
Option 6	5%	23%	20%	3%	5%	44%

Note [1] The soil type within the land take of each Route Corridor Option is based on EPA soils data. The % soil type within the land take of each Route Corridor Option is an indicative figure because the soil type may vary in a very small area and this would not be reflected in the EPA map data.

- ***Intensity of farming and land use along each route***

Farming intensity is the agronomist's appraisal of the type of farming along each Route Corridor Option. The number of dairy farms, the quality and size of the farmyards, presence of paddock systems and size of fields combine to give an impression of the intensity of farming along each route. Aerial photography and field notes were used to make this assessment. The presence of forestry is an indicator of poor land quality and forestry is less sensitive to the impacts from new road construction. In this assessment, the area of forestry land parcels affected by each Route Corridor Option is presented as an indicator of farming intensity. Therefore the presence of forestry along a Route Corridor Option is preferred. In general, farming within the study area is uniform and of a non-intensive nature and all Route Corridor Options are assessed to be equally intensive.

- ***Agronomy corridor preferences identified from field observations***

There are preferred agronomy options in certain areas. If a Route Corridor Option can run on-line or adjoining an existing road or railway line this is preferable to crossing and severing farms. Crossing areas of poor quality land is preferable to crossing areas of good quality land. In this section the following corridor preferences are identified and shown in RFig 4.3.1- RFig 4.3.4; Volume III.

o Between Longford and Edgeworthstown less disturbance to farm enterprises would be caused if the proposed corridor ran south of the railway line (RFig 4.3.2).

o Due to the visual assessment of the area south of the N4 between Edgeworthstown and Rathowen at Gneeve it was noted that this area has poor quality land and small field sizes and is located on the northern edge of a large

bog. This area is preferred to areas with well-developed farms on medium and good quality soils. Therefore, this area is identified as a corridor preference (RFig 4.3.3).

- Due to the visual assessment of the area east of Edgeworthstown in Cam and Clonwhelan it was noted that this area has poor quality land, forestry and bog. This area is preferred to others due to poor quality soils. Therefore, this area is identified as a corridor preference (RFig 4.3.3).
- Running on-line between Bunbrosna and Culleen Beg (southern end of proposed scheme RFig 4.3.4).

Quantitative Criteria

The total land take is the area of land taken from land parcels within 50 metres of the centreline of the Route Corridor Option and therefore is 100 metres wide. Areas of scrub, forestry and cutaway bog which were noted from the roadside survey and aerial photography examination have been subtracted from the calculated land take to give the area of agricultural land taken (column 4 of Table 4.3-4).

The length on line is the length of each Route Corridor Option which runs directly on or adjoining an existing road or railway line.

The impact on dairy and equine farms from severance and land take is generally higher than the impact on beef and tillage enterprises. This is because on these farms livestock have to be moved on a daily basis and the financial output per hectare and value of livestock is generally higher. The area of dairy and equine farms through which each Route Corridor Option crosses was measured.

The farmyard is the activity hub of the farm and therefore an impact on farmyards would be significant. Farmyards within 50 metres of the centre line of a Route Corridor Option are assumed to be directly affected by the proposed scheme.

In this report, the author, based on his own experience, has categorised the severance impact on each affected land parcel into 5 impact categories as follows;

Category 1 - No severance

Category 2 - Low severance (0-7% of land parcel severed).
Category 3 - Moderate severance (7-15% of land severed).
Category 4 - High severance (15-25% of land parcel severed).
Category 5 - Very high severance (>25% of land parcel severed).

The severed area of each land parcel is calculated using computer mapping software and the severed area is expressed as a percentage of the total area of the land parcel which remains after deducting the area of land take. The following values are assigned to each category of severance;

Value 0 => Category 1 (No severance)
Value 1 => Category 2 (Low severance)
Value 2 => Category 3 (Moderate severance)
Value 3 => Category 4 (High severance)
Value 4 => Category 5 (Very high severance)

The severance rating score of each Route Corridor Options is the sum of the severance values of each land parcel along that route. For example, Route Corridor Option 1 affects 225 land parcels. Of these 100 are severed. When the severance impact is categorised for each land parcel and a value ranging from 0 to 4 is assigned to the categories the total severance score of 292 is calculated as follows; 125 category 1 impacts = 0; 18 category 2 impacts = 18; 19 category 3 impacts = 38; 16 category 4 impacts = 48; 47 category 5 impacts = 188; Total Score = 0+18+38+48+188 = 292. Table 4.3-2 details the severance rating score of the 6 Route Corridor Options.

Table 4.3-2 Results of Quantitative Measurements: Land Take and Severance

Route Corridor Option	Number of land parcels affected	Number of land parcels severed	Number of land parcels with Category 1 severance value = 0	Number of land parcels with Category 2 severance value = 1 (Severance Rating Score)	Number of land parcels with Category 3 severance value = 2 (Severance Rating Score)	Number of land parcels with Category 4 severance value = 3 (Severance Rating Score)	Number of land parcels with Category 5 severance value = 4 (Severance Rating Score)	Total Severance Rating Score
1	225	100	125	18 (18x1=18)	19 (19x2=38)	16 (16x3=48)	47 (47x4=188)	292
2	232	120	112	20 (20x1=20)	20 (20x2=40)	14 (14x3=42)	66 (66x4=264)	366
3	231	127	104	32 (32x1=32)	16 (16x2=32)	14 (14x3=42)	65 (65x4=260)	366
4	246	125	121	16 (16x1=16)	23 (23x2=46)	19 (19x3=57)	67 (67x4=268)	387
5	238	124	114	21 (21x1=21)	26 (26x2=52)	18 (18x3=54)	59 (59x4=236)	363
6	238	117	121	19 (19x1=19)	32 (32x2=64)	36 (36x3=108)	70 (70x4=280)	367

4.3.2 Existing Environment

The land use in the study area is predominantly agricultural. According to the Central Statistic Office (CSO) Agricultural Census of 2000[2] the average size of farms in the study area is approximately 32 hectares. Ten percent of these farmers are dairy farmers and the remainder are mainly beef farmers. The majority of soils in the study area can be described as medium and good quality soils but there is a substantial proportion of poor quality soil (blanket peats and soils with peaty top soils – codes 65 & 41).

[2] *While farm surveys were conducted by the CSO in 2003, 2005 and 2007 the results of these surveys are available on a regional basis only and the analysis in this section is on a county basis – therefore the 2000 census data is more relevant. The results from the 2003, 2005 and 2007 farm surveys relating to average farm sizes and enterprises on a regional basis indicate that the results of the 2000 CSO are only changing at a gradual rate and therefore the 2000 CSO data is still relevant for this assessment.*

4.3.3 Route Corridor Option Appraisal (Qualitative)

In this section the qualitative characteristics of the six Route Corridor Options are assessed. This involves comparing the soil types and the intensity of farming and land use along each Route Corridor Option and identifying which preferred agronomy corridors the Route Corridor Options travel through. A simple scoring system for the qualitative characteristics is presented in table 4.3-3.

Route Corridor Option 1

Route Corridor Option 1 is 50.4 kilometres long. The estimated land take of this Route Corridor Option is 430 hectares after deductions are made for scrub, bog, forestry and waste land. The Route Corridor is on line for approximately 12.8 kms and therefore disturbance to agriculture is minimised along 25% of this route. Option 1 runs on or adjoining the existing N4 for approximately 3 kilometres in Edercloon, Cloonart South and Deerpark (north of Newtown Forbes) and approximately 9.7 kilometres from Bunbrosna to Culleen Beg (southern end of proposed scheme). The Route Corridor does not travel south of the railway line between Longford and Edgeworthstown, which is an agronomy preference. It runs south of the N4 through the margins of the bog at Gneeve between Edgeworthstown and Rathowen which is desirable from an agricultural point of view because the agricultural land parcels are small here and land quality is poor-medium. The soil type is approximately 25.5% mainly poor quality land and the remainder is medium - good quality. The majority of the peaty/poor quality soils occur north of Deerpark and at Gneeve. Farming along the Route Corridor is generally not intensive. Route Corridor Option 1 passes through six forestry land parcels consisting of 141 hectares of landtake.

Route Corridor Option 2

Route Corridor Option 2 is 50.2 kilometres long. The estimated land take of this Route Corridor Option is 445 hectares after deductions are made for scrub, bog, forestry and waste land. The Route Corridor is on line for approximatley 8.5 kilometres and therefore disturbance to agriculture is minimised along 17% of this route. Option 2 runs on line for approximately 1.1 kilometres in Edercloon and Kilmacannon (north of Newtown Forbes). Between Bunbrosna to Culleen Beg this Route Corridor Option is on line with the N4 for approximately 6.1 kilometres. It does not travel south of the railway line between Longford and Edgeworthstown which is an agronomy preference. The Route Corridor runs south of the N4 through the margins of the bog at Gneeve between Edgeworthstown and Rathowen which is desirable from an agricultural point

of view. Between Bunbrosna to Culleen Beg this Route Corridor Option leaves the existing N4 and runs south along the existing railway line for approximately 1.3km. This is less desirable than staying on the existing N4. The soil type is approximately 28.5% mainly poor quality land and the remainder is medium - good quality. The majority of the peaty/poor quality soils occur north of Deerpark and at Gneeve. Farming along the Route Corridor is generally not intensive. Route Corridor Option 2 passes through seven forestry land parcels consisting of 181 hectares of landtake.

Route Corridor Option 3

Route Corridor Option 3 is 53 kilometres long. The estimated land take of this Route Corridor Option is 455 hectares after deductions are made for scrub, bog, forestry and waste land. It is on line for approximately 2.2 kilometres and therefore disturbance to agriculture is minimised along 4% of this route. The Route Corridor runs on or adjoining the existing N4 in the following location for approximately 1.1 kilometres in Edercloon and Kilmacannon (north of Newtown Forbes) and for approximately 1.1 kilometres at the southern end of the scheme at Culleen More. Option 3 does not travel on line between Bunbrosna and Culleen Beg. This Route Corridor Option passes through an area of poor quality land east of Edgeworthstown in Cam and Clonwhelan which is desirable from an agricultural point of view. The soil type is approximately 34.5% mainly poor quality land and – it has the highest proportion of good quality (60%). The majority of the peaty/poor quality soils occur north of Deerpark and east of Edgeworthstown in Cam and Clonwhelan. Farming along the Route Corridor is generally not intensive. Route Corridor Option 3 passes through seven forestry land parcels consisting of 252 hectares of landtake.

Route Corridor Option 4

Route Corridor Option 4 is 50.6 kilometres long. The estimated land take of this Route Corridor Option is 454 hectares after deductions are made for scrub, bog, forestry and waste land. The Route Corridor is on line for approximately 11 kilometres and therefore disturbance to agriculture is minimised along 22% of this route. Option 4 runs on or adjoining the existing N4 for approximately 2.9 kilometres in Edercloon and Kilmacannon (north of Newtown Forbes). Between Bunbrosna to Culleen Beg this Route Corridor Option is on line with the N4 for approximately 6.8 kilometres and on line with the railway line for approximately 1.3 kilometers. The Route Corridor Option runs south of the N4 through the margins of the bog at Gneeve between Edgeworthstown and Rathowen which is desirable from an agricultural point of view. The soil type is approximately 28% mainly poor quality land and along with Route

Corridor Option 5 it has the lowest proportion of good quality land. The majority of the peaty/poor quality soils occur north of Deerpark, Drumaughly, Farraghroe and at Gneeve. Farming along the Route Corridor is generally not intensive although there is a cluster of dairy farms near Gorteenorna (north of Longford town). Route Corridor Option 4 passes through nine forestry land parcels consisting of 206 hectares of landtake.

Route Corridor Option 5

Route Corridor Option 5 is 54.4 kilometres long. The estimated land take of this Route Corridor Option is 471 hectares after deductions are made for scrub, bog, forestry and waste land. The Route Corridor is on line for approximately 12.2 kilometres and therefore disturbance to agriculture is minimised along 22% of this route. Option 5 runs on or adjoining the existing N4 for approximately 4.1 kilometres in Edercloon and Kilmacannon (north of Newtown Forbes). Between Bunbrosna to Culleen Beg this Route Corridor Option is on line with the N4 for approximately 6.8 kilometres. The Route Corridor runs on the southern side of Longford affecting two large dairy farms in this area. It runs south of the railway line between Longford and Edgeworthstown which is an agronomy preference. It runs south of the N4 through the margins of the bog at Gneeve between Edgeworthstown and Rathowen which is desirable from an agricultural point of view. Between Bunbrosna and Culleen Beg this Route Corridor leaves the existing N4 and runs south along the existing railway line for approximately 1.3 kilometres. This is less desirable than staying on the existing N4. The soil type is approximately 38% mainly poor quality land. Route Corridor Option 5 has the highest proportion of poor quality land and along with Route Corridor Option 4, it has the lowest proportion of good quality land. The majority of the peaty/poor quality soils occur north of Deerpark, along the southern side of Longford Town and at Gneeve. Farming along the Route Corridor is generally not intensive. Route Corridor Option 5 passes through eight forestry land parcels consisting of 226 hectares of landtake.

Route Corridor Option 6

Route Corridor Option 6 is 50.6 kilometres long. The estimated land take of this Route Corridor Option is 436 hectares after deductions are made for scrub, bog, forestry and waste land. This Route Corridor Option is on line for approximately 11.6 kms and therefore disturbance to agriculture is minimised along 23% of this route. Option 6 runs on or adjoining the existing N4 for approximately 3.5 kilometres in Edercloon and Kilmacannon (north of Newtown Forbes). Between Bunbrosna to Culleen Beg this Route Corridor is on line with the N4 for approximately 6.65 kilometres. The Route

Corridor runs south of the railway line between Longford and Edgeworthstown which is an agronomy preference (although Route Corridor Option 5 runs south of the N4 for a longer distance in this area). Option 6 runs south of the N4 through the margins of the bog at Gneeve between Edgeworthstown and Rathowen which is desirable from an agricultural point of view. Between Bunbrosna to Culleen Beg this Route Corridor leaves the existing N4 and runs south along the existing railway line for approximately 1.4 kms. This is less desirable than staying on the existing N4. The soil type is approximately 28% mainly poor quality land and the remainder is medium - good quality. The majority of the peaty/poor quality soils occur north of Deerpark and at Gneeve. Farming along the Route Corridor is generally not intensive. Route Corridor Option 6 passes through nine forestry land parcels consisting of 209 hectares of landtake.

Table 4.3-3 Qualitative Assessment Results: Soils and Intensity of Farming

	Route Corridor Option					
	1	2	3	4	5	6
Routes that run south of the railway line between Longford and Edgeworthstown					+ +	+
Routes that run on-line with N4 and railway line between Bunbrosna and Culleen Beg	+ +	+		+	+	+
Routes that run along northern edge of bog at Gneeve	+	+		+	+	+
Routes that run through area of poor soil quality in Cam and Clonwhelan			+			
Soil quality	+	+		+	++	+
Farming Intensity (agriculture is generally not intensive along all routes)	+	+	+	+	+	+
Total positive scores	**+ + + + + +**	**+ + + +**	**+ +**	**+ + + +**	**+ + + + + + +**	**+ + + + + +**
Order of Preference	**2**	**4**	**5**	**4**	**1**	**2**

4.3.4 Route Corridor Option Appraisal (Quantitative)

Table 4.3-4 presents the quantitative results for each of the route corridors for the following measured criteria;

- Length;
- Land take - Total land take in the 100 metre wide route corridor (excludes roads, rivers);
- Agricultural Land - Adjusted land take after scrub, forestry, bog and waste is deducted;
- Number of farm yards inside the 100 metre route corridor;
- Length-on-line;
- Area of the severed land parcels – Area of land that has been severed from the main farm;
- Total area of dairy and equine enterprises – If part of an enterprise is affected by a route corridor, the total area of the whole dairy/equine enterprise is included;
- Indicative severance impact rating of each route (as discussed in section 4.3.1).

Table 4.3-4 Results of Quantitative Measurements: Land Take and Severance

Route Corridor Option	Overall length	Land take	Land take of agricultural land (adjusted for non-productive land)	Number of farm yards affected within the 100m route corridor (i.e. within 50m of the centerline of the route)	Length - on –line (approx)	Area of land severed (i.e. land isolated from main farm by the route corridor)	Total area of dairy and equine enterprises affected	Indicative severance impact rating score
	(km)	(ha)	(ha)		(km)	(ha)	(ha)	
1	50.4	439	430	2	12.8	452	346	292
2	50.2	456	445	2	8.5	585	276	366
3	53	484	455	1	2.2	661	620	366
4	50.6	460	454	1	11	475	259	387
5	54.4	479	471	1	12.2	492	284	363
6	50.6	447	436	0	11.6	464	276	367

Table 4.3-5 shows the relative differences between the Route Corridor Options by presenting the results as percentages relative to the best ranking result for each criterion. The purpose of this Table is to show clearly the magnitude of differences. Cells with the best ranking are highlighted. Differences in the order of 1 – 2 % are generally not significant.

Table 4.3-5 Relative Results of Quantitative Measurements: Land Take and Severance

Route Corridor Option	Overall length	Land take of agricultural land	Number of farm yards affected within 50m of centerline	Length on line	Area of land severed	Area of dairy and equine enterprises affected	Indicative severance impact rating score
	(%)	(%)		(%)	(%)	(%)	(%)
Option 1	100	100	2	100	100	133	100
Option 2	100	104	2	66	129	106	125
Option 3	106	106	1	17	146	239	125
Option 4	101	106	1	86	105	100	133
Option 5	108	110	1	95	109	109	124
Option 6	101	101	0	91	103	106	126

Table 4.3-6 ranks each Route Corridor Option from 1 to 6 for each measured criteria. An overall ranking score for each Route Corridor Option is presented in the last

column. To avoid ranking the land take impact twice, the length of the Route Corridor Option and total land take area (columns 2 & 3 of Table 4.3-4) are omitted from this Table. Also while it is desirable to avoid farm yards it is possible to mitigate this impact by avoiding buildings or by replacing demolished buildings with new ones and for this reason this criteria is also omitted from table 4.3-6.

Table 4.3-6 Ranked Results of Quantitative Measurements: Land Take and Severance

Route Corridor	Ranking of Land take of agricultural land	Ranking of Length on line	Ranking of Area of dairy and equine enterprises affected	Ranking of Indicative severance impact rating score	Total ranking scores	Overall ranking of each route for total ranking scores
Option 1	**1**	**1**	5	**1**	**8**	**=1**
Option 2	3	5	2	2	**12**	**3**
Option 3	4	6	6	2	**18**	**6**
Option 4	4	4	**1**	6	**15**	**5**
Option 5	6	2	4	2	**14**	**4**
Option 6	**1**	3	2	2	**8**	**=1**

The Route Corridor Options with low overall ranking scores (column 6) are more preferable from an agricultural point of view than Route Corridor Options with high ranking scores. The best quantitative ranking score may not always result in the preferred Route Corridor Option because the qualitative assessment of criteria such as soil types and intensity of farming may be assessed to be of higher significance.

4.3.5 Conclusions

The preferred Route Corridor Option from an agricultural point of view will have the lowest land take, affect the lowest area of dairy and equine farms, avoid farmyards and have a low severance impact. It is preferable that the selected Route Corridor Option would have a high proportion of poor quality soils, avoid intensive farming areas and the Route Corridor Option should where possible travel on-line instead of through fields. It should also where possible travel along preferred agronomy corridors. None of the selected Route Corridor Options ranks first for all examined criteria.

Route Corridor Option 1 has the joint lowest quantitative scores and above average qualitative scores.

- The Route Corridor ranks joint first for the land take criteria.
- The Route Corridor has the best ranking score for length-on-line criteria.

- The Route Corridor ranks first for the indicative severance impact score criteria.
- The Route Corridor ranks fifth (second worst) for the area of dairy & equine farms affected criteria.
- The Route Corridor has an above average qualitative assessment score (Table 4.3-3). The soil quality indicated from the roadside survey and the EPA soils mapping data suggests that the soil quality is average along this Route Corridor Option. It uses the preferred agronomy corridor along the northern edge of the bog at Gneeve and it is on-line between Bunbrosna and Culleen Beg for longer than any other Route Corridor Option. It does not run along the preferred agronomy corridor south of the railway line between Longford and Edgeworthstown.
- From an agricultural point of view Route Corridor Option 1 is second preference. Overall it is assessed to have a **moderately negative** impact on agriculture

Route Corridor Option 2 has the third lowest quantitative scores and average qualitative scores.

- The Route Corridor ranks third for the land take criteria.
- The Route Corridor ranks fifth (second worst) for length-on-line criteria.
- The Route Corridor ranks joint second for the area of dairy & equine farms affected criteria.
- The Route Corridor ranks joint second for the indicative severance impact score criteria.
- The Route Corridor has an average qualitative assessment score (Table 4.3-3) The soil quality indicated from the roadside windshield survey and the EPA soils mapping data suggests that the soil quality is average along this Route Corridor Option. It uses the preferred agronomy corridor along the northern edge of the bog at Gneeve and it is on-line between Bunbrosna and Culleen Beg. It does not run along the preferred agronomy corridor south of the railway line between Longford and Edgeworthstown.
- From an agricultural point of view Route Corridor Option 2 is third preference. Overall it is assessed to have a **highly negative** impact on agriculture

Route Corridor Option 3 has the lowest (worst) quantitative scores and worst qualitative scores.

- The Route Corridor ranks joint fourth (second worst) for the land take criteria.
- The Route Corridor ranks sixth (worst) for length-on-line criteria.
- The Route Corridor ranks sixth (worst) for the area of dairy & equine farms affected criteria.
- The Route Corridor ranks joint second best for the indicative severance impact score criteria.
- The Route Corridor has a below average qualitative assessment score (Table 4.3-3) The soil quality indicated from the roadside windshield survey and the EPA soils mapping data suggests that the soil quality is best along this Route Corridor Option (which is not desirable from an agricultural point of view). It does not use the preferred agronomy corridor along the northern edge of the bog at Gneeve and it is on-line between Bunbrosna and Culleen Beg for only 1.1 kilometre. It does not run along the preferred agronomy corridor south of the railway line between Longford and Edgeworthstown.
- From an agricultural point of view Route Corridor Option 3 is least preferred. Overall it is assessed to have a **highly negative** impact on agriculture

Route Corridor Option 4 has the joint fourth lowest (second worst) quantitative scores (along with Route Corridor Option 5) and average qualitative scores.

- The Route Corridor ranks joint fourth for the land take criteria.
- The Route Corridor ranks fourth for the length-on-line criteria.
- The Route Corridor ranks first (best) for the area of dairy & equine farms affected criteria.
- The Route Corridor ranks sixth (worst) in the indicative severance impact score criteria.
- The Route Corridor has an average qualitative assessment score (Table 4.3-3) The soil quality indicated from the roadside windshield survey and the EPA soils mapping data suggests that the soil quality is average along this Route Corridor Option. It uses the preferred agronomy corridor along the northern edge of the bog at Gneeve and it is on-line between Bunbrosna and Culleen Beg. It does not run along the preferred agronomy corridor south of the railway line between Longford and Edgeworthstown.
- From an agricultural point of view Route Corridor Option 4 is joint fourth preference. Overall it is assessed to have a **highly negative** impact on agriculture

Route Corridor Option 5 has the joint fourth lowest quantitative scores (second worst along with Route Corridor Option 4) and the best qualitative scores.

- The Route Corridor ranks sixth (worst) for the land take criteria.
- The Route Corridor has the second best ranking for the length-on-line criteria.
- The Route Corridor ranks fourth for the area of dairy & equine farms affected criteria.
- The Route Corridor ranks joint second for the indicative severance impact score criteria.
- The Route Corridor has the best qualitative assessment score (Table 4.3-3) The soil quality indicated from the roadside windshield survey and the EPA soils mapping data suggests that the soil quality is worst along this Route Corridor option (which is desirable from an agricultural point of view). It uses the corridor along the northern edge of the bog at Gneeve and it is on-line between Bunbrosna and Culleen Beg. It runs south of the railway line between Longford and Edgeworthstown for a longer distance than Route Corridor Option 6.
- From an agricultural point of view Route Corridor Option 5 is joint fourth preference. The fact that its qualitative characteristics are good is balanced by a very high land take due to this route being the longest. Overall it is assessed to have a **highly negative** impact on agriculture

Route Corridor Option 6 has the lowest quantitative scores and above average qualitative scores.

- The Route Corridor ranks joint first in the land take criteria.
- The Route Corridor ranks third for length-on-line criteria.
- The Route Corridor has joint second best ranking score for the area of dairy & equine farms affected and indicative severance impact score criteria.
- The Route Corridor has an above average qualitative assessment score (Table 4.3-3) The soil quality indicated from the roadside windshield survey and the EPA soils mapping data suggests that the soil quality is average along this Route Corridor Option. It uses the preferred agronomy corridor along the northern edge of the bog at Gneeve and it is on-line between Bunbrosna and Culleen Beg for a length of 6.8 kilometres. It runs along the preferred agronomy corridor south of the railway line between Longford and Edgeworthstown.

- From an agricultural point of view Route Corridor Option 6 is the preferred Route Corridor Option because of its consistently good ranking scores. Overall it is assessed to have a **moderately negative** impact on agriculture

Table 4.3-7 Ranking of Options: (Soils, Intensity of Farming, Land Take and Severance Combined)

Route Corridor Option	Order of Preference	Overall Impact
Route Corridor Option 1	2	Moderately negative
Route Corridor Option 2	4	Highly negative
Route Corridor Option 3	6	Highly negative
Route Corridor Option 4	5	Highly negative
Route Corridor Option 5	3	Highly negative
Route Corridor Option 6	1	Moderately negative

4.4 Air Quality

This section outlines the methodology, baseline environment and results of the air quality assessment for the Route Corridor Selection Report.

4.4.1 Methodology

The air quality assessment for the Route Corridor selection study has been undertaken with reference to the Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA, 2006). The study has in particular considered the requirements of Chapter 3.0 of these guidelines *Route Corridor Selection*. The key considerations listed within the chapter are outlined below:

- Changes in the air quality constraints study area;
- Calculation of the different Route Corridor Options' index of overall change in exposure to nitrogen dioxide (NO_2) and particulates with a diameter of less than 10µm (PM_{10});
- Dependant upon local circumstances, the calculation of local NO_2 and PM_{10} concentrations at worst case locations (typically within 10 metres of the Route Corridor Options);
- The calculation of nitrogen oxides (NO_x) and nitrogen deposition at relevant designated habitats within 200 metres of the centreline of Route Corridor Options;
- Discussion of mitigation options; and
- Recommendations for additional air quality monitoring.

Further details of the approach to updating existing air quality information, the calculation of index of overall change in exposure, local air quality calculations and designated habitats calculations are presented in the following sub-sections.

In terms of air quality impacts the assessment is confined to within 200m of the centreline of each Route Corridor Option, as pollutant concentrations return to background concentrations at distances beyond this.

Updating Existing Air Quality Information

A review of the following online resources has been undertaken to establish if any updates to the baseline air quality data, as previously reported in the Constraints Study, are required:

- Environmental Protection Ireland – Air (http://www.epa.ie/environment/air/)
- Longford County Council – Environment (http://www.longfordcoco.ie/coco_environment.html)
- Westmeath County Council – Environment (http://www.westmeathcoco.ie/servicesa-z/environment/).

Index of Overall Change in Exposure

The index of overall change in exposure with respect to NO_2 and PM_{10} has been calculated for each of the Route Corridor Options. The Route Corridors under consideration are described in Chapter 3 of this report.

These Route Corridors options are presented in Volume III of the Route Corridor Selection Report, RFig 10.1 to 10.4, Route Corridor Option 1; RFig 20.1 to 20.4, Route Corridor Option 2; RFig 30.1 to 30.4, Route Corridor Option 3; RFig 40.1 to 40.4, Route Corridor Option 4; RFig 50.1 to 50.4, Route Corridor Option 5; and RFig 60.1 to 60.4, Route Corridor Option 6.

The calculations have been undertaken using the regional application of the Design Manual for Roads and Bridges (DMRB) air quality spreadsheet model Version 1.03c (July 2007). The numbers of properties within 50 metres of the centreline of the Route Corridor Options have been considered and the predictions have been undertaken for the opening year (2015). Transportation Planning (International) Ltd. provided the traffic data used in the index of overall change in exposure. Where a positive score is returned, this denotes an increase in exposure and a negative score, a reduction in exposure. The traffic data used in the assessment are presented in Chapter 6 of this report.

Local Air Quality Calculations

The concentrations of NO_2 and PM_{10} have been calculated at representative locations (e.g. residential properties) within 50 metres of either the existing N4 route or any of the Route Corridors Options. The calculations have been undertaken using the local application of the DMRB air quality spreadsheet, using traffic data provided by Transportation Planning (International Ltd). The calculations were undertaken for the opening year 'Do-Nothing' and 'Do-Something' scenarios. The locations of these sensitive receptors used for each Route Corridors Option are shown on RFig 4.4.1 to RFig 4.4.4. Volume III.

The background NO_2, NO_x and PM_{10} data used in the assessment are presented in Table 4.4-1. The background NO_x, NO_2 and PM_{10} data were obtained from an Irish EPA continuous monitoring study in Athlone undertaken between 5th March 2003 and 29th October 2003 (EPA, 2003). The monitoring was undertaken at the waterworks in Athlone on the east bank of River Shannon. The waterworks is located between the town centre (less than 1 km) and the N6 bypass. The site is considered to be outside of the direct influence of the two above sources and as such is an appropriate background location. The background NO_2, NO_x and PM_{10} concentrations have been corrected from period means (approximately 8 months) to annual means following the period to annual mean adjustment procedure outlined in Local Air Quality Management Technical Guidance LAQM.TG(03) (Defra, 2003). The 2003 and 2004 background concentrations have been converted into 2015 concentrations using the year on year correction factors as presented in LAQM.TG(03) (Defra, 2003).

Table 4.4-1 Local Air Quality Background Concentrations

Year	NO_x[A] (µg/m^3)	NO_2[A] (µg/m^3)	PM_{10}[B] (µg/m^3)	Secondary PM_{10}[C] (µg/m^3)
2003	13.8	10.4	23.2	-
2004	13.3	10.2	23.8	11.2
2015	9.3	8.2	21.1	8.8

Notes:

[A] Athlone NO_x and NO_2 period mean data corrected from average correction factor derived from annual datasets from Monaghan, Ballyfermot and Glashaboy (http://www.epa.ie/whatwedo/monitoring/air/data/).

[B] Athlone PM_{10} period mean data corrected from average correction factor from Phoenix Park, Heatherton Park and Rathmines (http://www.epa.ie/whatwedo/monitoring/air/data/).

[C] Secondary PM_{10} concentrations established from review of PM_{10} background maps for UK (http://www.airquality.co.uk/archive/index.php)

The results of the local air quality predictions for NO_2 and PM_{10} have been assessed against the Annual Average EU Limit Value of 40µg/m³. The PM_{10} predictions have also been assessed against the 50µg/m³ 24 hour EU Limit Value, which allows for 35 exceedances a year. The annual average NO_2 predictions are also discussed in relation to exceedances of the 1 hour EU Limit Value of 200µg/m³ (allowing for 18 exceedances a year). This is possible because of an empirical relationship identified by Laxen and Marner (2003), which identified that where annual averages are below 60µg/m³, exceedances of the 200µg/m³ hourly standard are unlikely. Receptors which exceed 90% of any of the annual average EU Limit Values have also been identified.

Designated Habitats Calculations

Designated habitats NO_x and nitrogen deposition calculations have been undertaken for designated habitat sites identified within 200 metres of any of the Route Corridor Options shown on RFig 4.4.1 to RFig 4.4.4. This included calculations for the following habitats:

Internationally Designated Site

- Clooneen Bog cSAC, pNHA (RFig 4.4.1)
- Lough Forbes/Ballykenny Fishertown Bog SPA,cSAC, pNHA (RFig 4.4.1)
- Lough Iron SPA , pNHA, Ramsar Site (RFig 4.4.4)
- Garriskil Bog SPA/cSAC (RFig 4.4.3)
- Scragh Bog cSAC, pNHA and Statutory Nature Reserve (RFig 4.4.4)
- Lough Owel cSAC/SPA, pNHA, Ramsar Site (RFig 4.4.4).

Nationally Designated Site

- Aghnamona Bog NHA (RFig 4.4.1)
- Rinn River NHA (RFig 4.4.1)
- Derrymore Bog pNHA (RFig 4.4.2)
- Royal Canal pNHA (RFig 4.4.2)
- Lough Garr NHA (RFig 4.4.3)
- Ballynafid Lake and Fen pNHA (RFig 4.4.4).

The calculations have been undertaken using the local application of the DMRB air quality spreadsheet model for the 'Do-Something' Scenario in the opening year (2015). Concentrations have been predicted at the closest point of the designated site

to the centreline of the Route Corridor Option. If exceedances (30µg/m³ EU Limit Value for NO_x) were predicted further calculations were undertaken to identify the point at which predictions were below the 30µg/m³ EU Limit Value for the protection of ecosystems. The background NO_x concentration used in the designated habitats calculations was the same as that presented in Table 4.4-1 and the background N-deposition used was 0.88kg/N/ha/yr. The background N-deposition value was calculated from the background NO_2 concentration presented in Table 4.4-1, following the method presented by the NRA guidance. Nitrogen deposition rates have been assessed against Critical Loads taken from Table A5.1: UNECE (2003) Critical Loads for Nitrogen, as reproduced in Appendix 6, Volume II. Impacts upon sensitive ecosystems, in particular, the value for raised and blanket bog of between 5 and 10kg/N/ha/yr has been selected based on the information provided by the Scheme Ecologist concerning the qualifying features of the different habitats.

4.4.2 Existing Environment

The review of existing information sources did not identify any further information than that originally identified at the constraints study stage.

4.4.3 Route Corridor Option Appraisal

The index of overall change, local screening calculation results and NO_x and nitrogen deposition results for each of the Route Corridor Options are presented in the following sub-sections. Calculations have also been undertaken for the existing N4 route and these results are also presented.

Route Corridor Option 1

The index of overall change results for Route Corridor Option 1 is presented below.

Table 4.4-2 Route Corridor Option 1: Index of Overall Change in Exposure

	NO_x Score	Better or Worse	PM_{10} Score	Better or Worse
Option 1	-1109276	Better	-24772	Better

The index of overall change score for option 1, for NO_x and PM_{10} illustrates a negative score and hence indicates an overall reduction in exposure to air pollution. The score

illustrates the impact the Route Corridors Option has which takes traffic away from populated areas. The largest improvements in exposure to air pollution are predicted at the existing N4 as this is where the largest reduction in traffic occurs as a result of the Route Corridors Option. It is also where there are the greatest number of receptors.

In addition to the calculation of the index of overall change, a number of worst case receptors were chosen for comparison against the EU Limit Values. The locations of the receptors are presented on RFig 4.4.1 to RFig 4.4.4.

Table 4.4-3 presents the predicted concentrations at these receptors in both the 'Do Nothing' and 'Do Something' Route Corridor Option 1 scenarios.

Table 4.4-3 Route Corridor Option 1: Opening Year (2015) Local Air Quality Predictions

Receptor (RFig 4.4.1 to 4.4.4)	Do Nothing			Do Something		
	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$
RR1	10.4	21.7	6	9.1	21.4	5
RR2	10.2	21.6	6	9.4	21.5	5
RR3	11.5	22.0	6	10.1	21.7	6
RR4	8.6	21.2	5	8.9	21.3	5
RR5	9.1	21.3	5	10.3	21.7	6
RR6	8.4	21.2	5	10.4	21.8	6
RR7	10.9	21.7	6	9.3	21.4	5
RR8	10.2	21.6	6	11.6	22.0	6
RR9	11.6	21.9	6	9.7	21.5	5
RR10	9.6	21.4	5	9.4	21.4	5
RR11	12.5	22.1	6	12.3	22.3	7
RR12	12.3	22.3	7	12.3	22.3	7
RR13	11.5	22.0	6	11.6	22.1	6

The modelled NO_2 and PM_{10} concentrations illustrate that none of the receptors is predicted to exceed the EU Limit Value (40.0 $\mu g/m^3$).

Table 4.4-4 presents the differences between the concentrations in the 'Do Nothing' and 'Do Something' for Route Corridor Option 1.

Table 4.4-4 Route Corridor Option 1: Opening Year (2015) Local Air Quality Predictions

Receptor	Difference between Do Something and Do Nothing		
	Annual Average NO_2 Concentration (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	PM_{10} Days >50µg/m³
RR1	-1.3	-0.3	-1
RR2	-0.8	-0.1	-1
RR3	-1.4	-0.3	0
RR4	0.3	0.1	0
RR5	1.2	0.4	1
RR6	2	0.6	1
RR7	-1.6	-0.3	-1
RR8	1.4	0.4	0
RR9	-1.9	-0.4	-1
RR10	-0.2	0	0
RR11	-0.2	0.2	1
RR12	0	0	0
RR13	0.1	0.1	0

Table 4.4-4 illustrates that the highest increase in pollutant concentrations is predicted at receptor RR6 (RFig 4.4.2), as a result of increased traffic passing the receptor.

In addition, Route Corridor Option 1 has the potential to impact on a number of designated sites, as presented in Table 4.4-5.

Table 4.4-5 illustrates the predicted NO_x concentrations and nitrogen deposition rates for each affected ecosystem.

Table 4.4-5 Route Corridor Option 1: Predicted NO_x and Nitrogen Deposition Rates

Ecosystem	Distance from Centreline of Route Corridor (m)	NO_x Concentration (µg/m³) Do-Nothing	NO_x Concentration (µg/m³) Do-Something	Deposition Rate Do-Nothing (kg N ha^{-1} yr^{-1})	Deposition Rate Do-Something (kg N ha^{-1} yr^{-1})
Aghnamona Bog	15	17.5	18.8	1.09	1.13
Clooneen Bog	15	18.0	19.1	1.11	1.14
Rinn River	15	17.6	18.6	1.09	1.13
Ballykenny-Fisherstown	54	17.6	12.9	1.09	0.95
Lough Forbes	54	17.6	12.9	1.09	0.95
Lough Garr	220	24.0	12.2	1.28	0.92
Lough Iron	15	9.3	25.5	0.82	1.32
Ballynafid Lake and Fen	15	28.2	32.3	1.39	1.49
Lough Owel	15	28.4	28.4	1.39	1.39

Note: Only ecosystems that are within 200 metres of an affected road have been assessed (e.g. the existing roads or option 1). Where a road passes through an ecosystem, a distance of 15 metres is used.

Table 4.4-5 illustrates that NO_x concentrations exceed the EU Limit Value at 15 metres at the Ballynafid Lake and Fen. Predicted NO_x concentrations at 20 metres are below the EU Limit Value (29.3µg/m³). All nitrogen deposition rates are well below the 5 kg N ha^{-1} yr^{-1} critical load values for all ecosystems.

Route Corridor Option 2

The index of overall change results for Route Corridor Option 2 is presented in Table 4.4-6.

Table 4.4-6 Route Corridor Option 2: Index of Overall Change in Exposure

	NO_x Score	Better or Worse	PM_{10} Score	Better or Worse
Option 2	-1180888	Better	-26820	Better

The index of overall change score for Route Corridor Option 2, for NO_x and PM_{10} illustrates a negative score and hence indicates an overall reduction in exposure to air pollution. The score illustrates the impact the option has which takes traffic away from populated areas. The largest improvements in exposure to air pollution are predicted

at the existing N4 as this is where the largest reduction in traffic occurs as a result of the option. It is also where there is the greatest number of receptors.

In addition in order to calculate the index of overall change a number of worst case receptors were chosen for comparison against the EU Limit Values. The locations of the receptors are presented on RFig 4.4.1 to RFig 4.4.4.

Table 4.4-7 presents the predicted concentrations at these receptors in both the 'Do Nothing' and 'Do Something' Route Corridor Option 2 scenarios.

Table 4.4-7 Route Corridor Option 2: Opening Year (2015) Local Air Quality Predictions

Receptor	Do Nothing			Do Something Option		
	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$
OR1	8.5	21.2	5	8.7	21.3	5
OR2	8.4	21.2	5	9.8	21.6	6
OR3	10.6	21.7	6	9.1	21.4	5
OR4	8.6	21.2	5	9.5	21.5	6
OR5	8.6	21.2	5	9.2	21.4	5
OR6	10.9	21.8	6	11.0	22.0	6
OR7	13.2	22.3	7	9.9	21.5	6
OR8	10.2	21.6	6	11.8	22.1	7
OR9	8.6	21.2	5	10.6	21.8	6
OR10	13.6	22.4	7	12.2	22.2	7
OR11	12.3	22.3	7	12.3	22.3	7

The modelled NO_2 and PM_{10} concentrations illustrate that none of the receptors is predicted to exceed the EU Limit Value.

Table 4.4-8 presents the differences between the concentrations in the 'Do Nothing' and 'Do Something' Route Corridor Option 2.

Table 4.4-8 Route Corridor Option 2: Difference in NO2 and PM10 Concentrations Opening Year (2015) Local Air Quality Predictions

Receptor	Difference between Do Something and Do Nothing		
	Annual Average NO_2 Concentration (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	PM_{10} Days >50µg/m³
OR1	0.2	0.1	0
OR2	1.4	0.4	1
OR3	-1.5	-0.3	-1
OR4	0.9	0.3	1
OR5	0.6	0.2	0
OR6	0.1	0.2	0
OR7	-3.3	-0.8	-1
OR8	1.6	0.5	1
OR9	2	0.6	1
OR10	-1.4	-0.2	0
OR11	0	0	0

Table 4.4-8 illustrates that the highest increase in pollutant concentrations is predicted at receptor OR9 as a result of increased traffic passing the receptor.

In addition, Route Corridor Option 2 has the potential to impact on a number of designated sites, as presented in Table 4.4-9.

Table 4.4-9 illustrates the predicted NO_x concentrations and nitrogen deposition rates for each effected ecosystem.

Table 4.4-9 Route Corridor Option 2: Predicted NO_x and Nitrogen Deposition Rates

Ecosystem	Distance from Centreline of Route Corridor (m)	NO_x Concentration (µg/m³) Do-Nothing	NO_x Concentration (µg/m³) Do-Something	Deposition Rate Do-Nothing(kg N ha^{-1} yr^{-1})	Deposition Rate Do-Something (kg N ha^{-1} yr^{-1})
Aghnamona Bog	15	17.5	18.8	1.09	1.13
Clooneen Bog	15	18.0	19.1	1.11	1.14
Rinn River	15	17.6	18.6	1.09	1.13
Ballykenny-Fisherstown	50	17.6	13.2	1.09	0.96
Lough Forbes	50	17.6	13.2	1.09	0.96
Lough Garr	220	24.0	12.2	1.28	0.92
Lough Iron	15	9.3	25.5	0.82	1.32
Lough Owel	15	28.4	28.4	1.39	1.39
Ballynafid Lake and Fen	108	28.2	17.8	1.39	1.10

Note: Only ecosystems that are within 200 metres of an affected road have been assessed (e.g. the existing roads or option 2). Where a road passes through an ecosystem, a distance of 15 metres is used.

Table 4.4-9 illustrates that NO_x concentrations do not exceed the EU Limit Value at any of the designated sites. All nitrogen deposition rates are well below the 5 kg N ha^{-1} yr^{-1} critical load values for all ecosystems.

Route Corridor Option 3

The index of overall change results for Route Corridor Option 3 is presented in Table 4.4.-10.

Table 4.4-10 Route Corridor Option 3: Index of Overall Change in Exposure

	NO_x Score	Better or Worse	PM_{10} Score	Better or Worse
Option 3	-1123814	Better	-25433	Better

The index of overall change score for Route Corridor Option 3, for NO_x and PM_{10} illustrates a negative score and hence indicates an overall reduction in exposure to air pollution. The score illustrates the impact of the option which takes traffic away from populated areas. The largest improvements in exposure to air pollution are predicted at the existing N4 as this is where the largest reduction in traffic occurs as a result of the option. It is also where there is the greatest number of receptors.

In addition to the calculation of the index of overall change, a number of worst case receptors were chosen for comparison against the EU Limit Values. The locations of the receptors are presented on RFig 4.4.1 to RFig 4.4.4.

Table 4.4-11 presents the predicted concentrations at these receptors in both the 'Do Nothing' and 'Do Something' Route Corridor Option 3 scenarios.

Table 4.4-11 Route Corridor Option 3: Opening Year (2015) Local Air Quality Predictions

Receptor	Do Nothing			Do Something		
	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$
GR1	8.5	21.2	5	8.6	21.2	5
GR2	8.6	21.2	5	9.4	21.5	5
GR3	8.6	21.2	5	8.9	21.3	5
GR4	9.1	21.3	5	10.1	21.6	6
GR5	8.4	21.2	5	10.2	21.7	6
GR6	8.3	21.2	5	10.0	21.6	6
GR7	8.2	21.1	5	9.6	21.5	5
GR8	9.0	21.3	5	9.4	21.4	5
GR9	8.4	21.2	5	10.5	21.7	6

The modelled NO_2 and PM_{10} concentrations illustrate that none of receptors is predicted to exceed the EU Limit Value.

Table 4.4-12 presents the differences between the concentrations in the 'Do Nothing' and 'Do Something' Route Corridor Option 3.

Table 4.4-12 Route Corridor Option 3: Difference in NO_2 and PM_{10} Concentrations Opening Year (2015) Local Air Quality Predictions

Receptor	Difference between Do Something and Do Nothing		
	Annual Average NO_2 Concentration (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	PM_{10} Days >50µg/m^3
GR1	0.1	0	0
GR2	0.8	0.3	0
GR3	0.3	0.1	0
GR4	1	0.3	1
GR5	1.8	0.5	1
GR6	1.7	0.4	1
GR7	1.4	0.4	0
GR8	0.4	0.1	0
GR9	2.1	0.5	1

Table 4.4-12 illustrates that the highest increase in pollutant concentrations is predicted at receptor GR9 (RFig 4.4.4). The increase in pollutants is as a result of traffic passing closer to this receptor.

In addition Route Corridor Option 3 has the potential to impact on a number of designated sites, as presented in Table 4.4-13.

Table 4.4-13 illustrates the predicted NOx concentrations and nitrogen deposition rates for each affected ecosystem.

Table 4.4-13 Route Corridor Option 3: Predicted NO_x and Nitrogen Deposition Rates

Ecosystem	Distance from Centreline of Route Corridor (m)	NO_x Concentration (µg/m^3) Do-Nothing	NO_x Concentration (µg/m^3) Do-Something	Deposition Rate Do-Nothing (kg N ha^{-1} yr^{-1})	Deposition Rate Do-Something (kg N ha^{-1} yr^{-1})
Aghnamona Bog	15	17.5	18.8	1.09	1.13
Clooneen Bog	15	18.0	19.1	1.11	1.14
Rinn River	15	17.6	18.6	1.09	1.13
Ballykenny-Fisherstown	50	17.6	13.2	1.09	0.96
Lough Forbes	50	17.6	13.2	1.09	0.96
Lough Garr	141	24.0	10.1	1.28	0.85
Garriskil Bog	140	9.3	10.1	0.82	0.85
Lough Owel	690	28.4	9.5	1.39	0.83
Ballynafid Lake and Fen	1000	28.2	16.5	1.39	1.06
Scragh Bog	165	9.3	9.9	0.82	0.84

Note: Only ecosystems that are within 200 metres of an affected road have been assessed (e.g. the existing roads or option 3). Where a road passes through an ecosystem, a distance of 15 metres is used.

Table 4.4-13 illustrates that NO_x concentrations do not exceed the EU Limit Value at any of the designated sites. All nitrogen deposition rates are well below the 5 kg N ha^{-1} yr^{-1} critical load values for all ecosystems.

Route Corridor Option 4

The index of overall change results for Route Corridor Option 4 is presented in Table 4.4-14.

Table 4.4-14 Route Corridor Option 4: Index of Overall Change in Exposure

	NO_x Score	Better or Worse	PM_{10} Score	Better or Worse
Option 4	-1047777	Better	-23423	Better

The index of overall change score for Route Corridor Option 4, for NO_x and PM_{10} illustrates a negative score and hence indicates an overall reduction in exposure to air pollution. The score illustrates the impact of the option which takes traffic away from populated areas. The largest improvements in exposure to air pollution are predicted

at the existing N4 as this is where the largest reduction in traffic occurs as a result of the option. It is also where there is the greatest number of receptors.

In addition to the calculation of the index of overall change a number of worst case receptors were chosen for comparison against the EU Limit Values. The locations of the receptors are presented on RFig 4.4.1 to RFig 4.4.4.

Table 4.4-15 presents the predicted concentrations at these receptors in both the 'Do Nothing' and 'Do Something' Route Corridor Option 4 scenarios.

Table 4.4-15 Route Corridor Option 4: Opening Year (2015) Local Air Quality Predictions

Receptor	Do Nothing			Do Something Option		
	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$
LAR1	8.5	21.2	5	8.6	21.3	5
LAR2	9.1	21.3	5	9.4	21.5	6
LAR3	10.0	21.6	6	9.6	21.6	6
LAR4	8.6	21.2	5	8.8	21.3	5
LAR5	8.2	21.1	5	9.4	21.5	5
LAR6	10.5	21.6	6	9.8	21.5	5
LAR7	10.2	21.6	6	11.0	21.9	6
LAR8	8.6	21.2	5	10.6	21.8	6
LAR9	13.6	22.4	7	12.3	22.2	7
LAR10	8.7	21.2	5	12.5	22.4	7
LAR11	12.3	22.3	7	12.3	22.3	7
LAR12	11.5	22.0	6	11.6	22.1	6

The modelled NO_2 and PM_{10} concentrations illustrate that none of receptors is predicted to exceed the EU Limit Value.

Table 4.4-16 presents the differences between the concentrations in the 'Do Nothing' and 'Do Something' for Route Corridor Option 4.

Table 4.4-16 Route Corridor Option 4: Difference in NO_2 and PM_{10} Concentrations Opening Year (2015) Local Air Quality Predictions

Receptor	Difference between Do Something and Do Nothing		
	Annual Average NO_2 Concentration (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	PM_{10} Days >50µg/m^3
LAR1	0.1	0.1	0
LAR2	0.3	0.2	0
LAR3	-0.4	0	0
LAR4	0.2	0.1	0
LAR5	1.2	0.4	0
LAR6	-0.7	-0.1	-1
LAR7	0.8	0.3	0
LAR8	2.0	0.6	1
LAR9	-1.3	-0.2	0
LAR10	3.8	1.2	2
LAR11	0	0	0
LAR12	0.1	0.1	0

Table 4.4-16 illustrates that the highest increase in pollutant concentrations is predicted at receptor LAR10 (RFig 4.4.4), the increase in pollutants is as a result of increased traffic passing the receptor.

In addition Route Corridor Option 4 has the potential to impact on a number of designated sites, as presented in Table 4.4-17.

Table 4.4-17 illustrates the predicted NO_x concentrations and nitrogen deposition rates for each affected ecosystem.

Table 4.4-17 Route Corridor Option 4: Predicted NOx and Nitrogen Deposition Rates

Ecosystem	Distance from Centreline of Route Corridor (m)	NO_x Concentration (µg/m³) Do-Nothing	NO_x Concentration (µg/m³) Do-Something	Deposition Rate Do-Nothing (kg N ha^{-1} yr^{-1})	Deposition Rate Do-Something (kg N ha^{-1} yr^{-1})
Aghnamona Bog	15	17.5	18.8	1.09	1.13
Clooneen Bog	15	18.0	19.1	1.11	1.14
Rinn River	15	17.6	18.6	1.09	1.13
Ballykenny-Fisherstown	54	17.6	12.9	1.09	0.95
Lough Forbes	54	17.6	12.9	1.09	0.95
Lough Garr	220	24.0	12.9	1.28	0.92
Lough Iron	15	9.3	25.4	0.82	1.31
Lough Owel	15	28.4	28.4	1.39	1.39
Ballynafid Lake and Fen	108	28.2	17.9	1.39	1.11

Note: Only ecosystems that are within 200 metres of an affected road have been assessed (e.g. the existing roads or option 4. Where a road passes through an ecosystem, a distance of 15 metres is used.

Table 4.4-17 illustrates that NO_x concentrations do not exceed the EU Limit Value at any of the designated sites. All nitrogen deposition rates are well below the 5 kg N ha^{-1} yr^{-1} critical load values for all ecosystems.

Route Corridor Option 5

The index of overall change results for Route Corridor Option 5 is presented in Table 4.4-18.

Table 4.4-18 Route Corridor Option 5: Index of Overall Change in Exposure

	NO_x Score	Better or Worse	PM_{10} Score	Better or Worse
Option 5	-1123164	Better	-25166	Better

The index of overall change score for Route Corridor Option 5, for NO_x and PM_{10} illustrates a negative score and hence indicates an overall reduction in exposure to air pollution. The score illustrates the impact of the route which takes traffic away from populated areas. The largest improvements in exposure to air pollution are predicted at the existing N4 as this is where the largest reduction in traffic occurs as a result of the option. It is also where there is the greatest number of receptors.

In addition to the calculation of the index of overall change a number of worst case receptors were chosen for comparison against the EU Limit Values. The locations of the receptors are presented on RFig 4.4.1 to RFig 4.4.4.

Table 4.4-19 presents the predicted concentrations at these receptors in both the 'Do Minimum' and 'Do Something' Route Corridor Option 5 scenarios.

Table 4.4-19 Route Corridor Option 5: Opening Year (2015) Local Air Quality Predictions

Receptor	Do Nothing			Do Something Option		
	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$
BDR1	8.5	21.2	5	8.6	21.3	5
BDR2	11.5	22.0	6	9.9	21.6	6
BDR3	9.7	21.5	5	9.5	21.5	5
BDR4	9.9	21.5	6	10.5	21.8	6
BDR5	8.4	21.2	5	9.3	21.5	5
BDR6	10.2	21.6	6	11.6	22.0	6
BDR7	8.6	21.2	5	10.6	21.8	6
BDR8	12.5	22.1	6	12.3	22.3	7
BDR9	12.3	22.3	7	12.3	22.3	7
BDR10	11.5	22.0	6	11.6	22.1	6

The modelled NO_2 and PM_{10} concentrations illustrate that none of receptors is predicted to exceed the EU Limit Value.

Table 4.4-20 presents the differences between the concentrations in the 'Do Nothing' and 'Do Something' Route Corridor Option 5.

Table 4.4-20 Route Corridor Option 5: Difference in NO_2 and PM_{10} Concentrations Opening Year (2015) Local Air Quality Predictions

Receptor	Difference between Do Something and Do Nothing		
	Annual Average NO_2 Concentration (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	PM_{10} Days >50µg/m³
BDR1	0.1	0.1	0
BDR2	-1.6	-0.4	0
BDR3	-0.2	0.0	0
BDR4	0.6	0.3	0
BDR5	0.9	0.3	0
BDR6	1.4	0.4	0
BDR7	2.0	0.6	1
BDR8	-0.2	0.2	1
BDR9	0.0	0.0	0
BDR10	0.1	0.1	0

Table 4.4-20 illustrates that the highest increase in pollutant concentrations is predicted at receptor BDR7 (RFig 4.4.3). The increase in pollutants is as a result of increased traffic passing this receptor.

In addition Route Corridor Option 5 has the potential to impact on a number of designated sites, as presented in Table 4.4-21.

Table 4.4-21 illustrates the predicted NO_x concentrations and nitrogen deposition rates for each affected ecosystem.

Table 4.4-21 Route Corridor Option 5: Predicted NO_x and Nitrogen Deposition Rates

Ecosystem	Distance from Centreline of Route Corridor (m)	NO_x Concentration ($\mu g/m^3$) Do-Nothing	NO_x Concentration ($\mu g/m^3$) Do-Something	Deposition Rate Do-Nothing(kg N ha^{-1} yr^{-1})	Deposition Rate Do-Something (kg N ha^{-1} yr^{-1})
Aghnamona Bog	15	17.5	18.8	1.09	1.13
Clooneen Bog	15	18.0	19.1	1.11	1.14
Rinn River	15	17.6	18.6	1.09	1.13
Ballykenny-Fisherstown	54	17.6	12.9	1.09	0.95
Lough Forbes	54	17.6	12.9	1.09	0.95
Royal Canal	15	18.5	23.0	1.12	1.25
Derrymore Bog	67	9.3	10.6	0.82	0.87
Lough Garr	220	24.0	12.2	1.28	0.92
Lough Owel	15	28.4	28.4	1.39	1.39
Lough Iron	15	9.3	22.4	0.82	1.23
Ballynafid Lake and Fen	108	28.2	17.8	1.39	1.10

Note: Only ecosystems that are within 200 metres of an affected road have been assessed (e.g. the existing roads or option 5). Where a road passes through an ecosystem, a distance of 15 metres is used.

Table 4.4-21 illustrates that NO_x concentrations do not exceed the EU Limit Value at any of the designated sites. All nitrogen deposition rates are well below the 5 kg N ha^{-1} yr^{-1} critical load values for all ecosystems.

Route Corridor Option 6

The index of overall change results for Route Corridor Option 6 is presented in Table 4.4-22.

Table 4.4-22 Route Corridor Option 6: Index of Overall Change in Exposure

	NO_x Score	Better or Worse	PM_{10} Score	Better or Worse
Option 6	-1178657	Better	-25418	Better

The index of overall change score for Route Corridor Option 6, for NO_x and PM_{10} illustrates a negative score and hence indicates an overall reduction in exposure to air pollution. The score illustrates the impact of the option which takes traffic away from populated areas. The largest improvements in exposure to air pollution are predicted

at the existing N4 as this is where the largest reduction in traffic occurs as a result of the option. It is also where there is the greatest number of receptors.

In addition to the calculation of the index of overall change, a number of worst case receptors were chosen for comparison against the EU Limit Values. The location of the receptors are presented on RFig 4.4.1 to 4.4.4.

Table 4.4-23 presents the predicted concentrations at these receptors in both the 'Do Nothing' and 'Do Something' scenarios for Route Corridor Option 6.

Table 4.4-23 Route Corridor Option 6: Opening Year (2015) Local Air Quality Predictions

Receptor	Do Nothing			Do Something Option		
	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$	Annual Average NO_2 Concentration ($\mu g/m^3$)	Annual Average PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Days >50$\mu g/m^3$
EER1	10.4	21.7	6	9.0	21.4	5
EER2	10.2	21.6	6	9.4	21.5	5
EER3	10.6	21.7	6	10.2	21.7	6
EER4	8.6	21.2	5	9.4	21.4	5
EER5	8.6	21.2	5	9.2	21.4	5
EER6	9.2	21.4	5	10.5	21.7	6
EER7	9.6	21.4	5	8.9	21.3	5
EER8	10.2	21.6	6	12.1	22.4	7
EER9	8.6	21.2	5	10.9	22.1	6
EER10	8.2	21.1	5	11.2	22.2	7
EER11	9.9	21.5	5	10.7	22.0	6
EER12	12.5	22.1	6	13.4	23.0	8
EER13	8.2	21.1	5	10.2	21.8	6
EER14	11.5	22.0	6	11.6	22.1	7

The modelled NO_2 and PM_{10} concentrations illustrate that none of receptors is predicted to exceed the EU Limit Value.

Table 4.4-24 presents the differences between the concentrations in the 'Do Nothing' and 'Do Something' Route Corridor Option 6.

Table 4.4-24 Route Corridor Option 6: Difference in NO_2 and PM_{10} Concentrations Opening Year (2015) Local Air Quality Predictions

Receptor	Difference between Do Something and Do Nothing		
	Annual Average NO_2 Concentration (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	PM_{10} Days >50µg/m^3
EER1	-1.4	-0.3	-1
EER2	-0.8	-0.1	-1
EER3	-0.4	0.0	0
EER4	0.8	0.2	0
EER5	0.6	0.2	0
EER6	1.3	0.3	1
EER7	-0.7	-0.1	0
EER8	1.9	0.8	1
EER9	2.3	0.9	1
EER10	3.0	1.1	2
EER11	0.8	0.5	1
EER12	0.9	0.9	2
EER13	2.0	0.7	1
EER14	0.1	0.1	1

Table 4.4-24 illustrates that the highest increase in pollutant concentrations is predicted at receptor EER10. The increase in pollutants is as a result of increased traffic passing this receptor.

In addition, Route Corridor Option 6 has the potential to impact on a number of designated sites, as presented in Table 4.4-25.

Table 4.4-25 illustrates the predicted NO_x concentrations and nitrogen deposition rates for each affected ecosystem.

Table 4.4-25 Route Corridor Option 6: Predicted NO_x and Nitrogen Deposition Rates

Ecosystem	Distance from Centreline of Route Corridor (m)	NO_x Concentration ($\mu g/m^3$) Do-Nothing	NO_x Concentration ($\mu g/m^3$) Do-Something	Deposition Rate Do-Nothing (kg N ha^{-1} yr^{-1})	Deposition Rate Do-Something (kg N ha^{-1} yr^{-1})
Aghnamona Bog	15	17.5	18.8	1.09	1.13
Clooneen Bog	15	18.0	19.1	1.11	1.14
Rinn River	15	17.6	18.7	1.09	1.13
Ballykenny-Fisherstown	54	17.6	12.9	1.09	0.95
Lough Forbes	54	17.6	12.9	1.09	0.95
Lough Garr	220	24.0	12.0	1.28	0.92
Lough Iron	62	9.3	14.3	0.82	0.99
Lough Owel	15	28.4	28.4	1.39	1.39
Ballynafid Lake and Fen	35	28.2	26.3	1.39	1.34

Note: Only ecosystems that are within 200 metres of an affected road have been assessed (e.g. the existing roads or option 6). Where a road passes through an ecosystem, a distance of 15 metres is used.

Table 4.4-25 illustrates that NO_x concentrations do not exceed the EU Limit Value at any of the designated sites. All nitrogen deposition rates are well below the 5 kg N ha^{-1} yr^{-1} critical load values for all ecosystems.

Carbon Emissions

The change in carbon emissions has been calculated by Transport Planning (International) Ltd from their traffic model. Table 4.4-26 illustrates the change in carbon emissions for each of the Route Corridor Options.

Table 4.4-26 Change in Carbon Emissions for Each Route Corridor Option

Route Corridor Option	Change in Carbon Emissions (Tonnes)	Order of Preference
Option 1	+106,110	3
Option 2	+109,867	4
Option 3	+129,000	6
Option 4	+91,059	1
Option 5	+116,454	5
Option 6	+94,055	2

There is predicted to be an increase in carbon emissions for each of the proposed Route Corridors Options.

4.4.4 Conclusions

The index of overall change results has been calculated for each of the six Route Corridors Options. All Route Corridors Options illustrate an overall reduction in exposure to air pollution and hence an improvement in air quality. This is as a result of all the Route Corridors Options taking traffic away from the most populated areas to less populated areas. The greatest improvements in air quality are predicted on the existing N4. All Route Corridors Options show very similar predicted scores, Route Corridor Option 2 shows the greatest reduction in score and hence the greatest improvement in air quality at receptors. The scores however are very similar for all the Route Corridors Options.

Table 4.4-27 Summary Index of Overall Change

Option	NO_x Score	NO_x Ranking	Better or Worse	PM_{10} Score	Better or Worse	PM_{10} Ranking
Option 1	-1109276	5	Better	-24772	Better	5
Option 2	-1180888	1	Better	-26820	Better	1
Option 3	-1123814	3	Better	-25433	Better	2
Option 4	-1047777	6	Better	-23423	Better	6
Option 5	-1123164	4	Better	-25166	Better	4
Option 6	-1178657	2	Better	-25418	Better	3

No exceedances of the EU Limit Value for either NO_2 or PM_{10} were predicted for the existing N4 route or for any of the proposed Route Corridors Options.

No exceedances of the critical load value for blanket or raised bogs were predicted for the proposed Route Corridors Options. Exceedances of the 30µg/m³ NO_x EU Limit Value were predicted at 15 metres (edge of carriageways) at Ballynafid Lake and Fen for Route Corridor Option 1, but not at 20 metres.

It is recommended that an air quality monitoring survey is undertaken following the selection of a preferred route alignment to gather baseline information along the route. The survey should consider the key road traffic related pollutants NO_x, NO_2 and PM_{10}. Monitoring is recommended, as there is limited available monitoring data for the study area.

The results of the air quality prediction should be considered in the selection of the preferred route alignment and in particular, the predicted exceedance of the NO_x EU Limit Value for the protection of ecosystems. Appropriate construction dust mitigation measures will be recommended as part of the EIA.

Table 4.4-28 presents the order of preference for each of the options assessed.

Table 4.4-28 Order of Preference (Air Quality)

Route Corridor	Order of Preference Index of Overall Change (NOx)	Order of Preference Index of Overall Change (PM_{10}) *	Total Score (sum of previous rankings)	Overall Order of Preference
Option 1	5	5	-	6 *
Option 2	1	1	2	1
Option 3	3	2	5	=2
Option 4	6	6	12	5
Option 5	4	4	8	4
Option 6	2	3	5	=2

* Route Corridor Option 1 ranked 6th as it is the only Option predicted to lead to exceedances of the air quality standard for the protection of vegetation.

The ranking of the various Route Corridor Options for air quality has been determined by considering the impact on sensitive receptors such as residential properties and designated sites. The index of overall change score has also been utilised to rank the

options in terms of preference. Route Corridor Option 1 is the only Corridor which has been predicted to lead to exceedances of the air quality standard for the protection of vegetation. As a result, this Route Corridor Option has been ranked low in terms of order of preference. The remaining Route Corridors Options are not predicted to cause any exceedances at designated sites therefore these have been ranked dependent on the scores in the index of overall change calculation. In terms of general air quality, Route Corridor Option 2 would therefore be the preferred option.

4.5 Noise and Vibration

The Noise and Vibration appraisal seeks to identify the optimum Route Corridor Option for the proposed scheme, with specific regard to potential noise and vibration impact of each Route Corridor Option on existing receptors. Receptors that are, or have the potential to be, particularly sensitive to noise and/or vibration include residences, schools, hospitals, places of worship, heritage buildings, special habitats, amenity areas in common use and designated quiet areas.

4.5.1 Methodology

The NRA guidance document "Guidance for the treatment of Noise and Vibration in National Road Schemes" states that there are three elements to the noise element of Route Corridor Selection. These elements consist of

- An appraisal of potential impact based upon property counts
- The consideration of likely changes in traffic flow
- A review of the need for, and difficulties associated with, noise mitigation measures.

Once these three elements have received detailed consideration, Route Corridor Options are ranked with respect to noise.

The NRA recommended methodology has been adopted for this appraisal.

Sensitive receptors have been identified by a combination of desk study and site survey method. These include site survey, review of aerial photographs and review of the An Post database.

4.5.2 Existing Environment

The existing noise climate in the study area is characterised to a large degree by road traffic on the existing N4 between Roosky and Mullingar, noise from the Sligo to Dublin railway line and generic environmental sources. Online Route Corridor Options following the approximate Route Corridor of the existing N4 would impact on

the highest number of houses due to the large number of houses located in proximity to the existing N4 road.

Route Corridor Options that are off line (separated from the existing N4 by sufficient distance) are less dominated by traffic noise and tend to be rural. Apart from noise generated at particular noise receptors (i.e. self induced residential noise), passing traffic on local roads and agricultural machinery activity would best characterise the noise climate.

While the adoption of an off line option would affect far fewer receptors, it could potentially have a higher degree of impact on some receptors, due to construction of and trafficking on a road within an area where the lower current ambient noise levels pertain. Where a Route Corridor Option is proposed in such a setting appropriate mitigation measures would be required, to ensure adherence to the design goal of $60dB_{Lden}$ as per the NRA guidelines described above, during the detailed design stage of the proposed road scheme.

4.5.3 Route Corridor Option Appraisal

The NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes indicate that the issue of vibration need not receive consideration at the Route Option Stage, as this is a detailed aspect addressed for particular special circumstances at Environmental Impact Assessment Stage.

In accordance with the NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes, all noise sensitive receptors within 300m of the centre line of each of the six Route Corridor Options have been identified, using the data available from the GIS mapping tools.

The node points referred to within this appraisal reflect the key points within each Route Corridor Option identified in RFig 10.1-10.4; 20.1-20.4; 30.1-30.4; 40.1-40.4; 50.1-50.4 and 60.1-60.4 of Volume III of this report.

These data have been tabulated and presented in Table 4.5-1 below. The noise sensitive receptors are defined in bands, depending on the offset distance from the

centreline of each of the Route Corridor Options. The NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes define the distance bands into which the noise sensitive receptors should be defined, as follows:

- Band 1: 0m to 50m from the Route Corridor centreline;
- Band 2: 50m to 100m from the Route Corridor centreline;
- Band 3: 100m to 200m from the Route Corridor centreline; and
- Band 4: 200m to 300m from the Route Corridor centreline.

Table 4.5-1 Noise Sensitive Receptors within Distance Offsets

Route Corridor Option	Receptors from Route Corridor Centreline 0m-50m	Receptors from Route Corridor Centreline 50m-100m	Receptors from Route Corridor Centreline 100m-200m	Receptors from Route Corridor Centreline 200m-300m
Option 1 Node 01-04	3	14	26	8
Option 1Node 04-07	2	10	47	38
Option 1 Node 07-08A	1	1	8	4
Option 1 Node 08A-14A	2	6	22	16
Option 1Node 14A-21	20	27	74	78
Option 1 Node 21-22	3	16	11	30
Total	**31**	**74**	**188**	**174**
Option 2 Node 01-03A	2	9	19	11
Option 2 Node 03A-07A	6	17	31	31
Option 2 Node 07A-08	5	22	45	102
Option 2 Node 08-14A	1	7	19	11
Option 2 Node 14A-21	11	17	74	76
Option 2 Node 21-22	3	16	11	30
Total	**28**	**88**	**199**	**261**
Option 3 Node 01-03A	2	9	19	11
Option 3 Node 03A-07	6	19	43	36
Option 3 Node 07-08A	1	1	8	4
Option 3 Node 08A-13A	3	14	27	15
Option 3 Node 13A-18B	2	9	27	29
Option 3 Node 18B-22	0	9	11	30
Total	**14**	**61**	**135**	**125**
Option 4 Node 01-04	3	14	26	8
Option 4 Node 04-04B	2	6	25	41
Option 4 Node 04B-14A	2	6	30	21
Option 4 Node 14A-21	11	17	74	76
Option 4 Node 21-22	3	14	9	24
Total	**21**	**57**	**164**	**170**
Option 5 Node 01-04	3	14	26	8
Option 5 Node 04-05B	3	10	46	41
Option 5 Node 05B-05D	1	5	57	55

Route Corridor Option	Receptors from Route Corridor Centreline 0m-50m	Receptors from Route Corridor Centreline 50m-100m	Receptors from Route Corridor Centreline 100m-200m	Receptors from Route Corridor Centreline 200m-300m
Option 5 Node 05D-14A	2	5	11	18
Option 5 Node 14A-21	10	18	74	76
Option 5 Node 21-22	3	14	9	24
Total	**22**	**66**	**223**	**222**
Option 6 Node 01-03A	1	9	21	6
Option 6 Node 3A-6	1	13	27	32
Option 6 Node 6-7	0	2	16	11
Option 6 Node 7-8A	0	1	7	6
Option 6 Node 8A-9A	0	0	2	2
Option 6 Node 9A-14	0	3	7	4
Option 6 Node 14-16	1	7	45	31
Option 6 Node 16-17A	0	3	7	11
Option 6 Node 17A-19	2	4	18	50
Option 6 Node 19-21	6	16	7	11
Option 6 Node 21-22	3	14	9	24
Total	**14**	**72**	**166**	**188**

Following the tabulation of the noise sensitive receptors along each of the Route Corridor Options, the NRA guidance indicates that the total number of receptors should be multiplied by an arbitrary rating factor, which is weighted for receptors closer to the centreline and decreasing at greater distances.

The arbitrary weighting factors are prescribed for the distance bands as follows:

- Band 1 (0-50m from centreline) - Weighting Factor = 4;
- Band 2 (50-100m from centreline) - Weighting Factor = 3;
- Band 3 (100-200m from centreline) - Weighting Factor = 2;
- Band 4 (200-300m from centreline) - Weighting Factor = 1.

The total number of receptors is multiplied by the arbitrary rating factor, and then the resultant values are added together to give a single number for each of the Route Corridor Options. The total figure is referred to as the Potential Impact Rating (PIR). The PIR values are used to assess the potential impact of each of the route option, with a higher PIR reflecting a higher potential impact.

The weighting of the receptors and the determination of the PIR is presented in Table 4.5-2 below.

Table 4.5-2 Potential Impact Rating Calculation

Route Corridor Option	Receptors from Route Corridor Centreline 0m – 50m	Receptors from Route Corridor Centreline 50m – 100m	Receptors from Route Corridor Centreline 100m – 200m	Receptors from Route Corridor Centreline 200m – 300m	Ranking Preference
Option 1 – Receptor No. Weighting Factor Product **PIR**	31 4 124	74 3 222	188 2 376	174 1 174 **896**	**4**
Option 2 – Receptor No. Weighting Factor Product **PIR**	28 4 112	88 3 264	199 2 398	261 1 261 **1035**	**6**
Option 3 – Receptor No. Weighting Factor Product **PIR**	14 4 56	61 3 183	135 2 270	125 1 125 **634**	**1**
Option 4 – Receptor No. Weighting Factor Product **PIR**	21 4 84	57 3 171	164 2 328	170 1 170 **753**	**2**
Option 5 – Receptor No. Weighting Factor Product **PIR**	22 4 88	66 3 198	223 2 446	222 1 222 **954**	**5**
Option 6 – Receptor No. Weighting Factor Product **PIR**	14 4 56	72 3 216	166 2 332	188 1 188 **792**	**3**

The application of the PIR methodology has been applied to all Route Corridor Options presented.

The results of the PIR rating are summarised in the following table:

Table 4.5-3 Summary of Potential Impact Rating

	PIR Weighted Score	Ranking	Route Corridor Option
Most desirable	634	1st	Option 3
	753	2nd	Option 4
	792	3rd	Option 6
	896	4th	Option 1
	954	5th	Option 5
Least desirable	1035	6th	Option 2

4.5.4 Assessment of Changes in Traffic Flow

All the off line Route Corridor Options will lead to a significant decrease in the amount of traffic on the existing N4 and as such would lead to a decrease in noise impact at the greatest number of sensitive receptors. It is shown in the traffic study that a large proportion of traffic would transfer to an offline option. This in turn would result in a reduction of traffic noise at a large number of receptors, located along the existing N4.

The Route Corridor section with the greatest potential negative impact is the Section length between Node 14 and Node 19 (which applies to Route Corridor Options 1, 2, 4, 5 & 6). This is due to its proximity to the existing N4 and passing by areas of relatively dense population. As such, it passes closest to the highest number of sensitive receptors. The fact that this section runs for the most part closely along the route of the existing N4 or close to online means it may have a narrow scope for proprietary noise mitigation measures due to a lack of space, as a function of the relatively built up areas it traverses.

This largely negates the potential for the use of cut/fill measures to provide noise attenuation. The number of receptors with direct access onto the existing N4 would also make the provision of effective noise barriers difficult, due to the gaps required for access/egress and landscape & visual concerns. As set out in Table 4.5-1, the following statements identify the number of receptors within each Route Corridor Option:

- Route Corridor Option 1 has approximately 467 properties within 300m of the route centreline. Of these, 105 properties lie within 100m of the centreline.
- Route Corridor Option 2 has approximately 576 properties within 300m of the centreline, with 116 of these properties within 100m of the centreline.
- Route Corridor Option 3 has approximately 335 properties within 300m of the corridor centreline. Of these, 75 properties are within 100m of the centreline.
- Route Corridor Option 4 has approximately 412 properties within 300m of the centreline. Of these, 78 properties are within 100m.
- Route Corridor Option 5 has approximately 533 properties within 300m, 88 of which are within 100m of the centreline.
- Route Corridor Option 6 has approximately 440 properties within 300m of the centreline, with 86 of these within 100m of the centreline.

4.5.5 Noise and Vibration Mitigation

As detailed above, the NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes indicate that specific assessment of vibration need not be assessed at Route Corridor Option Stage. However, at later stages mitigation measures for vibration may be required and as such appropriate mitigation measures are outlined below, to be assessed further at Environmental Impact Assessment Stage.

With regard to the potential for vibration impact on sensitive receptors the NRA Guidelines state that as a vehicle travels along a road, vibration can be generated in the road and subsequently propagate towards nearby buildings. Such vibration is generated by the interaction between a vehicle's wheels and the road surface and by direct transmission through the air of low frequency energy waves.

Some of these waves arise as a function of the size, shape and speed of the vehicle, and others from pressure fluctuations due to engine, exhaust and other noises generated by the vehicle. The guidelines go on to state:

"It has been found that ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. The Authority does not therefore consider it necessary to set limits for vibration during the operational phase of a road scheme."

In light of this, it is not predicted that there will be any significant vibration impact associated with the operational phase of the proposed scheme.

With regard to the potential for noise impact, the NRA guidance states that if mitigation measures are deemed necessary, the first aspect that should be considered is the alignment of the scheme. Where it is possible to amend the layout of the Route Corridor such that noise levels at affected receivers are reduced, without compromising any other locations or any other aspect of the scheme, then this approach should be adopted in preference to any of the measures discussed below.

The use of a low noise road surface is an effective and dependable mitigation measure by way of controlling road traffic noise "at source". The type (specification) and acoustic attenuation performance of any such low noise road surface would be similar in whichever scenario it were used, and as such is not a great aid at this Route Corridor selection stage of the scheme.

The most common form of mitigation is a physical noise barrier, specified for the attenuation of noise to a particular receptor or receptors. A noise barrier can take many forms, e.g. a cutting, an earthen berm, a wall or a proprietary timber noise barrier. The closer the barrier is to the source of noise (i.e. the road), the higher the reduction in traffic noise levels achieved.

Noise barriers in the form of cut/fill and to a lesser extent walls/fences, require space at the carriageway edge. In some cases, this is not achievable due to constrained space, especially in the case of on line options or off line options in an area higher receptor density. Often in this scenario, a low noise road surface may provide the best noise attenuation option for example between nodes 14 and 19 (Route Corridor Options 1, 2, 4, 5 & 6) for the reasons discussed under Section 4.5.4 of this assessment.

The NRA accepts that it may not always be sustainable to provide adequate mitigation in order to achieve the design goal of 60dBA_{Lden}. Therefore, a structured approach should be taken in order to ameliorate as far as practicable road traffic noise through

the consideration of measures such as alignment changes, barrier type (e.g. earthen berm), low noise road surfaces etc.

Mitigation measures are only deemed necessary when the following three conditions are met at designated sensitive receptors:

(a) the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of 60dBA_{Lden};

(b) the relevant noise level is at least 1dB more than the expected traffic noise level without the proposed road scheme in place;

(c) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1dB.

These conditions will ensure that mitigation measures arising out of this process are based upon the impact of the scheme under consideration.

4.5.6 Conclusions

Each of the six Route Corridor Options presented has been assessed through the use of the methodology defined in the relevant NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes. This has been completed through the use of the PIR weighting methodology outlined by the NRA, with respect to potential sensitive receptors, assessment of changes in traffic flow and consideration of Noise and Vibration mitigation measures.

This noise and vibration assessment has attempted to rank the Route Corridor Options presented in order of increasing potential noise impact. This impact has been quantified by means of the calculation of the numbers of sensitive receptors up to 300m either side of the Route Corridor centreline (i.e. total of a 600m width band), of each of the Route Corridor Options presented. Once a Preferred Route Corridor has been selected, further assessment will be undertaken on the potential impact on sensitive receptors of that Route Corridor Option, at Environmental Impact Assessment Stage.

In accordance with the NRA Guidelines, the number of properties within 300m of the proposed roadside has been identified for each Route Corridor Option, as these are

the properties most likely to experience impacts associated with traffic noise and vibration.

Based on the outcome of the PIR weighting methodology and other assessments as stated above the Route Corridors are listed in order of preference.

Table 4.5-4 Order of Preference (Traffic Noise and Vibration)

Route Corridor Option	Order of Preference	Scaling Statement
Route Corridor Option 1	4	Slightly Negative
Route Corridor Option 2	6	Slightly Negative
Route Corridor Option 3	1	Slightly Negative
Route Corridor Option 4	2	Slightly Negative
Route Corridor Option 5	5	Slightly Negative
Route Corridor Option 6	3	Slightly Negative

4.6 Cultural and Architectural Heritage

4.6.1 Introduction

This section has been prepared to assess the impact, if any, on the archaeological, architectural and cultural heritage resource of the proposed Route Corridors for the N4 Mullingar to Longford (Roosky) road improvement scheme, which extends through Counties Longford (OS Sheets 8, 9, 13, 14, 15, 18, 19 and 20) and Westmeath (OS Sheets 5, 6, 11, 12 and 19) (RFig 4.6, Volume III)

This study determines, as far as is reasonably possible from existing records, the nature of the cultural heritage resource surrounding the proposed Route Corridor Options for the N4 Mullingar to Roosky (Longford) road improvement scheme using appropriate methods of study. Desk based research is defined as an appraisal of the known or potential archaeological resource within a specified area consisting of a collation of existing written and graphic information. The appraisal takes place in order to identify the likely character, extent, quality and worth of the known or potential archaeological resource in order to make an appraisal of its merit in context.

This Route Corridor Selection Report follows on from an archaeological, architectural and cultural heritage Constraints Report submitted to Westmeath National Road Design Office (NRDO) in May 2008. The Constraints Study identified that while there are no National Monuments located within the constraints Study Area, there were 494 recorded archaeological sites listed in the Records of Monuments and Places between Co. Longford (314 sites) and Co. Westmeath (180).

In relation to the archaeological heritage of the proposed scheme, the Constraints Study outlined that it is the preferred mitigation strategy of all proposed developments to minimise the impact on the archaeological heritage by the avoidance of all known archaeological sites and their preservation *in situ.* This is in accordance with the National Monuments Legislation (1930-2004), the policies of the National Monuments Service of the Department of Environment Heritage and Local Government (DoEHLG), Longford County Council (LCC) and Westmeath County Council (WCC).

The Constraints Study identified 77 protected structures located within the Constraints Study Area, with 59 located in Co. Longford and 18 located in Co. Westmeath. These are afforded statutory protection under the *Local Government (Planning and*

Development) Act of 2000. The Constraints Study identified 78 National Inventory of Architectural Heritage (NIAH) structures located in County Westmeath within the constraints Study Area. The NIAH survey for Co. Longford was ongoing during research carried out for the Constraints Study but has since been published and is included within this Route Selection report.

The Constraints Study identified the following demesnes and estates as significant features of architectural heritage merit:

- Co. Longford: Castleforbes Demesne and Carrickglass Demesne.
- Co. Westmeath: Baronstown Demesne, Clanhugh Demesne, Newpass Demesne and Crumlin or Rockfield Demesne.

4.6.2 Methodology

The Route Corridor Selection Study involved detailed interrogation of the archaeological, historical and architectural background of the Study Area, with specific appraisal paid to a corridor of 250m either side of the centre line of the proposed Route Corridors for archaeological heritage in line with the NRA Guidelines for the assessment of Archaeological Heritage Impacts of National Roads Schemes (2005, 21). A corridor of 150m either side of the proposed route centre line was appraised with regards to built heritage, in accordance with the NRA Guidelines for the assessment of Architectural Heritage Impacts of National Roads Schemes (2005, 23). Where effects are identified that are unacceptable, these can then be avoided or reduced during the design process (Environmental Protection Agency 2003:1).

Full cognisance is given to the National Monuments Acts (1930-2004) in relation to archaeological heritage. In respect of built heritage, full recognition is given to the Local Government (Planning and Development) Act 2000 and the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act see Appendix 5.

Guideline and policy documents were also referenced in regards to best archaeological practice. These included:

- Department of Arts, Heritage, Gaeltacht and the Islands 1999 publication "*Framework and Principles for the Protection of the Archaeological Heritage*"

- The Environmental Protection Agency's (EPA) 2003 publications.-*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* and *Guidelines on the Information to be Contained in Environmental Impact Statements*.
- NRA *Guidelines for the Assessment of Archaeological & Architectural Heritage Impacts of National Road Schemes*, 2005

Paper Survey

The first phase of the appraisal involves a desk study. The following sources were examined and lists of areas of archaeological, architectural and cultural heritage potential were compiled:

i. Record of Monuments and Places of Counties Longford and Westmeath;
ii. Sites and Monuments Record for Counties Longford and Westmeath;
iii. Preservations Orders;
iv. Monuments in State Care Database;
v. Register of Historic Monuments;
vi. Database of current archaeological investigation licences (DoEHLG);
vii. Topographical files of the Irish Antiquities Division, National Museum of Ireland;
viii. Longford County Development Plan 2009-2015;
ix. Westmeath County Development Plan 2008-2014;
x. Ortho rectified aerial photography supplied by HyderTobin Consulting Engineers Ltd;
xi. Aerial Photography held by Geological Survey of Ireland, 1973-77, 1:30,000;
xii. Cartographic and documentary records;
xiii. National Inventory of Architectural Heritage Longford;
xiv. National Inventory of Architectural Heritage Westmeath;
xv. Excavations Bulletin, 1970-2005;
xvi. Irish Battlefields Project;
xvii. N4 Mullingar to Roosky (Longford) Road Improvement Scheme Constraints Study

Record of Monuments and Places is a list of archaeological sites known to the National Monuments Service, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Section as 'unlocated sites' and cannot be afforded legal protection due to lack of locational information. As a result these are omitted from the Record of Monuments and Places. SMR sites are also listed on the recently launched website created by the DoEHLG – www.archaeology.ie.

Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. There are no sites within the proposed Route Corridors which are subject to the protection of preservation orders or temporary preservation orders.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument. There are no National Monuments located within the proposed Route Corridors.

Register of Historic Monuments was established under Section 5 of the 1987 National Monuments Act, which requires the Minister to establish and maintain such a record. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places. There are 16 sites within the proposed Route Corridors featured on the Register of Historic Monuments: AH 40, AH 90, AH 95, AH 109, AH 112, AH 113, AH 114, AH 115, AH 116, AH 120, AH 121, AH 122, AH 129, AH 152, AH 155 and AH 163. The details for these sites are listed in Appendix 7, Volume II.

Database of current archaeological investigation licences is a list held by the National Monument Section of the DoEHLG that provides details of licences issued that have yet to appear within the Excavations Bulletin (2006-2009).

Topographical files of the National Museum of Ireland is the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance. Topographical files from within the proposed Route Corridors are listed in Appendix 6.

Westmeath County Development Plan (2008-2014) & Longford County Development Plan (2009-2015) contain a catalogue of all the protected structures and archaeological sites within the two counties. These were consulted to obtain information on cultural heritage sites within the Study Area.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. As part of the appraisal, aerial photographs were examined that are held by the Geological Survey of Ireland, which date to the 1970s, along with the scheme aerial photography and photographs available on www.archaeology.ie.

Cartographic sources are important in tracing land use development within the development area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape. The following Ordnance Survey 6" maps of Co. Longford (1837, 1862, 1914) and Westmeath (1838, 1877 and 1910.) were consulted as part of this study.

Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape of the proposed

development area. The bibliography that accompanies this section, Appendix 12 lists those texts used during this appraisal.

National Inventory of Architectural Heritage (NIAH) Longford and Westmeath The NIAH database was reviewed. The inventory is an evaluated record of a representative sample of the architectural heritage within a county, concentrating on the post-medieval period. The architectural heritage merit of each structure is classified according to the following categories as outlined in the *Local Government (Planning and Development) Act 2000*; Architectural, Archaeological, Technical, Historical, Artistic, Scientific, Cultural and Social. The inventory provides the following ratings for each structure; Local, Regional, National and International. Any structure given a regional rating or above is recommended for inclusion in the Record of Protected Structures (RPS) for respective County Councils.

Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland between 1970 and 2005 and since 1987 has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the Sites and Monuments Records (SMR's) and Recorded Monuments and Places (RMP) files. This information is also available online (www.excavations.ie) from 1970-2004.

The Irish Battlefields Project is a state funded project which seeks to research key battlefield sites in Irish history in terms of their location, extent and historical and archaeological backgrounds. The project operates to very strict criteria; including the fact that battles must have involved at least 1000 combatants and have had significant regional or national significance. The eventual aim of the project would be to assist in identifying the appropriate statutory protection under the National Monuments Legislation (1930–2004) that should be extended to battlefield sites within the ongoing consolidation and modernisation of this legislative code.

Windshield Surveys/Site Specific Inspections The second phase of the appraisal involved a windshield survey of the Study Area in an attempt to assess the current state of any recorded archaeological and built heritage sites that were accessible from

the existing road network and within the immediate vicinity of the proposed route options. Summarised accounts of the archaeological site specific inspections, supplementary to the SMR file site inspections are contained in Appendix 7, Volume II.

Definitions

For the purposes of this report a number of definitions will be applied to the sites that are identified within the vicinity of the Route Corridor Options.

Archaeological Heritage (AH) will refer to recorded archaeological sites listed within the SMR / RMP, which are subject to protection under the National Monuments Legislation (1930-2004).

All measurements in respect of recorded archaeological monuments located within any Route Corridor are taken from the edge of a 40m wide road landtake (based on the centreline shown in RFig 4.6.1 - RFig 4.6.8, Volume III) to the RMP archaeological constraint area of monument. However, if any proposed route should impact on an RMP archaeological constraint area, the measurement is made from the edge of the road to the upstanding remains where extant. In respect of any proposed route impacting upon an RMP constraint area where no above ground remains exist, the measurement will be made to the centre of the archaeological constraint area.

Built Heritage (BH) will be applied to sites of an architectural nature, such as Protected Structures and structures listed on the National Inventory of Architectural Heritage (NIAH) for County Westmeath and County Longford.

All measurements in respect of built heritage sites located within a Route Corridor are taken from the edge of 40m wide road landtake (based on the centreline shown in RFig 4.6.1 - RFig 4.6.8, Volume III) to the structure itself.

Area of Archaeological Potential (AAP) will be applied to areas such as river crossings, which are recognised as possessing archaeological potential and other potential archaeological sites that have been identified through aerial photographic analysis.

All measurements in respect of areas of archaeological potential located within a Route Corridor are taken from the edge of a 40m wide road landtake (based on the centreline shown RFig 4.6.1 - RFig 4.6.8, Volume III) to the edge of the AAP as has been designated within this report.

In order to assess, distil and present the findings of this study, the following definitions apply:

'Cultural Heritage' where used generically, is an over-arching term applied to describe any combination of archaeological, architectural and cultural heritage features, where:

- the term ***'archaeological heritage'*** is applied to objects, monuments, buildings or landscapes of an (assumed) age typically older than 1700AD (and recorded as archaeological sites within the Record of Monuments and Places)
- the term ***'built heritage'*** is applied to structures, buildings, their contents and settings of an (assumed) age typically younger than 1700AD
- the term ***'cultural heritage'***, where used specifically, is applied to other (often less tangible) aspects of the landscape such as historical events, folklore memories and cultural associations. This designation can also accompany an archaeological or architectural designation (NRA Guidelines 2005).

Determination of Impacts

An impact appraisal has been prepared along with a detailed Route Corridor appriasal based on potential impacts. The impact appraisal is undertaken to outline potential adverse impacts that the proposed development may have on the cultural heritage resource.

Impacts are generally categorised as either:

- Direct Impact – where an archaeological/built heritage feature or site is physically located within the footprint of a potential Route Corridor and entails the removal of part, or all of the monument or feature.
- Indirect Impact – where a feature or site of archaeological/built heritage merit or its setting is located outside of the footprint of the potential Route Corridor.

The level of impact on archaeological sites in accordance with the NRA guidelines can be:

- Imperceptible Impact - An impact capable of measurement but without noticeable consequences
- Slight Impact - An impact which causes changes to the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument..
- Moderate Impact - A moderate direct impact arises where a change to the site is proposed, which although noticeable, is not such that the archaeological integrity of the site is compromised and which is reversible. This arises where an archaeological feature can be incorporated into modern day development without damage and that all procedures used to facilitate this are reversible.
- Significant Impact - An impact which, by its magnitude, duration or intensity, alters an important aspect of the environment. An impact like this would be where part of a site would be permanently impacted upon, leading to a loss of character, integrity and data about the archaeological feature/site.
- Profound Impact - Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise when an archaeological site is completely and irreversibly destroyed by a proposed development.

The level of impact on built heritage sites in accordance with the NRA guidelines can be:

- Imperceptible Impact - An impact on built heritage of local importance that is capable of measurement but without noticeable consequences.
- Slight Impact - An impact that causes some minor changes to the character of architectural heritage of local or regional importance without affecting its integrity or sensitivities. Although noticeable, the effects do not directly impact on the architectural structure or feature. Impacts are reversible and of relatively short duration. Appropriate mitigation will reduce the impact.
- Moderate Impact - An impact that results in a change to the architectural heritage which, although noticeable, is not such that it alters the integrity of the heritage. The change is likely to be consistent with existing and emerging trends. Impacts are probably reversible and may be of a relatively short duration. Appropriate mitigation is very likely to reduce the impact.

- Significant Impact - An impact that, by its magnitude, duration or intensity alters the character and/or setting of the architectural heritage. These effects arise where an aspect or aspects of the architectural heritage is/are permanently impacted upon leading to a loss of character and integrity in the architectural structure or feature. Appropriate mitigation is unlikely to reduce the impact.
- Profound Impact - An impact that obliterates the architectural heritage of a structure or feature of national or international importance. These effects arise where an architectural structure or feature is completely and irreversibly destroyed by the proposed development. Mitigation is unlikely to remove adverse impacts.

Definitions as outlined in the National Road Authority's *Guidelines for the Assessment of Archaeological Heritage and Architectural Heritage Impacts of National Road Schemes (2005).*

The cultural heritage sites that have been identified within the Route Corridor Options have been assigned a potential impact. The impact type per Route Corridor has then been calculated i.e. 3 Profound, 5 Significant, 10 Moderate and so on. Those Route Corridor Options with Profound and Significant impacts are considered to be the least preferable as these are Direct impacts that result in the removal of all or part of a cultural heritage site. Therefore, the Route Corridor Options have been ranked according to the amount and severity of the potential impacts that have been identified. The Route Corridor with the fewest Direct impacts is ranked as being the most desirable option.

4.6.3 Existing Environment

Archaeological and Historical Background

The Study Area is a particularly rich archaeological landscape attested to by the large number of recorded archaeological sites identified within the proposed Route Corridor Options as detailed in the archaeological and historical background for the Scheme provided in Appendix 9, Volume II. There were 161 recorded archaeological heritage (AH sites) identified within the proposed Route Corridor Options during the paper survey. Of the 161 recorded sites within the Study Area, 86 sites are located in Co. Longford and 75 sites in Co. Westmeath. Those sites listed in Appendix 7, Volume II and all cultural heritage constraints are featured on RFig 4.6.1 to RFig 4.6.8. A detailed narrative route appraisal of the archaeological heritage located within the proposed Route Corridor Options is provided in Appendix 11, Volume II.

Built Heritage Background

There are 25 Built Heritage structures located within the proposed Route Corridor Options. These relate to six protected structures listed on the respective Longford and Westmeath RPS inventories located within proposed Route Corridor Options. Of these five are located in Co. Longford (BH 4, BH 5, BH 6, BH 7 and BH 8). One protected structure (BH 23) is located in Co. Westmeath. These structures are afforded statutory protection under the *Local Government (Planning and Development) Act of 2000*.

There are 18 NIAH structures located within the proposed Route Corridor Options of the Scheme. Six of these were identified in Co. Westmeath (BH 19, BH 20, BH 21, BH 22, BH 23 and BH 24) with BH 23 being dually listed on both NIAH and the Westmeath Record of Protected Structures. Twelve structures were identified in the Longford NIAH (BH 1, BH 4-8, BH 14-18 and BH 25). A total of five of these sites (BH 4-BH 8) were dually listed in the Longford Record of Protected Structures. All of the NIAH structures have been afforded a regional rating by the National Inventory of Architectural Heritage. Structures given this rating are recommended for inclusion on the respective county Record of Protected Structures.

Appendix 9 provides a detailed built heritage background of the Scheme based upon built heritage structures and features located within proposed Route Corridor Options. Appendix 10 provides a full inventory of all built heritage sites detailed in this report. All BH sites recorded within the proposed Route Corridors are shown in RFig 4.6.1 – Rfig 4.6.8. Detailed Architectural Route Appraisals for the proposed six Route Corridors are included in Appendix 11.

4.6.4 Archaeological and Cultural Heritage Route Corridor Appraisal

Route Corridor Option 1

Table 4.6-1 Route Corridor Option 1: Archaeological Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 1/ LF008-005	Lissagernal 209590/282100	Enclosure Site	6m SW	Indirect	Moderate
AH 2/ LF008-007	Deerpark/ 210820/28098	Ringfort	237m SW	Indirect	Imperceptible
AH 4/ LF008-016	Carrickmoyragh 211230/280680	Ringfort	107m SW	Indirect	Slight
AH 5/ LF008-019	212130/279590/ Lismoy	Ringfort	18m SW	Indirect	Slight
AH 6/ LF008-020	Lamagh/ 212350/27924	Ringfort	45m WSW from centre of constraint	Indirect	Moderate
AH 8 / LF013-014	Clooncoose 214460/277440	Ringfort	114m SW	Indirect	Slight
AH 10 / LF014-001	Clooncoose 215240/277209	Castle site	166m ENE	Indirect	Slight
AH 12/ LF014-005	Lisnamuck 215380/276210	Ringfort	176m SW	Indirect	Imperceptible
AH 13/ LF014-003	Clooncoose 215740/27660	Ringfort	155m NNE	Indirect	Slight
AH 14/ LF014-004	Clooncoose 215880/276390	Ringfort	47m NNE	Indirect	Slight
AH 15/ LF014-006	Ballymacwilliam 216360/276240	Ringfort	173m NE	Indirect	Imperceptible
AH 18/ LF014-021	Whiterock 216100/275660	Ringfort	238m SW	Indirect	Imperceptible
AH 20/ LF014-023	Ballymacwilliam 216710/275850	Ringfort	118m NE	Indirect	Slight
AH 21/ LF014-024	Ballymacwilliam 216810/275740	Ringfort	130m NE	Indirect	Slight
AH 22/ LF014-025	Ballymacwilliam 216900/275630	Ringfort	125m NE	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 25/ LF014-029	Whiterock/ Cooleeny	Enclosure Site	232m SW	Indirect	Imperceptible
AH 26/ LF014-036	Whiterock 216940/275000	Ringfort	25m S	Indirect	Slight
AH 29/ LF014-037	Cartron Little 217450/274940	Ringfort	50m NE	Indirect	Slight
AH 35 /LF014-071	Lissardowlan 218690/273940	Deserted Medieval Settlement	318m S	Indirect	Imperceptible
AH 41/ LF014-075	Corboy 220000/274220	Ringfort	181m NE	Indirect	Imperceptible
AH 44/ LF014-076	Corboy 220040/273970	Moated Site Possible	67m NE to centre of constraint	Indirect	Moderate
AH 48/ LF014-080	Corboy 220650/273450	Ringfort	63m NE to centre of constraint	Indirect	Moderate
AH 50/ LF014-082	Corboy 221050/273280	Ringfort	15m S	Indirect	Moderate
AH 53/ LF014-083	Ballynagoshen 221330/273050	Enclosure Site	175m S	Indirect	Imperceptible
AH 56 LF014-086	Ballynagoshen 221890/273270	Ringfort	17m from upstanding remains	Indirect	Moderate
AH 58/ LF014-107	Lackan 223250/272400	Ringfort	81m NE	Indirect	Slight
AH 63/ LF015-060	Ballindagny & Cullyvore 224530/271390	Ringfort	19m NE	Indirect	Moderate
AH 64 LF015-061	Abbey Land 224900/271350	Holy Well	218m NE	Indirect	Imperceptible
AH 65 LF015-062	Abbey Land 224990/271350	Abbey	264m NE	Indirect	Imperceptible
AH 67 LF020-002	Shantum 225130/270690	Possible Barrow	10m SW	Indirect	Moderate
AH 68 LF020-003	Shantum 225290/270580	Rectangular Enclosure	7m SW	Indirect	Moderate
AH 69/ LF020-008	Liscahill 226130/270260	Ringfort	18m SW of upstanding remains	Indirect	Moderate

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 70 LF020-005	Garryandrew 226660/270540	Possible Barrow	221m N	Indirect	Imperceptible
AH 71/ LF020-010	Garryandrew 226800/270460	Ringfort	139m N	Indirect	Slight
AH 73/ LF020-014	Kilsallagh 228480/270060	Enclosure Site	168m NE	Indirect	Imperceptible
AH 75/ LF020-015	Kilsallagh 228570/270000	Enclosure Site	147m NE	Indirect	Slight
AH 76/ LF020-016	Kilsallagh 228580/269850	Ringfort	15m NE	Indirect	Moderate
AH 77/ LF020-027	Kilsallagh 229540/269320	Enclosure	70m NE to upstanding remains	Indirect	Moderate
AH 82/ WM006-006	Loughanstown Lower/ 230680/268980	Ringfort	182m NE	Indirect	Imperceptible
AH 86/ WM006-012	Windtown/ 230700/268020	Ringfort	156m SW	Indirect	Imperceptible
AH 87/ WM006-017	Ballygarran 231110/267480	Ringfort	0m	Direct	Significant
AH 88/ WM006-018	Ballygarran 231250/267340	Ringfort	15m	Indirect	Moderate
AH 89/ WM006-016	Rathowen 230980/267040	Well	223m W	Indirect	Imperceptible
AH 91/ WM006-046	Joanstown 233090/262220	Castle Site	190m SW	Indirect	Imperceptible
AH 95/ WM006-050	Joanstown 234347/264392	Ringfort	42m SW	Indirect	Slight
AH 97/ WM011-008	Ballinalack 235040/263660	Earthwork	73m SW	Indirect	Slight
AH 98/ WM011-009	Ballinalack 235180/263510	Earthwork	108m SW	Indirect	Slight
AH 99/ WM011-011	Cullenhugh 235830/263450	Earthwork Site	58m NE to centre of constraint	Indirect	Moderate
AH 101/ WM011-018	Ballyvade 236650/262390	Ringfort	189m SW	Indirect	Imperceptible
AH 102/ WM011-	Rathaniska	Ringfort	198m SW	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
019	236860/262200				
AH 103/ WM011-020	Rathbennett 237160/262210	Earthwork	3m SW	Indirect	Moderate
AH 104/ WM011-028	Leny 237480/262400	Church	198m NE	Indirect	Imperceptible
AH 105/ WM011-027	Leny 237400/262500	Standing Stone	248m NE	Indirect	Imperceptible
AH 108/ WM011-058	Kilpatrick 237730/261780	Earthwork	108m SSW	Indirect	Slight
AH 109/ WM011-057	Kilpatrick 237810/261930	Ringfort	0m	Direct	Significant
AH 111/ WM011-062	Kilpatrick 237990/261670	Earthwork Site	83m S	Indirect	Slight
AH 112/ WM011-063	Kilpatrick 238080/261840	Ringfort	0m	Direct	Significant
AH 113/ WM011-066	Kilpatrick 238680/261600	Ringfort	77m SSW	Indirect	Slight
AH 114/ WM011-068	Kilpatrick 238830/261460	Ringfort	172m SSW	Indirect	Imperceptible
AH 115/ WM011-067	Kilpatrick 238870/261660	Ringfort	0m	Direct	Significant
AH 116/ WM011-073	Kilpatrick 239080/261280	Ringfort	198m SSW	Indirect	Imperceptible
AH 117/ WM011-034	Rathganny, Ballindurrow, Heathland, Culleendarragh 239730/263270	Linear Earthwork	0m	Direct	Significant
AH 119/ WM011-071	Ballynafid 240270/261380	Ringfort	217m N	Indirect	Imperceptible
AH 127/ WM012-089	Portnashangan 241530/260210	Ringfort	0m	Direct	Slight (excavated Ref.: 93E0139)
AH 128/ WM012-088	Portnashangan 241470/260300	Ringfort	0m	Direct	Slight (excavated Ref.: 93E0139)
AH 129/ WM012-092	Knightswood 241770/260500	Ringfort	280m E	Indirect	Imperceptible
AH 132	Portnashangan	Ringfort	6m from	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
/WM012-090	241550/259970		upstanding remains (to landtake that is an existing road)		
AH 133/ WM012-091	Portnashangan	Ringfort	88m E	Indirect	Slight
AH 146/ WM012-164	Portnashangan 242070/258830	Ringfort	28m E to upstanding remains	Indirect	Moderate
AH 148/ WM012-165	Culleen More 229540/269320	Ringfort	23m W to upstanding remains	Indirect	Moderate
AH 153/ WM012-168	Culleen More 242720/257430	Ringfort	13m NE	Indirect	Moderate
AH 154/ WM019-013	Cullen More 243110/256560	Barrow	27m NE	Indirect	Slight
AH 162/ WM011-065	Kilpatrick 238460/262013	Ringfort	106m N	Indirect	Slight
AH 163/ WM011-064	Kilpatrick 238444/262207	Ringfort	299m N	Indirect	Imperceptible
AAP 1	Edercloon/ Cloonart North 2207241/284596	Boggy land / close proximity to area of known archaeology	0m	Direct	Potentially Significant
AAP 2	Cloonart South/ Annaghcooleen 208402/283198	River Rinn Crossing	0m	Direct	Potentially Significant
AAP 3	Clooniher 208868/272731	Bogland	0m	Direct	Potentially Significant
AAP 4	Faghey/ Knockmartin/ Clloonrallagh 212643/279067	Stream crossing	0m	Direct	Potentially significant
AAP 11	Cloonbalt 214240/278038	Stream Crossing	0m	Direct	Potentially Significant
AAP 12	Clooncoose 214534/277685	River Camlin Crossing	0m	Direct	Potentially Significant
AAP 16	Lisnamuck/ Clooncoose 215382/276518	Stream Crossing	0m	Direct	Potentially Significant
AAP 19	Ballymacwilliam 219370/275975	Stream Crossing	0m	Direct	Potentially Significant
AAP 20	Whiterock/	Stream	0m	Direct	Potentially

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
	Ballymacwilliam 216583/275632	Crossing			Significant
AAP 26	Cloonahussey 219481/274302	Stream Crossing	0m	Direct	Potentially Significant
AAP 39	Shantum 225674/270505	Boggy land	0m	Direct	Potentially significant
AAP 40	Garryandrew 226544/270245	Stream Crossing	0m	Direct	Potentially significant
AAP 43	Kilsallagh 220650/269749	Boggy land	0m	Direct	Potentially significant
AAP 50	Rathowen 321694/266559	Stream Crossing	0m	Direct	Potentially significant
AAP 51	Rathowen 232201/266159	Stream Crossing	0m	Direct	Potentially significant
AAP 56	Joanstown 234091/264883	Boggy Land	0m	Direct	Potentially significant
AAP 58	Joanstown/ Ballinalack 234749/264139	River Inny Crossing	0m	Direct	Potentially significant
AAP 60	Glebe 234948/263969	Stream Crossing	0m	Direct	Potentially significant
AAP 66	Ballinalack 235887/263372	Stream Crossing	0m	Direct	Potentially significant
AAP 67	Ballyvade 236481/262969	Boggy Land	0m	Direct	Potentially significant
AAP 70	Ballynafid 241278/260650	Proximity to Ballynafid Lake	0m	Direct	Potentially Significant
AAP 75	Portnashangan/ Culleen More 242358/257907	Proximity to Lough Owel	0m	Direct	Potentially significant
AAP 77	Cartron Little/ Agharickard/ Toorfin 218615/274584	Proximity to Lissardowlan (AH 35)	0m	Direct	Potentially Significant

Conclusion

Route Corridor Option 1 contains 74 recorded archaeological sites with ringforts (47 recorded examples) being the most numerous monument type occurring. Route Corridor Option 1 would have a Direct Impact on seven recorded archaeological sites (AH 87, AH 109, AH 112, AH 115, AH 117, AH 127, AH 128). However, two of these sites (AH 127 and 128) have already been subject to archaeological excavation and as such the impact can be considered as Slight. Consultation of the topographical files of the National Museum of Ireland has identified 16 stray finds along the proposed Route Corridor Option 1 between Counties Longford and Westmeath. These were

overwhelmingly found in wetland contexts (Appendix 6). Consultation of aerial and photographic sources has identified 23 areas of archaeological potential (AAP's). This Route Corridor Option would have a Direct Impact on these sites.

Previous archaeological investigations at Edercloon Co. Longford identified previously unknown, unrecorded archaeological remains. The trackway complex at Edercloon Moore 2005, Ministerial Direction Ref.: A031-025 Licence Ref.: 05E0983) identified a wooden trackway complex which is believed to extend beyond the limit of excavation as indicated on RFig 4.6.1 as AAP 1. The proposed Route Corridor Option would have a Direct Impact on AAP 1. However, it may be possible to design around the specific area where the trackway was discovered by keeping within the existing fence line of the extant roadway.

Route Corridor Option 2

Table 4.6-2 Route Corridor Option 2: Archaeological Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 1/ LF008-005	Lissagernal 209590/282100	Enclosure Site	82m S	Indirect	Slight
AH 3/ LF008-008	Carrickmoyragh 211860/280970	Ringfort	5m SW	Indirect	Moderate
AH 8 / LF013-014	Clooncoose 214460/277440	Ringfort	55m ENE	Indirect	Slight
AH 9/ LF013-015	Lisnamuck 214320/276730	Ringfort	118m SW	Indirect	Slight
AH 11/ LF014-018	Templemichael Glebe 214840/27603	Enclosure	34m SW	Indirect	Slight
AH 16/ LF014-019	Ardnacassagh/ Ferskill 215310/275350	Ringfort	7m W of upstanding remains	Indirect	Moderate
AH 19/ LF014-027	Coolnahinch 215560/275080	Ringfort	25m NE	Indirect	Moderate
AH 23/ LF014-028	Kilnasavogue 216140/274800	Ringfort	148m NE	Indirect	Slight
AH 27/ LF014-060	Cooleeny 216530/274180	Ringfort	31m SW centre of constraint	Indirect	Moderate
AH 28/ LF014-067	Cooleeny 216950/274320	Enclosure Site	113m NNE	Indirect	Slight
AH 31/ LF014-068	Cooleeny 217640/274200	Ringfort	187m N	Indirect	Imperceptible
AH 32/ LF014-069	Cooleeny 217610/273720	Barrow	113m S	Indirect	Slight
AH 33/ LF014-070	Cooleeny 217690/273670	Ringfort	118m S	Indirect	Slight
AH 34/ LF014-072	Freehalman 217990/273460	Ringfort	156m SW	Indirect	Imperceptible
AH 35/ LF014-071	Lissardowlan 218690/273940	Deserted Medieval Settlement	149m NNE	Indirect	Slight
AH 39/	Cloonahard	Ringfort (01)	44m N	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
LF014-074	219169/273329	Souterrain (02)			
AH 40/ LF014-073	Cloonahard 219150/273600	Ringfort	240m N	Indirect	Imperceptible
AH 43/ LF014-079	Lisfarrell 220710/271986	Enclosure	128m NE	Indirect	Slight
AH 47/ LF014-081	Lisfarrell 220350/273040	Ringfort	15m SW	Indirect	Moderate
AH 58/ LF14-107	Lackan 223250/272400	Ringfort	173m NE	Indirect	Imperceptible
AH 63/ LF015-060	Ballindagny & Cullyvore 224530/271390	Ringfort	22m NE	Indirect	Moderate
AH 64 LF015-061	Abbey Land 224900/271350	Holy Well	206m NE	Indirect	Imperceptible
AH 65 LF015-062	Abbey Land 224990/271350	Abbey	56m W (link rd)	Indirect	Slight
AH 67 LF020-002	Shantum 225130/270690	Possible Barrow	14m SW	Indirect	Moderate
AH 68 LF020-003	Shantum 225290/270580	Rectangular Enclosure	10m SW	Indirect	Moderate
AH 69/ LF020-008	Liscahill 226130/270260	Ringfort	33m SW of upstanding remains	Indirect	Moderate
AH 70 LF020-005	Garryandrew 226660/270540	Possible Barrow	214m N	Indirect	Imperceptible
AH 71/ LF020-010	Garryandrew 226800/270460	Ringfort	138m N	Indirect	Slight
AH 73/ LF020-014	Kilsallagh 228480/270060	Enclosure Site	174m NE	Indirect	Imperceptible
AH 75/ LF020-015	Kilsallagh 228570/270000	Enclosure Site	152m NE	Indirect	Imperceptible
AH 76/ LF020-016	Kilsallagh 228580/269850	Ringfort	17m NE	Indirect	Moderate
AH 77/ LF020-027	Kilsallagh 229540/269320	Enclosure	3m NE	Indirect	Moderate
AH 82/	Loughanstown	Ringfort	179m NE	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
WM006-006	Lower/ 230680/268980				
AH 86/ WM006-012	Windtown/ 230700/268020	Ringfort	164m SW	Indirect	Imperceptible
AH 87/ WM006-017	Ballygarran 231110/267480	Ringfort	0m	Direct	Significant
AH 88/ WM006-018	Ballygarran 231250/267340	Ringfort	9m to upstanding remains	Indirect	Moderate
AH 89/ WM006-016	Rathowen 230980/267040	Well	226m W	Indirect	Imperceptible
AH 91/ WM006-046	Joanstown 233090/262220	Castle Site	187m SW	Indirect	Imperceptible
AH 95/ WM006-050	Joanstown 234347/264392	Ringfort	37m SW	Indirect	Slight
AH 97/ WM011-008	Ballinalack 235040/263660	Earthwork	77m SW	Indirect	Slight
AH 98/ WM011-009	Ballinalack 235180/263510	Earthwork	117m SW	Indirect	Slight
AH 99/ WM011-011	Cullenhugh 235830/263450	Earthwork Site	43m NE to centre of constraint	Indirect	Moderate
AH 101/ WM011-018	Ballyvade 236650/262390	Ringfort	201m SW	Indirect	Imperceptible
AH 102/ WM011-019	Rathaniska 236860/262200	Ringfort	202m SW	Indirect	Imperceptible
AH 103/ WM011-020	Rathbennett 237160/262210	Earthwork	55m SW to centre of constraint	Indirect	Moderate
AH 104/ WM011-028	Leny 237480/262400	Church	203m NE	Indirect	Imperceptible
AH 105/ WM011-027	Leny 237400/262500	Standing Stone	260m NE	Indirect	Imperceptible
AH 108/ WM011-058	Kilpatrick 237730/261780	Earthwork	114m SSW	Indirect	Slight
AH 109/ WM011-057	Kilpatrick 237810/261930	Ringfort	0m	Direct	Profound
AH 111/ WM011-	Kilpatrick	Earthwork	84m S	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
062	237990/261670	Site			
AH 112/ WM011-063	Kilpatrick 238080/261840	Ringfort	0m	Direct	Significant
AH 113/ WM011-066	Kilpatrick 238680/261600	Ringfort	70m SSW	Indirect	Slight
AH 114/ WM011-068	Kilpatrick 238830/261460	Ringfort	181m SW	Indirect	Imperceptible
AH 115/ WM011-067	Kilpatrick 238870/261660	Ringfort	0m	Direct	Significant
AH 116/ WM011-073	Kilpatrick 239080/261280	Ringfort	213m SSW	Indirect	Imperceptible
AH 117/ WM011-034	Rathganny, Ballindurrow, Heathland, Culleendarragh 239730/263270	Linear Earthwork	0m	Direct	Significant
AH 119/ WM011-071	Ballynafid 240270/261380	Ringfort	257m NE	Indirect	Imperceptible
AH 120/ WM012-084	Ballynafid 240650/260160	Ringfort	24m SW	Indirect	Moderate
AH 121/ WM012-085	Ballynafid 240560/259990	Ringfort	183m SW	Indirect	Imperceptible
AH 124/ WM012-098	Portnashangan 240750/259780	Ringfort	136m SW	Indirect	Slight
AH 125/ WM012-086	Portnashangan 240850/259830	Abbey	28m SW	Indirect	Moderate
AH 126/ WM012-087	Portnashangan 240950/259850	Earthwork	0m	Direct	Profound
AH 130/ WM012-099	Portnashangan 240920/259550	Ringfort	121m SW	Indirect	Slight
AH 131/ WM012-100	Portnashangan 241190/259670	Ringfort	8m NE	Indirect	Moderate
AH 140/ WM012-101	Portnashangan 241270/259370	Ringfort	15m SW	Indirect	Moderate
AH 141/ WM012-102	Portnashangan 241470/259160	Earthwork	63m SW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 146/ WM012-164	Portnashangan 242070/258830	Ringfort	34m E to upstanding remains	Indirect	Moderate
AH 148/ WM012-165	Culleen More 229540/269320	Ringfort	8m W to upstanding remains	Indirect	Moderate
AH 153/ WM012-168	Culleen More 242720/257430	Ringfort	35m NE	Indirect	Slight
AH 154/ WM019-013	Cullen More 243110/256560	Barrow	33m NE	Indirect	Slight
AH 162/ WM011-065	Kilpatrick 238460/262013	Ringfort	107m N	Indirect	Slight
AH 163/ WM011-064	Kilpatrick 238444/262207	Ringfort	310m N	Indirect	Imperceptible
AAP 1	Edercloon/ Cloonart North 2207241/284596	Boggy land / close proximity to area of known archaeology	0m	Direct	Potentially Significant
AAP 2	Cloonart South/ Annaghcooleen 208402/283198	River Rinn Crossing	0m	Direct	Potentially Significant
AAP 3	Clooniher 208868/272731	Bogland	0m	Direct	Potentially Significant
AAP 5	Carrickmoyragh 212042/280904	Stream Crossing	0m	Direct	Potentially significant
AAP 10	Cloonbalt 214093/278066	Stream Crossing	0m	Direct	Potentially Significant
AAP 13	Cloonbalt 214228/277682	Stream Crossing	0m	Direct	Potentially Significant
AAP 14	Cloonbalt 214297/277453	River Camlin Crossing	0m	Direct	Potentially Significant
AAP 15	Clooncoose 214593/276811	Stream Crossing	0m	Direct	Potentially Significant
AAP 25	Cooleeny/ Freehalman 218173/273600	Stream Crossing	0m	Direct	Potentially Significant
AAP 27	Ballygarve	Stream Crossing	0m	Direct	Potentially Significant
AAP 29	Lisfarrell 220404/272895	Stream Crossing	0m	Direct	Potentially Significant
AAP 30	Lisfarrell 220771/272783	Stream Crossing	0m	Direct	Potentially Significant
AAP 39	Shantum 225674/270505	Boggy land	0m	Direct	Potentially significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 40	Garryandrew 226544/270245	Stream Crossing	0m	Direct	Potentially significant
AAP 43	Kilsallagh 220650/269749	Boggy land	0m	Direct	Potentially significant
AAP 50	Rathowen 321694/266559	Stream Crossing	0m	Direct	Potentially significant
AAP 51	Rathowen 232201/266159	Stream Crossing	0m	Direct	Potentially significant
AAP 56	Joanstown 234091/264883	Boggy Land	0m	Direct	Potentially significant
AAP 58	Joanstown/ Ballinalack 234749/264139	River Inny Crossing	0m	Direct	Potentially significant
AAP 60	Glebe 234948/263969	Stream Crossing	0m	Direct	Potentially significant
AAP 66	Ballinalack 235887/263372	Stream Crossing	0m	Direct	Potentially significant
AAP 67	Ballyvade 236481/262969	Boggy Land	0m	Direct	Potentially significant
AAP 69	Portnashangan 240783/260143	Proximity to Lough Owel	0m	Direct	Potentially significant
AAP 75	Portnashangan/ Culleen More 242358/257907	Proximity to Lough Owel	0m	Direct	Potentially significant
AAP 78	Cartron Little/ Cooleeny/ Lissardowlan 217812/274235	Proximity to Lissardowlan (AH 35)	0m	Direct	Potentially Significant

Conclusion

Route Corridor Option 2 contains 71 recorded archaeological sites with ringforts (43 recorded examples) being the most numerous monument type occurring. This Route Corridor would have a Direct Impact on six recorded archaeological sites (AH 87, AH 109, AH 112, AH 115, AH 117 and AH 126). Consultation of the topographical files of the National Museum of Ireland has identified 17 stray finds along Route Corridor Option 2 between Counties Longford and Westmeath. These were overwhelmingly found in wetland contexts (Appendix 6). Consultation of aerial and photographic sources has identified 24 areas of archaeological potential (AAP's). The proposed Route Corridor would have a Direct Impact on these sites.

Previous archaeological investigations at Edercloon Co. Longford identified previously unknown, unrecorded archaeological remains. The trackway complex at Edercloon

Moore 2005, Ministerial Direction Ref.: A031-025 Licence Ref.: 05E0983) identified a wooden trackway complex which is believed to extend beyond the limit of excavation as indicated on RFig 4.6.1 as AAP 1. This Route Corridor Option would have a Direct Impact on AAP 1. However, it may be possible to design around the specific area where the trackway was discovered by keeping within the existing fence line of the extant roadway.

The investigations in Lisnamuck to the north of Longford town (Read 2003, Licence Ref.: 03E1194; 03E1369; Bulletin number 2003:1208 and Ó Maoldúin 2003, Licence Ref.: 03E1421, Bulletin number 2003:1209) identified previously unknown, unrecorded archaeology comprising a charcoal spread, a subcircular pit, and a burnt mound/*fulacht fiadh* with associated stake and postholes and three additional burnt mounds. The investigations took place c.100m southeast of a recorded archaeological monument LF014:005 (AH 12).

Route Corridor Option 3

Table 4.6-3 Route Corridor Option 3: Archaeological Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 1/ LF008-005	Lissagernal 209590/282100	Enclosure Site	68m S	Indirect	Slight
AH 3/ LF008-008	Carrickmoyragh 211860/280970	Ringfort	3m SW	Indirect	Moderate
AH 8 / LF013-014	Clooncoose 214460/277440	Ringfort	75m SW	Indirect	Slight
AH 10 / LF014-001	Clooncoose 215240/277209	Castle site	166m ENE	Indirect	Slight
AH 12/ LF014-005	Lisnamuck 215380/276210	Ringfort	176m SW	Indirect	Imperceptible
AH 13/ LF014-003	Clooncoose 215740/27660	Ringfort	155m NNE	Indirect	Imperceptible
AH 14/ LF014-004	Clooncoose 215880/276390	Ringfort	47m NNE	Indirect	Slight
AH 15/ LF014-006	Ballymacwilliam 216360/276240	Ringfort	173m NE	Indirect	Imperceptible
AH 20/ LF014-023	Ballymacwilliam 216710/275850	Ringfort	118m NE	Indirect	Slight
AH 21/ LF014-024	Ballymacwilliam 216810/275740	Ringfort	130m NE	Indirect	Slight
AH 22/ LF014-025	Ballymacwilliam 216900/275630	Ringfort	125m NE	Indirect	Slight
AH 25/ LF014-029	Whiterock/ Cooleeny	Enclosure Site	232m SW	Indirect	Imperceptible
AH 26/ LF014-036	Whiterock 216940/275000	Ringfort	25m S	Indirect	Slight
AH 29/ LF014-037	Cartron Little 217450/274940	Ringfort	50m NE	Indirect	Slight
AH 35 /LF014-071	Lissardowlan 218690/273940	Deserted Medieval Settlement	318m S	Indirect	Imperceptible
AH 41/ LF014-	Corboy 220000/274220	Ringfort	181m NE	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
075					
AH 44/ LF014-076	Corboy 220040/273970	Moated Site Possible	67m NE to centre of constraint	Indirect	Moderate
AH 48/ LF014-080	Corboy 220650/273450	Ringfort	63m NE to centre of constraint	Indirect	Moderate
AH 50/ LF014-082	Corboy 221050/273280	Ringfort	15m S	Indirect	Moderate
AH 53 LF014-083	Ballynagoshen 221330/273050	Enclosure Site	175m S	Indirect	Imperceptible
AH 56 LF014-086	Ballynagoshen 221890/273270	Ringfort	29m SE	Indirect	Moderate
AH 57 LF014-085	Lisanagh 223040/273650	Enclosure Site	0m	Direct	Significant
AH 59/ LF014-087	Bracklon 224070/273590	Earthwork	74m S	Indirect	Slight
AH 60/ LF015-047	Bracklon 224350/243690	Ringfort	50m SE	Indirect	Slight
AH 61/ LF015-046	Bracklon 224670/274020	Ringfort	0m	Direct	Significant
AH 62/ LF015-048	Bracklon 225140/273770	Ringfort	212m S	Indirect	Imperceptible
AH 66/ LF015-051	Lissnageeragh 226140/273210	Ringfort	247m SW	Indirect	Imperceptible
AH 72/ LF020-011	Cam/Lisnagrish 2287320/270830	Enclosure Site	26m NE from centre of constraint	Indirect	Moderate
AH 78/ LF020-018	Clonwhelan 230540/270160	Ringfort	32m NE	Indirect	Slight
AH 79/ LF020-019	Clonwhelan 230670/27110	Ringfort	154m NE	Indirect	Slight
AH 80/ WM006-004	Windtown North 230630/269160	Ringfort	252m SW	Indirect	Imperceptible
AH 81/ WM006-005	Windtown North 230790/269200	Ringfort	100m SW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 83/ WM006-007	Windtown South 231070/268950	Ringfort	68m SW	Indirect	Slight
AH 84/ WM006-008	Loughanstown 231640/268670	Ringfort	57m NE	Indirect	Slight
AH 85/ WM006-013	Loughanstown 231800/268460	Ringfort	65m NE	Indirect	Slight
AH 90/ WM006-014	Russagh 232320/267900	Ringfort	188m NE	Indirect	Imperceptible
AH 92/ WM006-021	Barratogher 233810/267820	Ringfort	257m N	Indirect	Imperceptible
AH 93/ WM006-022	Cappagh 234580/266950	Earthwork	46m SW to centre of constraint	Indirect	Moderate
AH 94 WM006-028	Cappagh 234910/266670	Earthwork	8m SW	Indirect	Moderate
AH 96 WM006-032	Ballyharney 23860/265670	Motte	38m SW	Indirect	Slight
AH 100/ WM006-054	Carrick 236560/264140	Ringfort	69m W	Indirect	Slight
AH 106/ WM011-014	Knockmorris 237800/263340	Ringfort	34m S	Indirect	Slight
AH 107/ WM011-013	Leny 237620/263510	Ringfort	38m N to centre of constraint	Indirect	Moderate
AH 110/ WM011-029	Fulmort 238410/263200	Ringfort	33m SW	Indirect	Slight
AH 117/ WM011-034	Rathganny, Ballindurrow, Heathland, Culleendarragh 239730/263270	Linear Earthwork	0m	Direct	Significant
AH 122/ WM012-022	Knightswood 241680/261680	Ringfort	193m SW	Indirect	Imperceptible
AH 123/ WM012-023	Knightswood 241689/261683	Ringfort	0m	Direct	Profound
AH 134/ WM012-029	Knightswood 241950/261070	Well	130m SW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 135/ WM012-030	Knightswood 242050/260880	Ring Barrow	149m SW	Indirect	Slight
AH 136/ WM012-094	Rathlevenagh 242280/260560	Ringfort	34m SW	Indirect	Slight
AH 137/ WM012-035	Rathlevenagh 242541/260660	Ringfort	82m NE	Indirect	Slight
AH 138/ WM012-103	Loughanstown 242420/259740	Ringfort	170m W	Indirect	Imperceptible
AH 139/ WM012-097	Loughanstown 242600/259900	Moated Site	0m	Direct	Significant
AH 143/ WM012-114	Loughanstown 242910/259490	Castle Site	144m E	Indirect	Slight
AH 144/ WM012-116	Loughanstown	Ringfort	292m E	Indirect	Imperceptible
AH 145/ WM012-104	Loughanstown 252750/259380	Ringfort	180m E	Indirect	Imperceptible
AH 147 /WM012-166	Ballynagall 242800/258930	Ringfort	8m W to up standing remains	Indirect	Moderate
AH 149/ WM012-202	Ballynagall 242850/258130	Earthwork	58m W	Indirect	Slight
AH 150/ WM012-170	Culleen More 243150/257820	Ringfort	60m E	Indirect	Slight
AH 151/ WM012-171	Culleen More 243030/257600	Earthwork	0m	Direct	Significant
AH 152/ WM012-172	Brockagh 243340/257540	Ringfort	247m E	Indirect	Imperceptible
AH 154/ WM019-013	Cullen More 243110/256560	Barrow	87m SW	Indirect	Slight
AAP 1	Edercloon/ Cloonart North 2207241/284596	Boggy land / close proximity to area of known archaeology	0m	Direct	Potentially Significant
AAP 2	Cloonart South/ Annaghcooleen 208402/283198	River Crossing	0m	Direct	Potentially Significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 3	Clooniher 208868/272731	Bogland	0m	Direct	Potentially Significant
AAP 5	Carrickmoyragh 212042/280904	Stream Crossing	0m	Direct	Potentially significant
AAP 11	Cloonbalt 214240/278038	Stream Crossing	0m	Direct	Potentially Significant
AAP 12	Clooncoose 214534/277685	River Camlin Crossing	0m	Direct	Potentially Significant
AAP 16	Lisnamuck/ Clooncoose 215382/276518	Stream Crossing	0m	Direct	Potentially Significant
AAP 19	Ballymacwilliam 219370/275975	Stream Crossing	0m	Direct	Potentially Significant
AAP 20	Whiterock/ Ballymacwilliam 216583/275632	Stream Crossing	0m	Direct	Potentially Significant
AAP 26	Cloonahussey 219481/274302	Stream Crossing	0m	Direct	Potentially Significant
AAP 35	Lisanagh/ Bracklon 223518/273714	Boggy land	0m	Direct	Potentially significant
AAP 36	Bracklon 225716/274070	Boggy land	0m	Direct	Potentially significant
AAP 37	Lissnageeragh 226628/272199	Stream Crossing	0m	Direct	Potentially significant
AAP 41	Cam/ Lisnagrish 227800/271157	Boggy land	0m	Direct	Potentially significant
AAP 42	Cam/ Lisnagrish 228492/270807	River Riffey crossing	0m	Direct	Potentially significant
AAP 44	Cam/ Lisnagrish 229606/270490	Stream Crossing	0m	Direct	Potentially significant
AAP 45	Clonwhelan	Stream Crossing	0m	Direct	Potentially significant
AAP 46	Clonwhelan 230135/270289	Boggy land	0m	Direct	Potentially significant
AAP 48	Clonwhelan/ Windtown North 230595/269733	River Riffey Crossing	0m	Direct	Potentially significant
AAP 49	Loughanstown Lower/ Windtown South 231330/268863	Boggy land	0m	Direct	Potentially significant
AAP 53	Barratogher/ Corrydonnellan 233872/267488	Stream Crossing	0m	Direct	Potentially significant
AAP 55	Cappagh 234765/266921	Boggy land	0m	Direct	Potentially significant
AAP 57	Cappagh/ Ballyharney 230875/265859	River Inny Crossing	0m	Direct	Potentially significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 59	Ballyharney 236144/265541	Stream Crossing	0m	Direct	Potentially significant
AAP 61	Grange 236407/265202	Stream Crossing	0m	Direct	Potentially significant
AAP 64	Grange 235403/263645	Stream Crossing	0m	Direct	Potentially significant
AAP 65	Grange 236706/264228	Stream Crossing	0m	Direct	Potentially significant
AAP 68	Fulmort 237791/236479	Potential Ringfort Site	0m	Direct	Potentially significant
AAP 71	Cullenabohogue	Stream Crossing	0m	Direct	Potentially Significant
AAP 72	Cullenabohogue	Stream Crossing	0m	Direct	Potentially Significant
AAP 73	Rathlevenagh	Stream Crossing	0m	Direct	Potentially Significant
AAP 74	Ballynagall	Stream Crossing	0m	Direct	Potentially Significant
AAP 76	Culleen More	Stream Crossing	0m	Direct	Potentially Significant
AAP 77	Cartron Little/ Agharickard/ Toorfin 218615/274584	Proximity to Lissardowlan (AH 35)	0m	Direct	Potentially Significant

Conclusion

Route Corridor Option 3 contains 62 recorded archaeological sites with ringforts (42 recorded examples) being the most numerous monument type occurring. This Route Corridor would have a Direct Impact on six recorded archaeological sites (AH 57, AH 61, AH 117, AH 123, AH 139 and AH 151). Consultation of the topographical files of the National Museum of Ireland has identified 10 stray finds along the proposed Route Corridor Option between Counties Longford and Westmeath. These were overwhelmingly found in wetland contexts (Appendix 6). Consultation of aerial and photographic sources has identified 34 areas of archaeological potential (AAP's). The proposed Route Corridor Option would have a Direct Impact on these sites.

Previous archaeological investigations at Edercloon Co. Longford identified previously unknown, unrecorded archaeological remains. The trackway complex at Edercloon Moore 2005, Ministerial Direction Ref.: A031-025 Licence Ref.: 05E0983) identified a wooden trackway complex which is believed to extend beyond the limit of excavation as indicated on RFig 4.6.1 as AAP 1. This Route Corridor would have a Direct Impact

on AAP 1. However, it may be possible to design around the specific area where the trackway was discovered by keeping within the existing fence line of the extant roadway.

Route Corridor Option 4

Table 4.6-4 Route Corridor Option 4: Archaeological Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 1/ LF008-005	Lissagernal 209590/282100	Enclosure Site	6m SW	Indirect	Moderate
AH 7/ LF008-018	Creenagh 214200/280080	Ringfort	215m SSW	Indirect	Imperceptible
AH 36/ LF014-012	Ballygarve 219840/276050	Enclosure	44m NE	Indirect	Slight
AH 42/ LF014-042	Newtownbond 221100/275040	Enclosure	74m SW	Indirect	Slight
AH 45/ LF014-077	Corboy 220810/274360	Ringfort	25m SW	Indirect	Moderate
AH 58/ LF014-107	Lackan 223250/272400	Ringfort	81m NE	Indirect	Slight
AH 63/ LF015-060	Ballindagny & Cullyvore 224530/271390	Ringfort	19m NE	Indirect	Moderate
AH 64 LF015-061	Abbey Land 224900/271350	Holy Well	218m NE	Indirect	Imperceptible
AH 65 LF015-062	Abbey Land 224990/271350	Abbey	264m NE	Indirect	Imperceptible
AH 67 LF020-002	Shantum 225130/270690	Possible Barrow	10m SW	Indirect	Moderate
AH 68 LF020-003	Shantum 225290/270580	Rectangular Enclosure	7m SW	Indirect	Moderate
AH 69/ LF020-008	Liscahill 226130/270260	Ringfort	18m SW of upstanding remains	Indirect	Moderate
AH 70 LF020-005	Garryandrew 226660/270540	Possible Barrow	221m N	Indirect	Imperceptible
AH 71/ LF020-010	Garryandrew 226800/270460	Ringfort	139m N	Indirect	Slight
AH 73/ LF020-014	Kilsallagh 228480/270060	Enclosure Site	168m NE	Indirect	Imperceptible
AH 75/ LF020-015	Kilsallagh 228570/270000	Enclosure Site	147m NE	Indirect	Slight
AH 76/ LF020-016	Kilsallagh 228580/269850	Ringfort	15m NE	Indirect	Moderate
AH 77/ LF020-027	Kilsallagh 229540/269320	Enclosure	70m NE to upstanding remains	Indirect	Moderate

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 82/ WM006-006	Loughanstown Lower/ 230680/268980	Ringfort	182m NE	Indirect	Imperceptible
AH 86/ WM006-012	Windtown/ 230700/268020	Ringfort	156m SW	Indirect	Imperceptible
AH 87/ WM006-017	Ballygarran 231110/267480	Ringfort	0m	Direct	Significant
AH 88/ WM006-018	Ballygarran 231250/267340	Ringfort	15m	Indirect	Moderate
AH 89/ WM006-016	Rathowen 230980/267040	Well	223m W	Indirect	Imperceptible
AH 91/ WM006-046	Joanstown 233090/262220	Castle Site	190m SW	Indirect	Imperceptible
AH 95/ WM006-050	Joanstown 234347/264392	Ringfort	42m SW	Indirect	Slight
AH 97/ WM011-008	Ballinalack 235040/263660	Earthwork	73m SW	Indirect	Slight
AH 98/ WM011-009	Ballinalack 235180/263510	Earthwork	108m SW	Indirect	Slight
AH 99/ WM011-011	Cullenhugh 235830/263450	Earthwork Site	58m NE to centre of constraint	Indirect	Moderate
AH 101/ WM011-018	Ballyvade 236650/262390	Ringfort	189m SW	Indirect	Imperceptible
AH 102/ WM011-019	Rathaniska 236860/262200	Ringfort	198m SW	Indirect	Imperceptible
AH 103/ WM011-020	Rathbennett 237160/262210	Earthwork	3m SW	Indirect	Moderate
AH 104/ WM011-028	Leny 237480/262400	Church	198m NE	Indirect	Imperceptible
AH 105/ WM011-027	Leny 237400/262500	Standing Stone	248m NE	Indirect	Imperceptible
AH 108/ WM011-058	Kilpatrick 237730/261780	Earthwork	108m SSW	Indirect	Slight
AH 109/ WM011-057	Kilpatrick 237810/261930	Ringfort	0m	Direct	Significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 111/ WM011-062	Kilpatrick 237990/261670	Earthwork Site	83m S	Indirect	Slight
AH 112/ WM011-063	Kilpatrick 238080/261840	Ringfort	0m	Direct	Significant
AH 113/ WM011-066	Kilpatrick 238680/261600	Ringfort	77m SSW	Indirect	Slight
AH 114/ WM011-068	Kilpatrick 238830/261460	Ringfort	172m SSW	Indirect	Imperceptible
AH 115/ WM011-067	Kilpatrick 238870/261660	Ringfort	0m	Direct	Significant
AH 116/ WM011-073	Kilpatrick 239080/261280	Ringfort	198m SSW	Indirect	Imperceptible
AH 117/ WM011-034	Rathganny, Ballindurrow, Heathland, Culleendarragh 239730/263270	Linear Earthwork	0m	Direct	Significant
AH 120/ WM012-084	Ballynafid 240650/260160	Ringfort	2m SW	Indirect	Moderate
AH 121/ WM012-085	Ballynafid 240560/259990	Ringfort	174m SW	Indirect	Imperceptible
AH 124/ WM012-098	Portnashangan 240750/259780	Ringfort	111m SW	Indirect	Slight
AH 125/ WM012-086	Portnashangan 240850/259830	Abbey	11m SW	Indirect	Moderate
AH 126/ WM012-087	Portnashangan 240950/259850	Earthwork	0m	Direct	Profound
AH 130/ WM012-099	Portnashangan 240920/259550	Ringfort	106m SW	Indirect	Slight
AH 131/ WM012-100	Portnashangan 241190/259670	Ringfort	2m NE	Indirect	Moderate
AH 140/ WM012-101	Portnashangan 241270/259370	Ringfort	14m SW	Indirect	Moderate
AH 141/ WM012-102	Portnashangan 241470/259160	Earthwork	68m SW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 146/ WM012-164	Portnashangan 242070/258830	Ringfort	28m E to upstanding remains	Indirect	Moderate
AH 148/ WM012-165	Culleen More 229540/269320	Ringfort	23m to centre of constraint	Indirect	Moderate
AH 153/ WM012-168	Culleen More 242720/257430	Ringfort	13m NE	Indirect	Moderate
AH 154/ WM019-013	Cullen More 243110/256560	Barrow	27m NE	Indirect	Slight
AH 162/ WM011-065	Kilpatrick 238460/262013	Ringfort	106m N	Indirect	Slight
AH 163/ WM011-064	Kilpatrick 238444/262207	Ringfort	299m N	Indirect	Imperceptible
AAP 1	Edercloon/ Cloonart North 2207241/284596	Boggy land / close proximity to area of known archaeology	0m	Direct	Potentially Significant
AAP 2	Cloonart South/ Annaghcooleen 208402/283198	River Crossing	0m	Direct	Potentially Significant
AAP 3	Clooniher 208868/272731	Bogland	0m	Direct	Potentially Significant
AAP 4	Faghey/ Knockmartin/ Clloonrallagh 212643/279067	Stream crossing	0m	Direct	Potentially significant
AAP 6	Prucklish/ Leitrim	Stream Crossing	0m	Direct	Potentially Significant
AAP 7	Creenagh	Stream Crossing	0m	Direct	Potentially Significant
AAP 8	Creenagh	Stream Crossing	0m	Direct	Potentially Significant
AAP 17	Gorteenorna	Stream Crossing	0m	Direct	Potentially Significant
AAP 18	Kiltyreher	River Camlin Crossing	0m	Direct	Potentially Significant
AAP 34	Corboy	Boggy land	0m	Direct	Potentially Significant
AAP 39	Shantum 225674/270505	Boggy land	0m	Direct	Potentially significant
AAP 40	Garryandrew 226544/270245	Stream Crossing	0m	Direct	Potentially significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 43	Kilsallagh 220650/269749	Boggy land	0m	Direct	Potentially significant
AAP 50	Rathowen 321694/266559	Stream Crossing	0m	Direct	Potentially significant
AAP 51	Rathowen 232201/266159	Stream Crossing	0m	Direct	Potentially significant
AAP 56	Joanstown 234091/264883	Boggy Land	0m	Direct	Potentially significant
AAP 58	Joanstown/ Ballinalack 234749/264139	River Inny Crossing	0m	Direct	Potentially significant
AAP 60	Glebe 234948/263969	Stream Crossing	0m	Direct	Potentially significant
AAP 66	Ballinalack 235887/263372	Stream Crossing	0m	Direct	Potentially significant
AAP 67	Ballyvade 236481/262969	Boggy Land	0m	Direct	Potentially significant
AAP 69	Portnashangan 240783/260143	Proximity to Lough Owel	0m	Direct	Potentially significant
AAP 75	Portnashangan/ Culleen More 242358/257907	Proximity to Lough Owel	0m	Direct	Potentially significant

Conclusion

Route Corridor Option 4 contains 57 recorded archaeological sites with ringforts (32 recorded examples) being the most numerous monument type occurring. This Route Corridor would have a Direct Impact on six recorded archaeological sites (AH 87, AH 109, AH 112, AH 115, AH 117 and AH 126). Consultation of the topographical files of the National Museum of Ireland has identified 17 stray finds along Route Corridor Option 4 between Counties Longford and Westmeath. These were overwhelmingly found in wetland contexts (Appendix 6). Consultation of aerial and photographic sources has identified 23 areas of archaeological potential (AAP's). This Route Corridor would have a Direct Impact on these sites.

Previous archaeological investigations at Edercloon Co. Longford identified previously unknown, unrecorded archaeological remains. The trackway complex at Edercloon Moore 2005, Ministerial Direction Ref.: A031-025 Licence Ref.: 05E0983) identified a wooden trackway complex which is believed to extend beyond the limit of excavation as indicated on RFig 4.6.1 as AAP 1. Route Corridor Option 4 would have a Direct Imapct on AAP 1. However, it may be possible to design around the specific area

where the trackway was discovered by keeping within the existing fence line of the extant roadway.

Consultation of the National Monuments Database listed an archaeological investigation having taken place in Prucklish townland in Co. Longford within the proposed Route Corridor Option 4 (Sweetman 2007, Licence Ref.: 07E1004), however no details concerning the findings of the investigations were available.

Route Corridor Option 5

Table 4.6-5 Route Corridor Option 5: Archaeological Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 1/ LF008-005	Lissagernal 209590/282100	Enclosure Site	6m SW	Indirect	Moderate
AH 2/ LF008-007	Deerpark/ 210820/28098	Ringfort	237m SW	Indirect	Imperceptible
AH 4/ LF008-016	Carrickmoyragh 211230/280680	Ringfort	107m SW	Indirect	Slight
AH 5/ LF008-019	212130/279590/ Lismoy	Ringfort	18m SW	Indirect	Slight
AH 6/ LF008-020	Lamagh/ 212350/27924	Ringfort	45m WSW from centre of constraint	Indirect	Moderate
AH 155/ LF008-031	Knockmartin/ 212560/278400	Ringfort	0m	Direct	Significant
AH 156/ LF013-024	Mullagh/ 211820/275300	Enclosure Site	161m E	Indirect	Slight
AH 157/ LF013-040	Cartronageeragh/ 212570/273550	Ringfort	25m E to the upstanding remains	Indirect	Moderate
AH 158/ LF013-042	212660/27331 Mullaghavorneen	Enclosure Site	0m	Direct	Significant
AH 159/ LF013-044	Lisduff/ 2140100/272980	Ringfort	135m N	Indirect	Slight
AH 160/ LF014-062	Ballymakeegan/ 214680/273080	Ringfort	134m N	Indirect	Slight
AH 34/ LF014-072	Freehalman 217990/273460	Ringfort	219m S	Indirect	Imperceptible
AH 37/ LF014-093	Cartronawar 218300/272820	Ringfort	116m S	Indirect	Slight
AH 38/ LF014-094	Cartronawar 218620/272630	Ringfort	194m S	Indirect	Imperceptible
AH 46/ LF014-096	Lisfarrell 219940/271160	Ringfort	113m S	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 49/ LF014-097	Lisfarrell 220370/272180	Enclosure	57m S	Indirect	Slight
AH 51/ LF014-099	Twentyacres 220760/272050	Ringfort	167m S	Indirect	Slight
AH 52/ LF014-098	Lisfarrell 220720/272170	Ringfort	55m S	Indirect	Slight
AH 54/ LF014-101	Treel 221190/272020	Ringfort	235m S	Indirect	Imperceptible
AH 55/ LF014-100	Lissaghanedan 221490/272160	Barrow	111m S	Indirect	Slight
AH 63/ LF015-060	Ballindagny & Cullyvore 224530/271390	Ringfort	19m NE	Indirect	Moderate
AH 64 LF015-061	Abbey Land 224900/271350	Holy Well	218m NE	Indirect	Imperceptible
AH 65 LF015-062	Abbey Land 224990/271350	Abbey	264m NE	Indirect	Imperceptible
AH 67 LF020-002	Shantum 225130/270690	Possible Barrow	10m SW	Indirect	Moderate
AH 68 LF020-003	Shantum 225290/270580	Rectangular Enclosure	7m SW	Indirect	Moderate
AH 69/ LF020-008	Liscahill 226130/270260	Ringfort	18m SW of upstanding remains	Indirect	Moderate
AH 70 LF020-005	Garryandrew 226660/270540	Possible Barrow	221m N	Indirect	Imperceptible
AH 71/ LF020-010	Garryandrew 226800/270460	Ringfort	139m N	Indirect	Slight
AH 73/ LF020-014	Kilsallagh 228480/270060	Enclosure Site	168m NE	Indirect	Imperceptible
AH 75/ LF020-015	Kilsallagh 228570/270000	Enclosure Site	147m NE	Indirect	Slight
AH 76/ LF020-016	Kilsallagh 228580/269850	Ringfort	15m NE	Indirect	Moderate
AH 77/ LF020-027	Kilsallagh 229540/269320	Enclosure	70m NE to upstanding remains	Indirect	Moderate
AH 82/ WM006-006	Loughanstown Lower/ 230680/268980	Ringfort	182m NE	Indirect	Imperceptible
AH 86/ WM006-012	Windtown/ 230700/268020	Ringfort	156m SW	Indirect	Imperceptible
AH 87/ WM006-017	Ballygarran 231110/267480	Ringfort	0m	Direct	Significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 88/ WM006-018	Ballygarran 231250/267340	Ringfort	15m	Indirect	Moderate
AH 89/ WM006-016	Rathowen 230980/267040	Well	223m W	Indirect	Imperceptible
AH 91/ WM006-046	Joanstown 233090/262220	Castle Site	190m SW	Indirect	Imperceptible
AH 95/ WM006-050	Joanstown 234347/264392	Ringfort	42m SW	Indirect	Slight
AH 97/ WM011-008	Ballinalack 235040/263660	Earthwork	73m SW	Indirect	Slight
AH 98/ WM011-009	Ballinalack 235180/263510	Earthwork	108m SW	Indirect	Slight
AH 99/ WM011-011	Cullenhugh 235830/263450	Earthwork Site	58m NE to centre of constraint	Indirect	Moderate
AH 101/ WM011-018	Ballyvade 236650/262390	Ringfort	189m SW	Indirect	Imperceptible
AH 102/ WM011-019	Rathaniska 236860/262200	Ringfort	198m SW	Indirect	Imperceptible
AH 103/ WM011-020	Rathbennett 237160/262210	Earthwork	3m SW	Indirect	Moderate
AH 105/ WM011-027	Leny 237400/262500	Standing Stone	248m NE	Indirect	Imperceptible
AH 104/ WM011-028	Leny 237480/262400	Church	198m NE	Indirect	Imperceptible
AH 108/ WM011-058	Kilpatrick 237730/261780	Earthwork	108m SSW	Indirect	Slight
AH 109/ WM011-057	Kilpatrick 237810/261930	Ringfort	0m	Direct	Significant
AH 111/ WM011-062	Kilpatrick 237990/261670	Earthwork Site	83m S	Indirect	Slight
AH 112/ WM011-063	Kilpatrick 238080/261840	Ringfort	0m	Direct	Significant
AH 113/ WM011-066	Kilpatrick 238680/261600	Ringfort	77m SSW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 114/ WM011-068	Kilpatrick 238830/261460	Ringfort	172m SSW	Indirect	Imperceptible
AH 115/ WM011-067	Kilpatrick 238870/261660	Ringfort	0m	Direct	Significant
AH 116/ WM011-073	Kilpatrick 239080/261280	Ringfort	198m SSW	Indirect	Imperceptible
AH 117/ WM011-034	Rathganny, Ballindurrow, Heathland, Culleendarragh 239730/263270	Linear Earthwork	0m	Direct	Significant
AH 120/ WM012-084	Ballynafid 240650/260160	Ringfort	2m SW	Indirect	Moderate
AH 121/ WM012-085	Ballynafid 240560/259990	Ringfort	174m SW	Indirect	Imperceptible
AH 124/ WM012-098	Portnashangan 240750/259780	Ringfort	111m SW	Indirect	Slight
AH 125/ WM012-086	Portnashangan 240850/259830	Abbey	11m SW	Indirect	Moderate
AH 126/ WM012-087	Portnashangan 240950/259850	Earthwork	0m	Direct	Profound
AH 130/ WM012-099	Portnashangan 240920/259550	Ringfort	106m SW	Indirect	Slight
AH 131/ WM012-100	Portnashangan 241190/259670	Ringfort	2m NE	Indirect	Moderate
AH 140/ WM012-101	Portnashangan 241270/259370	Ringfort	14m SW	Indirect	Moderate
AH 141/ WM012-102	Portnashangan 241470/259160	Earthwork	68m SW	Indirect	Slight
AH 146/ WM012-164	Portnashangan 242070/258830	Ringfort	28m E to upstanding remains	Indirect	Moderate
AH 148/ WM012-165	Culleen More 229540/269320	Ringfort	23m to centre of constraint	Indirect	Moderate
AH 153/ WM012-168	Culleen More 242720/257430	Ringfort	13m NE	Indirect	Moderate

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 154/ WM019-013	Cullen More 243110/256560	Barrow	27m NE	Indirect	Slight
AH 162/ WM011-065	Kilpatrick 238460/262013	Ringfort	106m N	Indirect	Slight
AH 163/ WM011-064	Kilpatrick 238444/262207	Ringfort	299m N	Indirect	Imperceptible
AAP 1	Edercloon/ Cloonart North 2207241/284596	Boggy land / close proximity to area of known archaeology	0m	Direct	Potentially Significant
AAP 2	Cloonart South/ Annaghcooleen 208402/283198	River Rinn Crossing	0m	Direct	Potentially Significant
AAP 3	Clooniher 208868/272731	Bogland	0m	Direct	Potentially Significant
AAP 4	Faghey/ Knockmartin/ Clloonrallagh 212643/279067	Stream crossing	0m	Direct	Potentially significant
AAP 9	Mullagh/Cartons 211804/275881	River Camlin Crossing	0m	Direct	Potentially Significant
AAP 21	Ballyminnion 211560/274992	Stream Crossing	0m	Direct	Potentially Significant
AAP 22	Ballyminnion/ Cartronageeragh 211895/274406	Boggy land	0m	Direct	Potentially Significant
AAP 23	Ballymakeegan 215764/272267	Boggy land	0m	Direct	Potentially Significant
AAP 24	Cooleeny/ Cartronawar 217789/273215	Stream Crossing	0m	Direct	Potentially Significant
AAP 28	Lisfarrell 218173/273600	Stream Crossing	0m	Direct	Potentially Significant
AAP 31	Lisfarrell 221053/272337	Boggy land	0m	Direct	Potentially Significant
AAP 32	Ballynagoshen 221700/272329	Stream Crossing	0m	Direct	Potentially Significant
AAP 33	Lackan 223037/272012	Boggy land	0m	Direct	Potentially Significant
AAP 39	Shantum 225674/270505	Boggy land	0m	Direct	Potentially significant
AAP 40	Garryandrew 226544/270245	Stream Crossing	0m	Direct	Potentially significant
AAP 43	Kilsallagh 220650/269749	Boggy land	0m	Direct	Potentially significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 50	Rathowen 321694/266559	Stream Crossing	0m	Direct	Potentially significant
AAP 51	Rathowen 232201/266159	Stream Crossing	0m	Direct	Potentially significant
AAP 56	Joanstown 234091/264883	Boggy Land	0m	Direct	Potentially significant
AAP 58	Joanstown/ Ballinalack 234749/264139	River Inny Crossing	0m	Direct	Potentially significant
AAP 60	Glebe 234948/263969	Stream Crossing	0m	Direct	Potentially significant
AAP 66	Ballinalack 235887/263372	Stream Crossing	0m	Direct	Potentially significant
AAP 67	Ballyvade 236481/262969	Boggy Land	0m	Direct	Potentially significant
AAP 69	Portnashangan 240783/260143	Proximity to Lough Owel	0m	Direct	Potentially significant
AAP 75	Portnashangan/ Culleen More 242358/257907	Proximity to Lough Owel	0m	Direct	Potentially significant

Conclusions

Route Corridor Option 5 contains 71 recorded archaeological sites with ringforts (45 recorded examples) being the most numerous monument type occurring. This Route Corridor would have a Direct Impact on eight recorded archaeological sites (AH 155, AH 158, AH 87, AH 109, AH 112, AH 115, AH 117 and AH 126). Consultation of the topographical files of the National Museum of Ireland has identified 19 stray finds along Route Corridor Option 5 between Counties Longford and Westmeath. These were overwhelmingly found in wetland contexts (Appendix 6). Consultation of aerial and photographic sources has identified 25 areas of archaeological potential (AAP's). This Route Corridor would have a Direct Impact on these sites.

Previous archaeological investigations at Edercloon Co. Longford identified previously unknown, unrecorded archaeological remains. The trackway complex at Edercloon Moore 2005, Ministerial Direction Ref.: A031-025 Licence Ref.: 05E0983) identified a wooden trackway complex which is believed to extend beyond the limit of excavation as indicated on RFig 4.6.1 as AAP 1. However, it may be possible to design around the specific area where the trackway was discovered by keeping within the existing fence line of the extant roadway.

During July and August 2009, archaeological excavations were carried out along the path of the N5 Longford Bypass, which would form by the proposed Route Option 5. A total of four archaeological sites were discovered and subject to excavation. Three of these were located within the townland of Mullagh (Sites 1-3). Mullagh 1 consisted of an Iron Age bowl furnace, pit and post hole. This represents a metal working site. Mullagh 2 contained 54 inhumations dating to the later medieval period (15th-17th centuries), along with pits and a cereal drying kiln. Mullagh 3 was formed by an isolated pit. The fourth site was located within the townland of Aghareagh and consisted of likely Bronze Age burnt spreads. These sites have been excavated and the entire route of the N5 Bypass (c. 3km) has been subject to archaeological investigation. As such no futher archaeological mitigation would be required for this section of the Route Option 5.

Route Corridor Option 6

Table 4.6-6 Route Corridor Option 6: Archaeological Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 1/ LF008-005	Lissagernal 209590/282100	Enclosure Site	68m S	Indirect	Slight
AH 3/ LF008-008	Carrickmoyragh 211860/280970	Ringfort	3m SW	Indirect	Moderate
AH 8 / LF013-014	Clooncoose 214460/277440	Ringfort	114m SW	Indirect	Slight
AH 10 / LF014-001	Clooncoose 215240/277209	Castle site	166m ENE	Indirect	Slight
AH 12/ LF014-005	Lisnamuck 215380/276210	Ringfort	176m SW	Indirect	Imperceptible
AH 13/ LF014-003	Clooncoose 215740/27660	Ringfort	155m NNE	Indirect	Imperceptible
AH 14/ LF014-004	Clooncoose 215880/276390	Ringfort	47m NNE	Indirect	Slight
AH 15/ LF014-006	Ballymacwilliam 216360/276240	Ringfort	173m NE	Indirect	Imperceptible
AH 18/ LF014-021	Whiterock 216100/275660	Ringfort	238m SW	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 20/ LF014-023	Ballymacwilliam 216710/275850	Ringfort	118m NE	Indirect	Slight
AH 21/ LF014-024	Ballymacwilliam 216810/275740	Ringfort	130m NE	Indirect	Slight
AH 22/ LF014-025	Ballymacwilliam 216900/275630	Ringfort	125m NE	Indirect	Slight
AH 25/ LF014-029	Whiterock/ Cooleeny	Enclosure Site	232m SW	Indirect	Imperceptible
AH 26/ LF014-036	Whiterock 216940/275000	Ringfort	50m SW	Indirect	Slight
AH 29/ LF014-037	Cartron Little 217450/274940	Ringfort	89m NE	Indirect	Slight
AH 31/ LF014-068	Cooleeny 217640/274200	Ringfort	103m W	Indirect	Slight
AH 34/ LF014-072	Freehalman 217990/273460	Ringfort	118m SW	Indirect	Slight
AH 35/ LF014-071	Lissardowlan 218690/273940	Deserted Medieval Settlement	155m NNE	Indirect	Slight
AH 39/ LF014-074	Cloonahard 219169/273329	Ringfort (01) Souterrain (02)	60m N	Indirect	Slight
AH 46/ LF014-096	Lisfarrell 219940/271160	Ringfort	113m S	Indirect	Slight
AH 49/ LF014-097	Lisfarrell 220370/272180	Enclosure	57m S	Indirect	Slight
AH 51/ LF014-099	Twentyacres 220760/272050	Ringfort	167m S	Indirect	Slight
AH 52/ LF014-098	Lisfarrell 220720/272170	Ringfort	55m S	Indirect	Slight
AH 54/ LF014-101	Treel 221190/272020	Ringfort	235m S	Indirect	Imperceptible
AH 55/ LF014-100	Lissaghanedan 221490/272160	Barrow	111m S	Indirect	Slight
AH 63/ LF015-060	Ballindagny & Cullyvore 224530/271390	Ringfort	19m NE	Indirect	Moderate

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 64 LF015-061	Abbey Land 224900/271350	Holy Well	218m NE	Indirect	Imperceptible
AH 65 LF015-062	Abbey Land 224990/271350	Abbey	264m NE	Indirect	Imperceptible
AH 67 LF020-002	Shantum 225130/270690	Possible Barrow	10m SW	Indirect	Moderate
AH 68 LF020-003	Shantum 225290/270580	Rectangular Enclosure	7m SW	Indirect	Moderate
AH 69/ LF020-008	Liscahill 226130/270260	Ringfort	18m SW of upstanding remains	Indirect	Moderate
AH 70 LF020-005	Garryandrew 226660/270540	Possible Barrow	221m N	Indirect	Imperceptible
AH 71/ LF020-010	Garryandrew 226800/270460	Ringfort	139m N	Indirect	Slight
AH 73/ LF020-014	Kilsallagh 228480/270060	Enclosure Site	168m NE	Indirect	Imperceptible
AH 75/ LF020-015	Kilsallagh 228570/270000	Enclosure Site	147m NE	Indirect	Slight
AH 76/ LF020-016	Kilsallagh 228580/269850	Ringfort	15m NE	Indirect	Slight
AH 77/ LF020-027	Kilsallagh 229540/269320	Enclosure	70m NE to upstanding remains	Indirect	Slight
AH 82/ WM006-006	Loughanstown Lower/ 230680/268980	Ringfort	182m NE	Indirect	Imperceptible
AH 86/ WM006-012	Windtown/ 230700/268020	Ringfort	156m SW	Indirect	Imperceptible
AH 87/ WM006-017	Ballygarran 231110/267480	Ringfort	0m	Direct	Significant
AH 88/ WM006-018	Ballygarran 231250/267340	Ringfort	15m	Indirect	Moderate
AH 89/ WM006-016	Rathowen 230980/267040	Well	223m W	Indirect	Imperceptible
AH 91/ WM006-046	Joanstown 233090/262220	Castle Site	190m SW	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 95/ WM006-050	Joanstown 234347/264392	Ringfort	42m SW	Indirect	Slight
AH 97/ WM011-008	Ballinalack 235040/263660	Earthwork	73m SW	Indirect	Slight
AH 98/ WM011-009	Ballinalack 235180/263510	Earthwork	108m SW	Indirect	Slight
AH 99/ WM011-011	Cullenhugh 235830/263450	Earthwork Site	58m NE to centre of constraint	Indirect	Moderate
AH 101/ WM011-018	Ballyvade 236650/262390	Ringfort	189m SW	Indirect	Imperceptible
AH 102/ WM011-019	Rathaniska 236860/262200	Ringfort	198m SW	Indirect	Imperceptible
AH 103/ WM011-020	Rathbennett 237160/262210	Earthwork	3m SW	Indirect	Moderate
AH 104/ WM011-028	Leny 237480/262400	Church	198m NE	Indirect	Imperceptible
AH 105/ WM011-027	Leny 237400/262500	Standing Stone	248m NE	Indirect	Imperceptible
AH 109/ WM011-057	Kilpatrick 237810/261930	Ringfort	0m	Direct	Significant
AH 108/ WM011-058	Kilpatrick 237730/261780	Earthwork	108m SSW	Indirect	Slight
AH 111/ WM011-062	Kilpatrick 237990/261670	Earthwork Site	83m S	Indirect	Slight
AH 112/ WM011-063	Kilpatrick 238080/261840	Ringfort	0m	Direct	Significant
AH 113/ WM011-066	Kilpatrick 238680/261600	Ringfort	77m SSW	Indirect	Slight
AH 114/ WM011-068	Kilpatrick 238830/261460	Ringfort	172m SSW	Indirect	Imperceptible
AH 115/ WM011-067	Kilpatrick 238870/261660	Ringfort	0m	Direct	Significant
AH 116/ WM011-073	Kilpatrick 239080/261280	Ringfort	198m SSW	Indirect	Imperceptible

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AH 117/ WM011-034	Rathganny, Ballindurrow, Heathland, Culleendarragh 239730/263270	Linear Earthwork	0m	Direct	Significant
AH 119/ WM011-071	Ballynafid 240270/261380	Ringfort	239m N	Indirect	Imperceptible
AH 120 WM012-084	Ballynafid 240650/260160	Ringfort	61m SW	Indirect	Slight
AH 125/ WM012-086	Portnashangan 240850/259830	Abbey	105m SW	Indirect	Slight
AH 126/ WM012-087	Portnashangan 240950/259850	Earthwork	23m SW	Indirect	Moderate
AH 131/ WM012-100	Portnashangan 241190/259670	Ringfort	23m SW	Indirect	Moderate
AH 141/ WM012-102	Portnashangan 241470/259160	Earthwork	185m SW	Indirect	Imperceptible
AH 146/ WM012-164	Portnashangan 242070/258830	Ringfort	28m E to upstanding remains	Indirect	Moderate
AH 148/ WM012-165	Culleen More 229540/269320	Ringfort	23m W to upstanding remains	Indirect	Moderate
AH 153/ WM012-168	Culleen More 242720/257430	Ringfort	13m NE	Indirect	Moderate
AH 154/ WM019-013	Cullen More 243110/256560	Barrow	27m NE	Indirect	Slight
AH 162/ WM011-065	Kilpatrick 238460/262013	Ringfort	106m N	Indirect	Slight
AH 163/ WM011-064	Kilpatrick 238444/262207	Ringfort	299m N	Indirect	Imperceptible
AAP 1	Edercloon/ Cloonart North 2207241/284596	Boggy land / close proximity to area of known archaeology	0m	Direct	Potentially Significant
AAP 2	Cloonart South/ Annaghcooleen 208402/283198	River Rinn Crossing	0m	Direct	Potentially Significant
AAP 3	Clooniher 208868/272731	Bogland	0m	Direct	Potentially significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 5	Carrickmoyragh 212042/280904	Stream Crossing	0m	Direct	Potentially significant
AAP 11	Cloonbalt 214240/278038	Stream Crossing	0m	Direct	Potentially Significant
AAP 12	Clooncoose 214534/277685	River Camlin Crossing	0m	Direct	Potentially Significant
AAP 16	Lisnamuck/ Clooncoose 215382/276518	Stream Crossing	0m	Direct	Potentially Significant
AAP 19	Ballymacwilliam 219370/275975	Stream Crossing	0m	Direct	Potentially Significant
AAP 20	Whiterock/ Ballymacwilliam 216583/275632	Stream Crossing	0m	Direct	Potentially Significant
AAP 25	Cooleeny/ Freehalman 218173/273600	Stream Crossing	0m	Direct	Potentially Significant
AAP 28	Lisfarrell 218173/273600	Stream Crossing	0m	Direct	Potentially Significant
AAP 31	Lisfarrell 221053/272337	Boggy land	0m	Direct	Potentially Significant
AAP 32	Ballynagoshen 221700/272329	Stream Crossing	0m	Direct	Potentially Significant
AAP 33	Lackan 223037/272012	Boggy land	0m	Direct	Potentially Significant
AAP 39	Shantum 225674/270505	Boggy land	0m	Direct	Potentially significant
AAP 40	Garryandrew 226544/270245	Stream Crossing	0m	Direct	Potentially significant
AAP 43	Kilsallagh 220650/269749	Boggy land	0m	Direct	Potentially significant
AAP 50	Rathowen 321694/266559	Stream Crossing	0m	Direct	Potentially significant
AAP 51	Rathowen 232201/266159	Stream Crossing	0m	Direct	Potentially significant
AAP 56	Joanstown 234091/264883	Boggy Land	0m	Direct	Potentially significant
AAP 58	Joanstown/ Ballinalack 234749/264139	River Inny Crossing	0m	Direct	Potentially significant
AAP 60	Glebe 234948/263969	Stream Crossing	0m	Direct	Potentially significant
AAP 66	Ballinalack 235887/263372	Stream Crossing	0m	Direct	Potentially significant
AAP 67	Ballyvade 236481/262969	Boggy Land	0m	Direct	Potentially significant
AAP 69	Portnashangan/ Culleen More 243039/257867	Proximity to Lough Owel	0m	Direct	Potentially Significant

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
AAP 75	Portnashangan/ Culleen More 242358/257907	Proximity to Lough Owel	0m	Direct	Potentially significant
AAP 78	Cartron Little/ Cooleeny/ Lissardowlan 217812/274235	Proximity to Lissardowlan (AH 35)	0m	Direct	Potentially Significant

Conclusions

Route Corridor Option 6 contains 72 recorded archaeological sites with ringforts (42 recorded examples) being the most numerous monument type occurring. This Route Corridor would have a Direct Impact on five recorded archaeological sites (AH 87, AH 109, AH 117, AH 112 and AH 115). Consultation of the topographical files of the National Museum of Ireland has identified 16 stray finds along Route Corridor Option 6 between Counties Longford and Westmeath. These were overwhelmingly found in wetland contexts (Appendix 6). Consultation of aerial and photographic sources has identified 27 areas of archaeological potential (AAP's). This Route Corridor would have a Direct Impact on these sites.

Previous archaeological investigations at Edercloon Co. Longford identified previously unknown, unrecorded archaeological remains. The trackway complex at Edercloon Moore 2005, Ministerial Direction Ref.: A031-025 Licence Ref.: 05E0983) identified a wooden trackway complex which is believed to extend beyond the limit of excavation as indicated on RFig 4.6.1 as AAP 1. This Route Corridor would have a Direct Impact on AAP 1. However, it may be possible to design around the specific area where the trackway was discovered by keeping within the existing fence line of the extant roadway.

The archaeological sites that have been identified within the Route Corridor Options have been assigned a potential impact. The impact type per Route Corridor has then been calculated i.e 3 Profound, 5 significant, 10 moderate and so on. Those Route Corridor Options with Profound and Significant Impacts are considered to be the least preferable as these are Direct Impact that result in the removal or all or part of a cultural heritage site. Therefore, the Route Corridor Options have been ranked according to the amount and severity of the potential impacts that have been identified. The Route Corridor Option with the fewest Direct Impact is ranked as being the most desirable option.

Table 4.6-7 Summary Comparison of Archaeological Heritage Impacts

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
Profound		Earthwork (AH 126)	Ringfort (AH 123)	Earthwork (AH 126)	Earthwork (AH 126)	
Negative Significant	Ringfort (AH 87) Ringfort (AH 109) Ringfort (AH 112) Ringfort (AH 115) Linear Earthwork (AH 117)	Ringfort (AH 87) Earthwork (AH 109) Ringfort (AH 112) Ringfort (AH 115) Linear Earthwork (AH 117)	Enclosure Site (AH 57) Ringfort (AH 61) Linear Earthwork (AH 117) Moated Site (AH 139) Earthwork (AH 151)	Ringfort (AH 87) Earthwork (AH 109) Linear Earthwork (AH 117) Ringfort (AH 112) Ringfort (AH 115)	Ringfort (AH 87) Earthwork (AH 109) Ringfort (AH 155) Enclosure Site (AH 158) Linear Earthwork (AH 117) Ringfort (AH 112) Ringfort (AH 115)	Ringfort (AH 87) Ringfort (AH 112) Ringfort (AH 115) Linear Earthwork (AH 117) Ringfort (AH 109)
Negative Moderate	Enclosure Site (AH 1) Ringfort (AH 6) Moated Site Possible (AH 44) Ringfort (AH 48)	Ringfort (AH 3) Ringfort (AH 16) Ringfort (AH 27) Ringfort (AH 63) Possible Barrow (AH	Ringfort (AH 3) Moated Site Possible (AH 44) Ringfort (AH 48) Ringfort (AH 50)	Enclosure Site (AH 1) Ringfort (AH 45) Ringfort (AH 63) Possible Barrow (AH 67)	Enclosure Site (AH 1) Ringfort (AH 6) Enclosure site (AH 157) Ringfort (AH 63) Possible Barrow (AH	Ringfort (AH 3) Ringfort (AH 63) Possible Barrow (AH 67) Rectangular

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	Ringfort (AH 50) Ringfort (AH 56) Ringfort (AH 63) Possible Barrow (AH 67) Enclosure (AH 68) Ringfort (AH 69) Ringfort (AH 76) Enclosure (AH 77) Ringfort (AH 88) Earthwork Site (AH 99) Earthwork (AH 103) Ringfort (AH 146) Ringfort (AH 148) Ringfort (AH 153)	67) Enclosure (AH 68) Ringfort (AH 69) Ringfort (AH 76) Enclosure (AH 77) Ringfort (AH 88) Earthwork Site (AH 99) Earthwork (AH 103) Ringfort (AH 120) Abbey (AH 125) Ringfort (AH 131) Ringfort (AH 140) Ringfort (AH 146) Ringfort (AH 148) Ringfort (AH 153)	Ringfort (AH 56) Enclosure Site (AH 72) Earthwork (AH 93) Earthwork (AH 94) Ringfort (AH 107) Ringfort (AH 147)	Rectangular Enclosure (AH 68) Ringfort (AH 69) Ringfort (AH 76) Enclosure (AH 77) Ringfort (AH 88) Earthwork Site (AH 99) Earthwork (AH 103) Ringfort (AH 120) Abbey (AH 125) Ringfort (AH 131) Ringfort (AH 140) Ringfort (AH 146) Ringfort (AH 148) Ringfort (AH 153)	67) Rectangular Enclosure (AH 68) Ringfort (AH 69) Ringfort (AH 76) Enclosure (AH 77) Ringfort (AH 88) Earthwork Site (AH 99) Earthwork (AH 103) Ringfort (AH 120) Abbey (AH 125) Ringfort (AH 131) Ringfort (AH 140) Ringfort (AH 146) Ringfort (AH 148) Ringfort (AH 153)	Enclosure (AH 68) Ringfort (AH 69) Ringfort (AH 88) Earthwork Site (AH 99) Earthwork (AH 103) Earthwork (AH 126) Ringfort (AH 131) Ringfort (AH 146) Ringfort (AH 148) Ringfort (AH 153)
Potentially Significant	Boggy land/ Proximity to known archaeology (AAP 1) River Rinn Crossing (AAP 2) Boggy land (AAP 3)	Boggy land/ Proximity to known archaeology (AAP 1) River Rinn Crossing (AAP 2) Boggy land (AAP 3)	Boggy land/ Proximity to known archaeology (AAP 1) River Rinn Crossing (AAP 2) Boggy land (AAP 3)	Boggy land/ Proximity to known archaeology (AAP 1) River Rinn Crossing (AAP 2) Boggy land (AAP 3)	Boggy land/ Proximity to known archaeology (AAP 1) River Rinn Crossing (AAP 2) Boggy land (AAP 3)	Boggy land/ Proximity to known archaeology (AAP 1) River Rinn Crossing (AAP 2) Boggy land (AAP 3)

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	Stream Crossing (AAP 4) Stream Crossing (AAP 11) River Camlin Crossing (AAP 12) Stream Crossing (AAP 16) Stream Crossing (AAP 19) Stream Crossing (AAP 20) Stream Crossing (AAP 26) Boggy land (AAP 39) Stream Crossing (AAP 40) Boggy land (AAP 43) Stream Crossing (AAP 50) Stream Crossing (AAP 51) Boggy land (AAP 56)	Stream Crossing (AAP 5) Stream Crossing (AAP 10) Stream Crossing (AAP 13) River Camlin Crossing (AAP 14) Stream Crossing (AAP 15) Stream Crossing (AAP 25) Stream Crossing (AAP 27) Stream Crossing (AAP 29) Stream Crossing (AAP 30) Boggy land (AAP 39) Stream Crossing (AAP 40) Boggy land (AAP 43) Stream Crossing (AAP	Stream Crossing (AAP 5) Stream Crossing (AAP 11) River Camlin Crossing (AAP 12) Stream Crossing (AAP 16) Stream Crossing (AAP 19) Stream Crossing (AAP 20) Stream Crossing (AAP 26) Boggy land (AAP 35) Boggy land (AAP 36) Stream Crossing (AAP 37) Boggy land (AAP 41) River Riffey Crossing (AAP 42) Stream Crossing (AAP 44)	Stream Crossing (AAP 6) Stream Crossing (AAP 7) Stream Crossing (AAP 8) Stream Crossing (AAP 17) River Camlin Crossing (AAP 18) Boggy land (AAP 34) Boggy land (AAP 39) Stream Crossing (AAP 40) Boggy land (AAP 43) Stream Crossing (AAP 50) Stream Crossing (AAP 51) Boggy land (AAP 56) River Inny Crossing (AAP 58) Stream Crossing (AAP	Stream Crossing (AAP 4) River Camlin Crossing (AAP 9) Stream Crossing (AAP 21) Boggy land (AAP 22) Boggy land (AAP 23) Stream Crossing (AAP 24) Stream Crossing (AAP 28) Boggy land (AAP 31) Stream Crossing (AAP 32) Boggy land (AAP 33) Stream Crossing (AAP 40) Boggy land (AAP 40) Boggy land (AAP 43) Stream Crossing (AAP 50) Stream Crossing (AAP	Stream Crossing (AAP 5) Stream Crossing (AAP 11) River Camlin Crossing (AAP 12) Stream Crossing (AAP 16) Stream Crossing (AAP 19) Stream Crossing (AAP 20) Stream Crossing (AAP 25) Stream Crossing (AAP 28) Boggy land (AAP 31) Stream Crossing (AAP 32) Boggy land (AAP 33) Boggy land (AAP 39) Stream Crossing (AAP 40)

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	River Inny Crossing (AAP 58) Stream Crossing (AAP 60) Stream Crossing (AAP 66) Boggy land (AAP 67) Proximity to Ballinafid Lake (AAP 70) Proximity to Lough Owel (AAP 75) Proximity to Lissardowlan/AH 35 (AAP 77)	50) Stream Crossing (AAP 51) Boggy land (AAP 56) River Inny Crossing (AAP 58) Stream Crossing (AAP 60) Stream Crossing (AAP 66) Boggy land (AAP 67) Proximity to Lough Owel (AAP 69) Proximity to Lough Owel (AAP 75) Proximity to Lissardowlan/AH 35 (AAP 78)	Stream Crossing (AAP 45) Boggy land (AAP 46) River Riffey Crossing (AAP 48) Boggy land (AAP 49) Stream Crossing (AAP 53) Boggy land (AAP 55) River Inny Crossing (AAP 57) Stream Crossing (AAP 59) Stream Crossing (AAP 61) Stream Crossing (AAP 64) Stream Crossing (AAP 65) Potential Ringfort Site (AAP 68) Stream Crossing (AAP 71)	60) Stream Crossing (AAP 66) Boggy land (AAP 67) Proximity to Lough Owel (AAP 69) Proximity to Lough Owel (AAP 75)	51) Boggy land (AAP 56) River Inny Crossing (AAP 58) Stream Crossing (AAP 60) Stream Crossing (AAP 66) Boggy land (AAP 67) Proximity to Lough Owel (AAP 69) Proximity to Lough Owel (AAP 75)	Boggy land (AAP 43) Stream Crossing (AAP 50) Stream Crossing (AAP 51) Boggy land (AAP 56) River Inny Crossing (AAP 58) Stream Crossing (AAP 60) Stream Crossing (AAP 66) Boggy land (AAP 67) Proximity to Lough Owel (AAP 69) Proximity to Lough Owel (AAP 75) Proximity to Lissardowlan/AH 35 (AAP 78)

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
			Stream Crossing (AAP 72) Stream Crossing (AAP 73) Stream Crossing (AAP 74) Proximity to Lough Owel (AAP 75) Stream Crossing (AAP 76) Proximity to Lissardowlan/AH 35 (AAP 77)			
Negative Slight	Ringfort (AH 4) Ringfort (AH 5) Ringfort (AH 8) Castle Site (AH 10) Ringfort (AH 13) Ringfort (AH 14) Ringfort (AH 20) Ringfort (AH 21) Ringfort (AH 22)	Enclosure Site (AH 1) Ringfort (AH 8) Enclosure (AH 11) Ringfort (AH 19) Ringfort (AH 23) Ringfort (AH 28) Barrow (AH 32) Ringfort (AH 33) Ringfort (AH 34)	Enclosure Site (AH 1) Ringfort (AH 8) Castle Site (AH 10) Ringfort (AH 14) Ringfort (AH 20) Ringfort (AH 21) Ringfort (AH 22) Ringfort (AH 26) Ringfort (AH 29)	Enclosure (AH 36) Enclosure (AH 42) Ringfort (AH 58) Ringfort (AH 71) Enclosure Site (AH 75) Ringfort (AH 95) Earthwork (AH 97) Earthwork (AH 98) Earthwork (AH 108)	Ringfort (AH 4) Ringfort (AH 5) Enclosure site (AH 156) Ringfort (AH 159) Ringfort (AH 160) Ringfort (AH 37) Ringfort (AH 46) Enclosure (AH 49) Ringfort (AH 51)	Enclosure Site (AH 1) Ringfort (AH 8) Ringfort (AH 10) Ringfort (AH 14) Enclosure (AH 20) Ringfort (AH 21) Ringfort (AH 22) Ringfort (AH 26) Ringfort (AH 29)

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	Ringfort (AH 26) Ringfort (AH 29) Ringfort (AH 58) Ringfort (AH 71) Rectangular Enclosure Site (AH 75) Ringfort (AH 95) Earthwork (AH 97) Earthwork (AH 98) Earthwork (AH 108) Earthwork Site (AH 111) Ringfort (AH 113) Ringfort (AH 127) Ringfort (AH 128) Ringfort (AH 133) Barrow (AH 154) Ringfort (AH 162)	Deserted Medieval Settlement (AH 35) Ringfort (AH 39) Enclosure (AH 43) Ringfort (AH 47) Ringfort (AH 58) Rectangular Ringfort (AH 71) Enclosure Site (AH 75) Ringfort (AH 86) Ringfort (AH 95) Earthwork (AH 97) Earthwork (AH 98) Earthwork (AH 108) Earthwork Site (AH 111) Ringfort (AH 113) Ringfort (AH 124) Ringfort (AH 130) Earthwork (AH 141) Barrow (AH 154) Ringfort (AH 162)	Earthwork (AH 59) Ringfort (AH 60) Ringfort (AH 78) Ringfort (AH 79) Ringfort (AH 81) Ringfort (AH 83) Ringfort (AH 84) Ringfort (AH 85) Motte (AH 96) Ringfort (AH 100) Ringfort (AH 106) Ringfort (AH 110) Holy Well (AH 134) Ring Barrow (AH 135) Ringfort (AH 136) Ringfort (AH 137) Castle Site (AH 143) Earthwork (AH 149) Ringfort (AH 150) Barrow (AH 154)	Earthwork Site (AH 111) Ringfort (AH 113) Ringfort (AH 124) Ringfort (AH 130) Earthwork (AH 141) Barrow (AH 154) Ringfort (AH 162)	Ringfort (AH 52) Barrow (AH 55) Ringfort (AH 71) Enclosure Site (AH 75) Ringfort (AH 95) Earthwork (AH 97) Earthwork (AH 98) Earthwork (AH 108) Earthwork Site (AH 111) Ringfort (AH 113) Ringfort (AH 124) Ringfort (AH 130) Earthwork (AH 141) Barrow (AH 154) Ringfort (AH 162)	Ringfort (AH 31) Ringfort (AH 34) Deserted Medieval Settlement (AH 35) Ringfort (AH 39) Ringfort (AH 46) Enclosure (AH 49) Ringfort (AH 51) Ringfort (AH 52) Barrow (AH 55) Ringfort (AH 71) Enclosure Site (AH 75) Ringfort (AH 76) Enclosure (AH 77) Ringfort (AH 95) Earthwork (AH 97) Earthwork (AH 98) Earthwork (AH 108) Earthwork Site (AH 111) Ringfort (AH 113)

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
						Ringfort (AH 120) Abbey (AH 125) Barrow (AH 154) Ringfort (AH 162)
Negative Imperceptible	Ringfort (AH 2) Ringfort (AH 12) Ringfort (AH 15) Ringfort (AH 18) Ringfort (AH 25) Deserted Medieval Settlement (AH 35) Ringfort (AH 41) Enclosure Site (AH 53) Holy Well (AH 64) Abbey (AH 65) Possible Barrow (AH 70) Enclosure Site (AH 73) Ringfort (AH 82) Ringfort (AH 86) Holy Well (AH 89) Castle Site (AH 91)	Ringfort (AH 9) Ringfort (AH 31) Ringfort (AH 40) Holy Well (AH 64) Abbey (AH 65) Possible Barrow (AH 70) Enclosure Site (AH 73) Ringfort (AH 82) Holy Well (AH 89) Castle Site (AH 91) Ringfort (AH 101) Ringfort (AH 102) Church (AH 104) Standing Stone (AH 105) Ringfort (AH 114) Ringfort (AH 116)	Ringfort (AH 12) Ringfort (AH 13) Ringfort (AH 15) Ringfort (AH 25) Deserted Medieval Settlement (AH 35) Ringfort (AH 41) Enclosure Site (AH 53) Ringfort (AH 62) Ringfort (AH 66) Ringfort (AH 80) Ringfort (AH 90) Ringfort (AH 92) Ringfort (AH 122) Ringfort (AH 138) Ringfort (AH 144) Ringfort (AH 145)	Ringfort (AH 7) Holy Well (AH 64) Abbey (AH 65) Possible Barrow (AH 70) Enclosure Site (AH 73) Ringfort (AH 82) Ringfort (AH 86) Holy Well (AH 89) Castle Site (AH 91) Ringfort (AH 101) Ringfort (AH 102) Church (AH 104) Standing Stone (AH 105) Ringfort (AH 114) Ringfort (AH 116) Ringfort (AH 121)	Ringfort (AH 2) Ringfort (AH 34) Ringfort (AH 38) Ringfort (AH 54) Holy Well (AH 64) Abbey (AH 65) Possible Barrow (AH 70) Enclosure Site (AH 73) Ringfort (AH 82) Ringfort (AH 86) Holy Well (AH 89) Castle Site (AH 91) Ringfort (AH 101) Ringfort (AH 102) Church (AH 104) Standing Stone (AH 105)	Ringfort (AH 12) Ringfort (AH 13) Ringfort (AH 15) Ringfort (AH 18) Ringfort (AH 25) Ringfort (AH 54) Holy Well (AH 64) Abbey (AH 65) Possible Barrow (AH 70) Enclosure Site (AH 73) Ringfort (AH 82) Ringfort (AH 86) Holy Well (AH 89) Castle Site (AH 91) Ringfort (AH 101) Ringfort (AH 102)

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	Ringfort (AH 101) Ringfort (AH 102) Church (AH 104) Standing Stone (AH 105) Ringfort (AH 114) Ringfort (AH 116) Ringfort (AH 119) Ringfort (AH 129) Ringfort (AH 132) Ringfort (AH 163)	Ringfort (AH 121) Ringfort (AH 163)	Ringfort (AH 152)	Ringfort (AH 163)	Ringfort (AH 114) Ringfort (AH 116) Ringfort (AH 121) Ringfort (AH 163)	Church (AH 104) Standing Stone (AH 105) Ringfort (AH 114) Ringfort (AH 116) Ringfort (AH 119) Earthwork (AH 141) Ringfort (AH 163)
Order of Preference	**2**	**4**	**5**	**3**	**6**	**1**

4.6.5 Built Heritage Route Option Appraisal

Route Corridor Option 1

Table 4.6-8 Route Corridor Option 1: Built Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH 1/ NIAH 13400803	Cloonart South/ 208323/283161	Bridge	11m SW	Indirect	Significant
BH 2	Lissagernal/ 209343/282321	Vernacular House	48m SW	Indirect	Slight
BH 3	Lissagernal/ 209624/282117	Possible Gate Lodge	45m SW	Indirect	Slight
BH 4/ RPS 34 NIAH 13400805	Deerpark/ 210509/281741	Demesne Lands & demesne wall	0m	Direct	Significant
BH 5/ RPS 21 NIAH 13400802	Deerpark/ 210827/281428	Gate Lodge	5m NE/SW (Link Road)	Indirect	Significant
BH 6/ RPS 316 & 317 NIAH 13400809 & 13400808	Carrickmoyragh/ 211043/280985	Carrickmoyragh House and Outbuildings	54m SW	Indirect	Moderate
BH 7/ RPS 325 & 326 NIAH 13303014 & 13303015	St. Anne's Glebe 211458/280395	St. Anne's Glebe House and Outbuildings	130m SW	Indirect	Slight
BH 8/ RPS 321 to 324 NIAH 13400811, 13400812, 13303019, 13303032	Lismoy 211957/279886	Lismoy House, entrance, gatelodge & outbuildings	90m SW	Indirect	Slight
BH 17 NIAH 13401447	Lackan/ 223170/272469	Farmhouse and Outbuildings	117m NE	Indirect	Slight
BH 18 NIAH 13401448	Lackan/ 222690/272619	Farmhouse and Outbuildings	98m SW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH 20/ NIAH 15401115	Leny 236952/262638	Farm House	73m NE	Indirect	Moderate
BH 21/ NIAH 15401135	Rathaniska 237043/ 262319	Country House	45m SW	Indirect	Moderate
BH 22/ NIAH 15401123	Ballynafid 239021/263069	Former Railway Station	213m NE	Indirect	Imperceptible
BH 23/ RPS B265/ NIAH 15401201	Ballynafid 241016/260929	Former RIC Barracks	18m	Indirect	Moderate
BH 24/ NIAH 15401204	Knightswood 241171/ 260804	School	38m	Indirect	Moderate

Conclusions

There are 15 BH sites located within Route Corridor Option 1. Six of these sites are listed on the Longford and Westmeath Record of Protected Structures. Thirteen sites are listed on the NIAH inventories for Longford and Westmeath with BH 4, BH 5, BH 6, BH 7, BH 8 and BH 23 dually listed on the Record of Protected Structures and NIAH for Longford and Westmeath. Two unrecorded sites were identified through cartographic analysis/windshield survey (BH 2 and BH 3).

Route Corridor Option 1 will have a Direct Impact on one built heritage site, which consists of BH 4. This is listed in the Longford Record of Protected Structures and relates to the former deerpark associated with Castleforbes Demesne. No defined boundary has been given within the RPS as to the limits of the demesne landscape. However, the NIAH list the demesne wall that runs along the SW boundary of the existing road within the survey, and as such, this could be argued as being the edge of the Deerpark Demesne that is subject to protection. The line of the demesne wall is shown as BH 4 on RFig 4.6.1 of this report. The demesne lands of Deerpark should be considered as being located to the SW of this wall. Route Corridor Option 1 would have an Indirect but Significant impact on two structures; BH 1 a bridge that is included within the NIAH for Longford and BH 5, a gatehouse associated with Castleforbes demesne. This structure is included within the RPS listing for buildings associated within the demesne. The Route Corridor Option would be located within the immediate vicinity of these two structures.

Route Corridor Option 2

Table 4.6-9 Route Corridor Option 2: Built Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH1/ NIAH 13400803	Cloonart South/ 208323/283161	Bridge	77m SW	Indirect	Slight
BH 2	Lissagernal/ 209343/282321	Vernacular House	39m SW	Indirect	Slight
BH 3	Lissagernal/ 209624/282117	Gate Lodge	107m SW	Indirect	Slight
BH 4/ RPS 34 NIAH 13400805	Deerpark/ 210509/281741	Demesne Lands & demesne wall	82m SW	Indirect	Slight
BH 12/ NIAH 13401406	Cooleeny/ 217033/273915	Cooleeny House	104m S	Indirect	Slight
BH 13/ NIAH 13401405	Cooleeny/ 217143/247202	St. Michael's RC Church	133m N	Indirect	Slight
BH 14/ NIAH 13401443	Cooleeny/ 217822/273922	Rosemount House	81m S	Indirect	Slight
BH 20/ NIAH 15401115	Leny 236952/262638	Farm House	73m NE	Indirect	Moderate
BH 21/ NIAH 15401135	Rathaniska 237043/ 262319	Country House	45m SW	Indirect	Moderate

Conclusions

There are nine BH sites located within Route Corridor Option 2. One of these sites is listed on the Longford Record of Protected Structures (BH 4). Seven sites are listed on the NIAH inventories for Longford and Westmeath. Two unrecorded sites were identified through cartographic analysis/windshield survey (BH 2 and BH 3).

Route Corridor Option 2 will not have a Direct Impact on any identified sites of built heritage significance. The closest structure to the Route Corridor Option is a vernacular house (BH 2), which is not listed within the RPS or NIAH for County Longford. The closest structure listed within the RPS is the Deerpark demesne lands (BH 4), which were associated with the Castle Forbes Estate. These are protected within the RPS, with the demesne boundary wall also listed within the NIAH.

Route Corridor Option 3

Table 4.6-10 Route Corridor Option 3: Built Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH1/ NIAH 13400803	Cloonart South/ 208323/283161	Bridge	77m SW	Indirect	Slight
BH 2	Lissagernal/ 209343/282321	Vernacular House	39m SW	Indirect	Slight
BH 3	Lissagernal/ 209624/282117	Gate Lodge	107m SW	Indirect	Slight
BH 4/ RPS 34 NIAH 13400805	Deerpark/ 210509/281741	Demesne Lands & demesne wall	82m SW	Indirect	Slight
BH 19/ 13402007	Clonwhelan/ 230710/269725	Level Crossing Gates	65m NE	Indirect	Moderate

Conclusions

There are five BH sites located within Route Corridor Option 3. One of these sites is listed on the Longford Record of Protected Structures (BH 4). Three sites are listed on the NIAH inventory for Co. Longford (BH 1, BH 4 and BH 19). Two unrecorded sites were identified through cartographic analysis/windshield survey (BH 2 and BH 3).

Route Corridor Option 3 will not have a Direct Impact on any identified sites of built heritage significance. The closest structure to the Route Corridor is a vernacular house (BH 2), which is not listed within the RPS or NIAH for County Longford. The closest structure listed within the RPS is the Deerpark demesne lands, which were associated with the Castle forbes Estate. These are protected within the RPS, with the demesne boundary wall also listed within the NIAH.

Route Corridor Option 4

Table 4.6-11 Route Corridor Option 4: Built Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH 1/ NIAH 13400803	Cloonart South/ 208323/283161	Bridge	11m SW	Indirect	Significant
BH 2	Lissagernal/ 209343/282321	Vernacular House	48m SW	Indirect	Slight
BH 3	Lissagernal/ 209624/282117	Gate Lodge	45m SW	Indirect	Slight
BH 4/ RPS 34 NIAH 13400805	Deerpark/ 210509/281741	Demesne Lands & demesne wall	0m	Direct	Moderate
BH 9	Knockloughlin/ 216823/278860	Possible Former Barracks	26m N	Indirect	Moderate
BH 16 / NIAH 13401437	Corboy/ 220974/274582	Corboy House Outbuildings	130m NE	Indirect	Slight
BH 17/ NIAH 13401447	Lackan/ 223170/272469	Farmhouse and Outbuildings	117m NE	Indirect	Slight
BH 18/ NIAH 13401448	Lackan/ 222690/272619	Farmhouse and Outbuildings	98m SW	Indirect	Slight
BH 20/ NIAH 15401115	Leny 236952/262638	Farm House	73m NE	Indirect	Moderate
BH 21/ NIAH 15401135	Rathaniska 237043/262319	Country House	45m SW	Indirect	Moderate
BH 25 NIAH 13401438	Corboy 221039/274043	Vernacular house	130m SW	Indirect	Slight

Conclusions

There are eleven BH sites located within Route Corridor Option 4. Six sites are listed on the Longford NIAH (BH 1, BH 4, BH 16, BH 17, BH 18 & BH 25) and two sites are listed on the Westmeath NIAH (BH 20 and BH 21). Two unrecorded sites were identified through cartographic analysis/windshield survey (BH 2 and BH 3) and another (BH 9) was identified through public submission.

Route Corridor Option 4 will have a Direct Impact on one built heritage site, which consists of BH 4. This site is listed in the Longford Record of Protected Structures and relates to the former deerpark associated with Castleforbes Demesne. No defined boundary has been given within the RPS as to the limits of the demesne landscape. However, the NIAH list the demesne wall that runs along the SW boundary of the existing road within the survey, and as such, this could be argued as being the edge of the Deerpark Demesne that is subject to protection. The line of the demesne wall is shown as BH 4 on RFig 4.6.1 of this report. The demesne lands of Deerpark should be considered as being located to the SW of this wall.

The footprint this Route Corridor Option will be less than Route Corridor Options 1 and 5 and this option will be at a greater distance from the built heritage site therefore it has been assigned a lesser impact level to Option 1 and 5.

Route Corridor Option 5

Table 4.6-12 Route Corridor Option 5: Built Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH 1/ NIAH 13400803	Cloonart South/ 208323/283161	Bridge	27m SW	Indirect	Moderate
BH 2	Lissagernal/ 209343/282321	Vernacular House	70m SW	Indirect	Slight
BH 3	Lissagernal/ 209624/282117	Gate Lodge	51m SW	Indirect	Slight
BH 4/ RPS 34 NIAH 13400805	Deerpark/ 210509/281741	Demesne Lands & demesne wall	0m	Direct	Significant
BH 5/ RPS 21 NIAH 13400802	Deerpark/ 210827/281428	Gate Lodge	5m NE/SW (Link Road)	Indirect	Significant
BH 6/ RPS 316 & 317 NIAH 13400809 & 13400808	Carrickmoyragh/ 211043/280985	Carrickmoyragh House and Outbuildings	118m SW	Indirect	Slight
BH 7/ RPS 325	St. Anne's Glebe 211458/280395	St. Anne's Glebe House	164m SW	Indirect	Slight

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
& 326 NIAH 13303014 & 13303015		and Outbuildings			
BH 8/ RPS 321 to 324 NIAH 13400811, 13400812, 13303019, 13303032	Lismoy 211957/279886	Lismoy House, entrance, gatelodge & outbuildings	114m SW	Indirect	Slight
BH 10	Ballyminnion 212327/273711	Bridge	0m	Direct	Significant
BH 11	Cartronageeragh 212327/273711	Canal	0m	Direct	Moderate
BH 15 NIAH 13401424	Cloonahard/ 218880/272973	Level Crossing	99m N	Indirect	Slight
BH 20/ NIAH 15401115	Leny 236952/262638	Farm House	51m NE	Indirect	Moderate
BH 21/ NIAH 15401135	Rathaniska 237043/ 262319	Country House	57m SW	Indirect	Moderate

Conclusions

There are thirteen BH sites located within Route Corridor Option 5. Of these sites five are listed within the Longford Record of Protected Structures (BH 4, BH 5, BH 6, BH 7 and BH 8)

Seven sites are listed within the NIAH inventory for Co. Longford (BH 1, BH 4-8 and BH 15) and two sites are listed on the Westmeath NIAH (BH 20 and BH 21). Four unrecorded sites were identified through cartographic analysis/windshield survey (BH 2, BH 3, BH 10 and BH 11).

Route Corridor Option 5 will have a Direct Impact on one built heritage site, which consists of BH 4. This is listed in the Longford Record of Protected Structures and relates to the former deerpark associated with Castleforbes Demesne. No defined boundary has been given within the RPS as to the limits of the demesne landscape.

However, the NIAH list the demesne wall that runs along the SW boundary of the existing road within the survey, and as such, this could be argued as being the edge of the Deerpark Demesne that is subject to protection. The line of the demesne wall is shown as BH 4 on RFig 4.6.1 of this report. The demesne lands of Deerpark should be considered as being located to the SW of this wall.

Route Corridor Option 5 would also have a Direct Impact on BH 11 – The Longford Branch of the Royal Canal which is not subject to statutory protection. This Route Corridor would have an Indirect but Significant impact on BH 1 and BH 10 both of which are bridges located within the immediate vicinity of the proposed Route Corridor.

Route Corridor Option 6

Table 4.6-13 Route Corridor Option 6: Built Heritage

Site No	Townland/NGR	Site Type	Distance	Type of Impact	Impact Level
BH 1 NIAH 13400803	Cloonart South/ 208323/283161	Bridge	11m SW	Indirect	Significant
BH 2	Lissagernal/ 209343/282321	Vernacular House	48m SW	Indirect	Slight
BH 3	Lissagernal/ 209624/282117	Possible Gate Lodge	107m SW	Indirect	Slight
BH 4/ RPS 34 NIAH 13400805	Deerpark/ 210509/281741	Demesne Lands & demesne wall	82m SW	Indirect	Slight
BH 14 NIAH 13401443	Cooleeny/ 217822/273922	Rosemount House	137m SW	Indirect	Slight
BH 20 NIAH 15401115	Leny 236952/262638	Farm House	73m NE	Indirect	Moderate
BH 21 NIAH 15401135	Rathaniska 237043/ 262319	Country House	45m SW	Indirect	Moderate
BH 22 15401123	Ballynafid 239021/263069	Former Railway Station	213m NE	Indirect	Imperceptible

Conclusions

There are eight BH sites located within Route Corridor Option 6. One of these sites is listed on the Longford Record of Protected Structures (BH 4). Three sites are listed on the NIAH inventory for Co. Longford (BH 1, BH 4 and BH 14) and three are listed on the Westmeath NIAH (BH 20, BH 21, BH 22). Two unrecorded sites were identified through cartographic analysis/windshield survey (BH 2 and BH 3).

Route Corridor Option 6 will not have a Direct Impact on any identified sites of built heritage significance. The closest structure to the Route Corridor Option is a bridge (BH 1), which is listed within the NIAH for County Longford. The structure will be in the immediate vicinity of the Route Corridor and although the impact is Indirect, it is considered to be Significant. The closest structure listed within the RPS is the Deerpark demesne lands, which were associated with the Castle Forbes Estate. These are protected within the RPS, with the demesne boundary wall also listed within the NIAH.

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The built heritage sites that have been identified within the Route Corridor Options have been assigned a potential impact. The impact type per Route Corridor has then been calculated i.e 3 Profound, 5 significant, 10 moderate and so on. Those Route Corridor Options with Profound and Significant impacts are considered to be the least preferable as these are Direct Impacts that result in the removal or all or part of a cultural heritage site. Therefore, the Route Corridor Options have been ranked according to the amount and severity of the potential impacts that have been identified. The Route Corridor Option with the fewest Direct Impacts is ranked as being the most desirable option.

Table 4.6-14 Summary Comparison of Built Heritage Impacts

Impact Type	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
Negative Significant	Bridge (BH 1) Gate Lodge (BH 5) Deerpark/ Demesne Lands & wall (BH 4)			Bridge (BH 1)	Deerpark/ Demesne Lands & wall (BH 4) Gate Lodge (BH 5) Bridge (BH 10)	Bridge (BH 1)
Negative Moderate	Country House (BH 6) Farmhouse (BH 20) Country House (BH 21) Former RIC Barracks (BH 23) School (BH 24)	Farmhouse (BH 20) Country House (BH 21)	Level Crossing Gates (BH 19)	Deerpark/ Demesne Lands & wall (BH 4) Possible Former Barracks (BH 9) Farmhouse (BH 20) Country House (BH 21)	Bridge (BH 1) Canal (BH 11) Farmhouse (BH 20) Country House (BH 21)	Farmhouse (BH 20) Country House (BH 21)
Negative	Vernacular House (BH 2)	Bridge (BH 1)	Bridge (BH 1)	Vernacular House (BH	Vernacular House (BH	Vernacular House (BH 2)

Slight	Gate Lodge (BH 3) Country House (BH 7) Country House (BH 8) Farmhouse (BH 17) Farmhouse (BH 18)	Vernacular House (BH 2) Gate Lodge (BH 3) Deerpark/ Demesne Lands & wall (BH 4) Farmhouse (BH 12) Church (BH 13) Farmhouse (BH 14)	Vernacular House (BH 2) Gate Lodge (BH 3) Deerpark/ Demesne Lands & wall (BH 4)	2) Gate Lodge (BH 3) Outbuildings (BH 16) Farmhouse (BH 17) Farmhouse (BH 18) Vernacular house (BH 25)	2) Gate Lodge (BH 3) Country House (BH 6) Country House (BH 7) Country House (BH 8) Level Crossing Gate Lodge (BH 15)	Gate Lodge (BH 3) Deerpark/ Demesne Lands & wall (BH 4) Farmhouse (BH 14)
Negative Imperceptible	Former Railway Station (BH 22)					Former Railway Station (BH 22)
Order of Preference	**5**	**2**	**1**	**4**	**6**	**3**

4.6.6 Conclusion

Table 4.6-15 Summary Comparison of Archaeological and Built Heritage Impacts

Those sites highlighted in bold have been identified within all Route Corridor Options with the same impact.

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
Profound		AH 126	AH 123	AH 126	AH 126	
Negative Significant	AH 87, AH 109, AH 112, AH 115, **AH 117**, BH 1, BH 4, BH 5	AH 87, AH 109, AH 112, AH 115, **AH 117**,	AH 57, AH 61, **AH 117**, AH 139, AH 151	AH 87, AH 109, **AH 117**, AH 112, AH 115, BH 1	AH 109, AH 155, AH 158, AH 87, **AH 117**, AH 112, AH 115, , BH 4, BH 5, BH 10	AH 87, AH 109, AH 112, AH 115, **AH 117**, BH 1
Negative Moderate	AH 1, AH 6, AH 44, AH 48, AH 50, AH 56, AH 63, AH 67, AH 68, AH 69, AH 76, AH 77, AH 88, AH 99, AH 103, AH 146, AH 148, AH 153, BH 6, BH 20, BH 21, BH 23, BH 24	AH 3, AH 16, AH 27, AH 63, AH 67, AH 68, AH 69, AH 76, AH 77, AH 88, AH 99, AH 103, AH 120, AH 125, AH 131, AH 140, AH 146, AH 148, AH 153, BH 20, BH 21	AH 3, AH 44, AH 48, AH 50, AH 56, AH 72, AH 93, AH 94, AH 107, AH 147, BH 19	AH 1, AH 45, AH 63, AH 67, AH 68, AH 69, AH 76, AH 77, AH 88, AH 99, AH 103, AH 120, AH 125, AH 131, AH 140, AH 146, AH 148, AH 153, BH 4, BH 9, BH 20, BH 21	AH 1, AH 6, AH 157, AH 63, AH 67, AH 68, AH 69, AH 76, AH 77, AH 88, AH 99, AH 103, AH 120, AH 125, AH 131, AH 140, AH 146, AH 148, AH 153, BH 1, BH 11, BH 20, BH 21	AH 3, AH 63, AH 67, AH 68, AH 69, AH 88, AH 99, AH 103, AH 126, AH 131, AH 146, AH 148, AH 153, BH 20, BH 21
Potentially Significant	**AAP 1**, **AAP 2, AAP 3,** AAP 4, AAP 11, AAP 12, AAP 16, AAP 19, AAP 20, AAP 26, AAP 39,	**AAP 1, AAP 2, AAP 3,** AAP 5, AAP 10, AAP 13, AAP 14, AAP 15, AAP 25, AAP 27, AAP 29,	**AAP 1, AAP 2, AAP 3,** AAP 5, AAP 11, AAP 12, AAP 16, AAP 19, AAP 20, AAP 26, AAP 35, AAP 36,	**AAP 1, AAP 2, AAP 3,** AAP 6, AAP 7, AAP 8, AAP 17, AAP 18, AAP 34, AAP 39, AAP 40,	**AAP 1, AAP 2, AAP 3,** AAP 4, AAP 9, AAP 21, AAP 22, AAP 23, AAP 24,	**AAP 1, AAP 2, AAP 3,** AAP 5, AAP 11, AAP 12, AAP 16, AAP 19, AAP 20, AAP 25, AAP

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	AAP 40, AAP 43, AAP 50, AAP 51, AAP 56, AAP 58, AAP 60, AAP 66, AAP 67, AAP 70, **AAP 75**, AAP 77	AAP 30, AAP 39, AAP 40, AAP 43, AAP 50, AAP 51, AAP 56, AAP 58, AAP 60, AAP 66, AAP 67, AAP 69, **AAP 75,** AAP 78	AAP 37, AAP 41, AAP 42, AAP 44, AAP 45, AAP 46, AAP 48, AAP 49, AAP 53, AAP 55, AAP 57, AAP 59, AAP 61, AAP 64, AAP 65, AAP 68, AAP 71, AAP 72, AAP 73, AAP 74, **AAP 75,** AAP 76, AAP 77	AAP 43, AAP 50, AAP 51, AAP 56, AAP 58, AAP 60, AAP 66, AAP 67, AAP 69, **AAP 75**	AAP 28, AAP 31, AAP 32, AAP 33, AAP 40, AAP 43, AAP 50, AAP 51, AAP 56, AAP 58, AAP 60, AAP 66, AAP 67, AAP 69, **AAP 75**	28, AAP 31, AAP 32, AAP 33, AAP 39, AAP 40, AAP 43, AAP 50, AAP 51, AAP 56, AAP 58, AAP 60, AAP 66, AAP 67, AAP 69, **AAP 75,** AAP 78
Negative Slight	AH 4, AH 5, AH 8, AH 10, AH 13, AH 14, AH 20, AH 21, AH 22, AH 26, AH 29, AH 58, AH 71, AH 75, AH 95, AH 97, AH 98, AH 108, AH 111, AH 113, AH 127, AH 128, AH 133, AH 154, AH 162, **BH 2,** BH 3, BH 7, BH 8, BH 17, BH 18	AH 1, AH 8, AH 11, AH 19, AH 23, AH 28, AH 32, AH 33, AH 34, AH 35, AH 39, AH 43, AH 47, AH 58, AH 71, AH 75, AH 86, AH 95, AH 97, AH 98, AH 108, AH 111, AH 113, AH 124, AH 130, AH 141, AH 154, AH 162, BH 1, **BH 2,** BH 3, BH 4, BH 12, BH 13, BH 14	AH 1, AH 8, AH 10, AH 14, AH 20, AH 21, AH 22, AH 26, AH 29, AH 59, AH 60, AH 78, AH 79, AH 81, AH 83, AH 84, AH 85, AH 96, AH 100, AH 106, AH 110, AH 134, AH 135, AH 136, AH 137, AH 143, AH 149, AH 150, AH 154, BH 1, **BH 2,** BH 3, BH 4	AH 36, AH 42, AH 58, AH 71, AH 75, AH 95, AH 97, AH 98, AH 108, AH 111, AH 113, AH 124, AH 130, AH 141, AH 154, AH 162, **BH 2,** BH 3, BH 16, BH 17, BH 18, BH 25	AH 4, AH 5, AH 156, AH 159, AH 160, AH 37, AH 46, AH 49, AH 51, AH 52, AH 55, AH 71, AH 75, AH 95, AH 97, AH 98, AH 108, AH 111, AH 113, AH 124, AH 130, AH 141, AH 154, AH 162, **BH 2,** BH 3, BH 6, BH 7, BH 8, BH 15	AH 1, AH 8, AH 10, AH 14, AH 20, AH 21, AH 22, AH 26, AH 29, AH 31, AH 34, AH 35, AH 39, AH 46, AH 49, AH 51, AH 52, AH 55, AH 71, AH 75, AH 76, AH 77, AH 95, AH 97, AH 98, AH 108, AH 111, AH 113, AH 120, AH 125, AH 154, AH 162, **BH 2,** BH 3, BH 4, BH 14
Negative Imperceptible	AH 2, AH 12, AH 15, AH 18, AH 25, AH 35, AH 41, AH 53, AH 64, AH 65, AH 70, AH 73, AH	AH 9, AH 31, AH 40, AH 64, AH 65, AH 70, AH 73, AH 82, AH 89, AH 91, AH 101, AH 102, AH 104, AH	AH 12, AH 13, AH 15, AH 25, AH 35, AH 41, AH 53, AH 62, AH 66, AH 80, AH 81, AH 90, AH 92, AH	AH 7, AH 64, AH 65, AH 70, AH 73, AH 82, AH 86, AH 89, AH 91, AH 101, AH 102, AH	AH 2, AH 34, AH 38, AH 54, AH 64, AH 65, AH 70, AH 73, AH 82, AH 86, AH	AH 12, AH 13, AH 15, AH 18, AH 25, AH 54, AH 64, AH 65, AH 70, AH 73, AH 82, AH 86,

Impact Level	Route Corridor Option 1	Route Corridor Option 2	Route Corridor Option 3	Route Corridor Option 4	Route Corridor Option 5	Route Corridor Option 6
	82, AH 86, AH 89, AH 91, AH 101, AH 102, AH 104, AH 105, AH 114, AH 116, AH 119, AH 129, AH 132, AH 163, BH 22	105, AH 114, AH 116, AH 121, AH 163	122, AH 138, AH 144, AH 145, AH 152	104, AH 105, AH 114, AH 116, AH 121, AH 163	89, AH 91, AH 101, AH 102, AH 104, AH 105, AH 114, AH 116, AH 121, AH 163	AH 89, AH 91, AH 101, AH 102, AH 104, AH 105, AH 114, AH 116, AH 119, AH 141, AH 163, BH 22
Order of preference	**5**	**3**	**2**	**4**	**6**	**1**

4.6.7 Summary Discussion of Route Corridor Options

Table 4.6-16 Summary of Archaeological Heritage (AH) Impacts

Route Corridor	Profound Negative	Significant Negative	Potential Significant Negative	Moderate Negative	Slight Negative	Imperceptible Negative
Option 1	-	5	-	18	25	26
Option 2	1	5	-	19	28	18
Option 3	1	5	-	10	29	17
Option 4	1	5	-	18	16	17
Option 5	1	7	-	19	24	20
Option 6	-	5	-	13	32	23

Table 4.6-17 Summary of Built Heritage (BH) Impacts

Route Corridor	Profound Negative	Significant Negative	Potential Significant Negative	Moderate Negative	Slight Negative	Imperceptible Negative
Option 1	-	3	-	5	6	1
Option 2	-	-	-	2	7	-
Option 3	-	-	-	1	4	-
Option 4	-	1	-	4	6	-
Option 5	-	3	-	4	6	-
Option 6	-	1	-	2	4	1

Table 4.6-18 Summary of Area of Archaeological Potential (AAP) Impacts

Route Corridor	Profound negative	Significant negative	Potential significant negative	Moderate negative	Slight negative	Imperceptible negative
Option 1	-	-	23	-	-	-
Option 2	-	-	25	-	-	-
Option 3	-	-	34	-	-	-
Option 4	-	-	21	-	-	-
Option 5	-	-	24	-	-	-
Option 6	-	-	27	-	-	-

Table 4.6-19 Summary of Architectural Heritage (AH), Built Heritage (BH) and Area of Archaeological Potential (AAP) Impacts

Route Corridor	Profound negative	Significant negative	Moderate negative	Slight negative	Imperceptible negative	Potential significant negative	Order of preference
Option 1	-	8	23	31	27	23	5
Option 2	1	5	21	35	18	25	3
Option 3	1	5	11	33	17	34	2
Option 4	1	6	22	22	17	21	4
Option 5	1	10	23	30	20	24	6
Option 6	-	6	15	36	24	27	1

Summary Route Corridor Option 1

No sites will be Profoundly Impacted by Route Corridor Option 1. However, five AH sites and three BH sites will be Significantly Impacted. This will involve the partial removal of the five archaeological sites and the construction of the road within the immediate vicinity of the structures of architectural significance, including the partial truncation of the demesne grounds associated with Castle forbes Estate. A total of 23 potentially Significant Impacts were identified in the form of Areas of Archaeological Potential (AAP). These comprise areas that hold the potential due to their landscape characteristics, of containing archaeology or their proximity to known archaeological sites. This number of impacts on AAPs is similar for Route Corridor Options 2, 4, 5 and 6. Route Corridor Option 1 has 23 Moderate Impacts comprising 18 AH and 5 BH respectively. While there are no Profound Impacts associated with Route Corridor Option 1, it has been assessed as having 8 Significant impacts, 5 AH and 3 BH. As a result it is considered to be the fifth most preferable Route Corridor Option.

Summary Route Corridor Option 2

One Profound AH Impact has been identified within Route Corridor Option 2, along with five Significant AH Impacts. Route Corridor Option 2 possesses a similar amount of Slight and Imperceptible Impacts to Route Corridor Options 1, 3, 5 and 6. Option 2 has 25 potential Significant AAP Impacts, this is similar to Route Corridor Options 1, 4, 5 and 6. On the basis of there being six Direct Impacts one of which is Profound and more Moderate Impacts (when compared to Route Corridor Option 3), Route Corridor Option 2 has been ranked as the third most preferable Route Corridor.

Summary Route Corridor Option 3

Route Corridor Option 3 has one Profound AH Impact and five Significant AH Impacts upon the cultural heritage resource. The number of potentially Significant Impacts on AAPs along this route is the highest of all the Route Corridor Options totyalling 34. Slight and Imperceptible Impacts are similar to Route Corridor Options 1,2 and 5. Due to the total Direct Impacts but less Moderate Impacts (when compared to Route Corridor Option 2) Route Corridor Option 3 is considered to be the second most preferable option out of the six Route Corridor Options.

Summary Route Corridor Option 4

Route Corridor Option 4 possesses one Profound Impact on AH and six Significant Impacts, 5 AH and 1 BH respectively. The potentially Significant Impacts on AAPs totals 21, which is the lowest of all the Route Corridor Options. Moderate Negative Impacts total 22 comprising 18 AH and 4 BH. Slight and Imperceptible Impacts combined for AH and BH are the lowest of all six Route Corridor Options at 39. However, due to the presence of a Profound Impact and six Significant Impacts, Route Corridor Option 4 has been ranked as the fourth most preferable Route Corridor Option.

Summary Route Corridor Option 5

Option 5 possesses the largest Direct Impacts, with one profound (AH) and ten (7 AH and 3 BH) signficant. Although the total of potentially significant impacts on AAPs totals less than three of the other route options and only slightly more than the remaining two options and the moderate and slight impacts are also similar to the other options, the amount of direct impacts means that this corridor is considered to be the least most desirable route option.

Summary Route Corridor Option 6

No Profound Impacts have been identified within this Route Corridor Option, which is in line with Option 1. This Route Corridor does possess six Significant Impacts (5 AH and 1 BH), which means it has of the six Route Corridor Options the least direct impact on the cultural heritage resource due to the lack of profound impacts identified. The potentially Significant Impacts are second highest of all the Route Corridor Options at 27. Moderate, slight and imperceptible impacts are all similar to the other Route Corridor Options. The fact that this option possesses the least direct impact on

the archaeological and architectural resource means that it is easily identifiable as the most desirable route corridor.

Table 4.6-20 Summary Ranking of Route Corridor Options (Cultural and Architectural Heritage)

Route Corridor Option	Order of Preference	Scaling Statement
Route Corridor Option 1	5	Highly Negative
Route Corridor Option 2	3	Moderately Negative
Route Corridor Option 3	2	Moderately Negative
Route Corridor Option 4	4	Highly Negative
Route Corridor Option 5	6	Highly Negative
Route Corridor Option 6	1	Moderately Negative

4.6.8 Action Plan to Minimise Construction Delays

An Archaeological Resolution Contract (ARC) in advance of the main Construction Contract will be implemented. Slit trenches will be dug at regular intervals along the emerging preferred route during the ARC. This will ensure that archaeological excavations will not delay construction works.

A Watching Brief if appropriate will be put in place during construction works to ensure that any previously unrecorded sites which come to light during the course of the development are adequately identified and recorded.

4.7 Soils and Geology and Hydrogeology

Soils and Geology

4.7.1 Introduction

Six Route Corridor Options have been considered in this geological appraisal. With respect to the identified Route Corridor Options, this section provides an overview of the geomorphological environment, the unconsolidated (glacial subsoils and post glacial soils) geological environment and the solid bedrock geology. Geological heritage, historical land use and economic use of the geological environment are also discussed.

4.7.2 Methodology

This section of the Route Corridor Selection Report has been carried out to fulfil an appraisal of each Route and to carry out a comparative evaluation of the Route Corridors.

The existing geological and hydrogeological environment has been described in the Constraints Report (N4 Mullingar to Longford (Roosky) Constraints Study).

Additional appraisals have been carried out using aerial photos, data from a peat probing survey and a field survey (May 2008) and data from the Phase 1 ground investigation undertaken in July through to September 2008.

The approach adopted in the Route Corridor Option appraisal and the appraisal of Poor Ground has consisted of:

i. Desk study of geological and hydrogeological setting of specific Route Corridor Options;
ii. Evaluation of Route Corridor Options from a visual survey (field survey); and
iii. Evaluation of geotechnical data, using ground investigation data (peat probes, trial pits and borehole data).

Owing to the general similarity of the regional geological and hydrogeological setting across the study area, there are few impacts that differ and would be considered significantly different in an appraisal for ranking particular Route Corridors. The geological Route Corridor Option appraisal provided herein provides details of the setting and potential impacts of the six Route Corridors. The main attributes of importance in the appraisal are peat/soft ground, economic geological sites and geological heritage.

The Route Corridor width considered is a nominal 500m in accordance with the NRA *Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Roads Schemes* (2008). However this width was extended over the karst aquifer areas in the order of kilometres. In addition, where the 500m corridor widths applied, a feature or a point of note that occurred just outside this distance was taken account of in the study.

These attributes have been included in the Project Appraisal Balance Sheet (PABS) presented in Appendix 1, Volume II.

In terms of the appraisal, the construction of a new road will impact on the geological and hydrogeological environment. Positive impacts will be brought about from a development of a greater scientific understanding of the geological and hydrogeological setting of this region. Within the appraisal the criteria ranges on a scale from:

- Minor positive;
- Neutral;
- Slightly negative;
- Moderately negative;
- Major Negative.
- Severe Negative

These criteria are set out in Table 4.2 of the NRA Guidelines (2008).

Significant information for the Study Area was collected and collated during the constraints stage of the project, whereby geological and hydrogeological issues were discussed and unacceptable impacts and risks identified. This Route Corridor Selection Stage is a further refinement of the Constraints Study, albeit the study extent is confined to actual Route Corridors.

4.7.3 Overview of Solid Geology, Subsoils and Soils along Route Corridors

Regional Overview

County Westmeath and County Longford have been heavily glaciated in the recent geological past. The geomorphological landform of Westmeath and Longford is characterised by generally low lying, flat terrain, interspersed with undulating to gently undulating drumlin terrain.

The low-lying, flat terrain is generally occupied with large expanses of peat deposits, underlain by deep (i.e. thick) drift deposits (RFig 4.7.1 to 4.7.4 Subsoils Overview, Volume III). These drift deposits are dominated by fine materials of low to moderate permeability. The formation of the peat deposits is considered to result from impeded perculation through the subsoil material and also the high water table in the region, associated with the low relief in relation to the regional hydrology. Where the peat is absent soils are dominated by the distribution of poorly drained and well-drained mineral soils and alluvium. The soils overview is shown in RFig 4.7.17 to 4.7.20 and Site Investigation shown in RFig 4.7.21 to 4.7.28 (Volume III). The soils are also described in Section 4.3 of this Report, Land Use: Agriculture.

The peatlands in the midlands have been assessed and many have been designated as areas of ecological importance. The designated areas are illustrated on RFig 4.7.5 to RFig 4.7.8 and RFig 4.10.1 to RFig 4.10.8, Volume III.

A peat probing survey (June 2008) was carried out to specifically examine the presence and thickness of the peat. The ground investigation programme findings are summarised as follows:

- In general, the logs indicate that cutover peat is present where it is mapped on the Teagasc subsoils dataset, as presented in the Constraints Report. However, there are areas where peat is absent and where peat is thicker than expected for 'cutover' peat. The thicker areas are the areas of intact bog which can be observed on the aerial photos and generally coincide with areas of raised bog.
- Forty six out of fifty nine probes into the peat recorded depths of peat of less than 3m thick, with the majority less than 2m.

- In general the peat is underlain by clays or sands and gravels.
- The peat probe programme highlighted areas of thicker deposits (greater than 3m) in the following areas:
  - At the northwestern most end of the Route Corridor domain in the townland of Tomisky and Edercloon. This area is the starting point for all Route Corridor Options;
  - Northeast of Lough Forbes between the townlands of Clooniher and Annaghcooleen;
  - Between Edgeworthstown and Rathowen in the townland of Windtown North along the county boundary. Route Corridor Option 3 traverses this area;
  - Garriskill Bog which is located to the north of all the Route Corridor Options, and lies closest to Option 3.

Drumlins intersperse the low lying flat landscape, forming higher elevation areas and dividing the large tracts of peatlands. The drumlins are most pronounced to the north of the study area, i.e. north of the existing N4.

Drumlins are glacial ridges of compact glacial material which accumulates under the ice sheets and are shaped in the orientation of the ice flow. These drumlins are aligned in a north-west to southeast direction, indicating the general direction of glacier flow of the final ice stream.

Small and limited gravel deposits are recorded to the east of Edgeworthstown (Clonwhelan and Street). These sinuous and discontinuous deposits were laid down by glacial meltwater during the ice sheet retreat phase.

There are also notable areas of alluvium, particularly in the vicinity of Longford Town along the Camlin River and its tributaries. These coincide with areas of known flooding.

The depths of the subsoils are variable, though in general are relatively thick. The areas of shallower subsoils coincide with the elevated portions of the landscape. upland areas

The bedrock of Westmeath and Longford is dominated by Carboniferous impure limestone across the majority of the Route Corridor domain. There are minor amounts of sandstones, shales and volcanic rocks occupying a small proportion near the northernmost end of the study area. There is also a proportion of pure limestone between Newtown Forbes and Longford Town (northwest of study area). The distribution of bedrock within the study area is shown on RFig 4.7.9 to RFig 4.7.12, Bedrock Geology Overview, Volume III.

Route Corridor Option 1 (RFig 10.1 to RFig 10.4)

Route Corridor Option 1 commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (Node 04), to the north of Newtown Forbes. The Route Corridor generally runs close to the existing N4, running largely to the south of the exiting N4 between Nodes 2 and 2A near Cloonart North. The geomorphological environment in this area (Node 01 to Node 04) is characterised by generally low-lying flat terrain. There are significant areas of peat, which are of considerable thickness in places, evidenced from peat probing at Tomisky and Edercloon. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate where the peat is absent. Compact till deposits underlie the peat, which are generally composed of clay and gravelly clay. This material is generally of low to moderate permeability. From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprises impure limestones, sandstones and shales.

From Deerpark (Node 04) this Route Corridor Option passes offline to the north of Newtown Forbes and Longford Town to Lisnamuck (Node 07). The geomorhological environment is characterised by rolling lowland. There are no areas of significant peat deposits recorded in this area. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate. The subsoil is recorded as till, generally comprising clay and gravelly clay, expected to be of low to moderate permeability. The subsoil materials along the River Camlin are recorded as comprising alluvium deposits. This comprises a mixture of fluvial-granular materials. Between Clooniher (Node 03) and Lissagernal (Node 03A) the Route Corridor traverses over a unit of conglomerate and sandstone. This zone occupies approximately 800m. Between Lissagernal (Node 03A) and Deerpark (Node 04) the Route Corridor Option is

underlain by turbidites and shales that extend as far as Carrickmoyragh. In Carrickmoyragh, between Node 04 and Lismoy (Node 05) and as far as Clooncoose (Node 07), approximately 5km, the bedrock is recorded as limestone.

From Clooncoose to Ballynagoshen (Node 07 to Node 10A) the Route Corridor runs offline to the north of the existing N4 alignment. The geomorphological environment is characterised by rolling to gently undulating lowland. There are no significant areas of peat recorded in this section of the Route Corridor. “Deep well-drained soils” dominate. The dominant subsoil is recorded as clay to gravelly clay till, however small areas of alluvium are recorded along stream and river sections, where fluvial-granular materials may be encountered. The subsoil thickness in this area is not considered significant and areas of exposed bedrock are recorded. The bedrock in this area is recorded as generally impure limestone, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town.

From Ballynagoshen to Windtown (Node 10A to 16) the Route Corridor runs offline to the south of the existing N4 alignment, running to the south of Edgeworthstown. The geomorphological environment is characterised by rolling lowland and low-lying flat terrain. Significant peat deposits are recorded in this area, most notably in the environs of Derrydooan. The soils where peat is absent are dominated by “poorly drained mineral soils”. The subsoils underlying the peat are dominated by clay and gravelly clay till, of low to moderate permeability. Alluvium deposits are noted along some river channels. The bedrock is dominated by impure limestone.

From Windtown to Ballinalack (Node 16 to 17) the Route Corridor runs to the south of the existing N4 alignment. The alignment runs to the south of Rathowen and Ballinalack. The geomorphological environment is characterised by rolling lowland interspersed in significant areas by low lying peatlands. The Route Corridor generally avoids the areas of extensive peat in this section. The subsoils are recorded as clay and gravelly clay till. The bedrock is dominated by impure limestones.

From Ballinalack the Route Corridor runs largely to the south of the existing N4 between Nodes 17 and 19, then follows the route of the existing N4 alignment to Node 21A near Culleen Beg. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel. The Route Corridor endeavours to avoid

areas of peat, however short sections may encounter thin deposits along the Route Corridor. Soils are dominated by “well-drained mineral soils”. The subsoil material varies from a limestone derived till to a chert derived till. The composition of these tills is dominated by clay. However the Chert Till may be composed of more granular lenses. In Clanhugh Demesne (Node 20) the bedrock mapping shows a change from an impure limestone to a cherty limestone, and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone.

Route Corridor Option 2 (RFig 20.1 to RFig 20.4)

This Route Corridor option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark, to the north of Newtown Forbes. This Route Corridor passes largely to the north of the existing N4 at Cloonart North. The geomorphological environment in this area (Node 01 to Node 04) is characterised by generally low-lying flat terrain. There are significant areas of peat, which are of considerable thickness in places, evidenced from peat probing at Tomisky and Edercloon. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate where the peat is absent. Till deposits underlie the peat, composed of compact clay and gravelly clay, of low to moderate permeability.

The bedrock is dominated by impure limestones. From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprises impure limestones, sandstones and shales. Between Clooniher (Node 03) and Kilmacannon (Node 03B) the Route Corridor traverses over a unit of conglomerate and sandstone.

From Deerpark this Route Corridor option passes offline to the north of the existing N4 alignment to Clooncoose (Node 07A). The geomorhological environment is characterised by rolling lowland, with one low lying area at Creenagh, where peat is recorded. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate. The subsoil is recorded as till, generally comprising clay and gravelly clay, expected to be of low to moderate permeability. The subsoil materials along the River Camlin are recorded as comprising alluvium deposits. This comprises a mixture of fluvial-granular materials.

From Kilmacannon (Node 03B) to Carrickmoyragh the Route Corridor Option is underlain by turbidites and shales. In Carrickmoyragh, between Node 04 and Cloonrallagh (Node 06) and as far as Clooncoose (Node 07A), approximately 5km, the bedrock is mapped as limestone.

From Clooncoose to Coolnahinch (Node 07A to Node 08) the Route Corridor runs along the existing Longford Bypass. The geomorphological environment is characterised by gently rolling lowland. There are no areas of peat recorded along this section of the Route Corridor. “Deep well-drained soils” dominate. The subsoil is recorded as comprising clay to gravelly clay, expected to be of low to moderate permeability. The underlying bedrock in this area is recorded as an alternating succession of limestone, sandstone and shale.

From Coolnahinch to Ballinalack (Node 08 to Node 17) the Route Corridor runs to the south of the existing N4 alignment, bypassing Edgeworthstown, Rathowen and Ballinalack to the south. The geomorphological environment is characterised by rolling lowland interspersed with low-lying flat terrain. Significant peat deposits are recorded in the environs of Derrydooan. The subsoil is recorded as comprising clay and gravelly clay. The bedrock in this area is recorded as impure limestone.

From Ballinalack to Culleen Beg (Node 17 to Node 21) the Route Corridor runs close to the existing N4, with an offline section parallel to the existing Dublin-Sligo railway line to the south of Ballynafid Lake. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel pNHA, cSAC and SPA. The Route Corridor endeavours to avoid areas of peat, however short sections may encounter thin deposits along the Route Corridor. Soils are dominated by “well-drained mineral soils”. The mineral subsoil material varies from a till derived from limestone to a till derived from chert. The composition of both tills will be similar and will be dominated by clay, however the chert till may be composed of more granular lenses. The bedrock underlying the unconsolidated material comprises impure limestone. In Clanhugh Demesne the bedrock mapping shows a change from an impure limestone to a cherty limestone, extending from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by

an impure limestone. This Route Corridor ties into the existing Mullingar dual carriageway at Node 21A to Node 22 (Culleen Beg).

Route Corridor Option 3 (RFig 30.1 to RFig 30.4)

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark, to the north of Newtown Forbes. This Route Corridor passes largely to the north of the existing N4 at Cloonart North. The geomorphological environment in this area is characterised by generally low-lying flat terrain. There are significant areas of peat, which are of considerable thickness in places, evidenced from peat probing at Tomisky and Edercloon. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate where the peat is absent. Till deposits underlie the peat, composed of compact clay and gravelly clay, of low to moderate permeability. The bedrock is dominated by impure limestones however between Clooniher (Node 03) and Kilmacannon (Node 03B) the Route Corridor traverses over a unit of conglomerate and sandstone.

From Deerpark this Route Corridor Option passes to the north of the existing N4 alignment to Cloonrallagh (Node 06). The geomorphological environment is characterised by rolling lowland, with one low lying area at Creenagh. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate. The subsoil is recorded as till, generally comprising clay and gravelly clay and is expected to be of low to moderate permeability. The subsoil materials along the River Camlin are recorded as comprising alluvium deposits. This comprises a mixture of fluvial-granular materials. The underlying bedrock in this area is recorded as a Pure Carbonate Limestone, which is known to contain fractures and cavities at depth. From Kilmacannon (Node 03B) to Carrickmoyragh the Route Corridor Option is underlain by turbidites and shales. In Carrickmoyragh, between Node 04 and Cloonrallagh (Node 06) and as far as Clooncoose (Node 07), approximately 5km, the bedrock is mapped as limestone.

Through Cloonrallagh to Clooncoose (Node 06 to Node 07) the Route Corridor runs north of the existing N4 alignment. The geomorphological environment in this area is gently rolling lowland with a predominant gradient towards the River Camlin valley. The subsoil material in this area is dominated by alluvium deposits associated with

the River Camlin, and comprises an assortment of materials from clay to gravel. The underlying bedrock is this area is recorded as a Pure Carbonate Limestone, which is known to contain fractures and cavities at depth. From Clooncoose to Heathland (Node 07 to Node 18A), approximately 30km, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town.

From Clooncoose to Ballynagoshen (Node 07 to Node 10) the Route Corridor runs to the north of the existing N4 alignment. The Route Corridor runs to the south of Carrickglass Demesne pNHA. The geomorphological environment is characterised by rolling to gently undulating lowland. There are no significant areas of peat recorded in this section of the Route Corridor. “Deep well-drained soils” dominate. The dominant subsoil is recorded as clay to gravelly clay till, however small areas of alluvium are recorded along stream and river sections, where fluvial-granular materials may be encountered. The subsoil thickness in this area is not significant and areas of exposed bedrock are recorded.

From Ballynagoshen to Curry (Node 15) the Route Corridor passes north of the existing N4 alignment. The geomorphological environment to the north of Edgeworthstown is characterised by undulating lowlands rising to hilly topography (max elevation of 120-130m OD) at Brackloon. The dominant subsoil is recorded as a chert dominated clay and gravelly clay deposit. The underlying bedrock in this area is recorded as impure limestone. The thickness of subsoil material along this section is not considered to be extensive, with rock outcropping at the surface recorded in a number of areas along this section of the Route Corridor.

From Curry (Node 15) to Culleen Beg the Route Corridor runs to the north of the existing N4 alignment, bypassing Rathowen, Ballinalack, Bunbrosna, Ballynafid and Portnashangan to the north. The Route Corridor also runs to the north of Ballynafid Lake and Fen pNHA and Scragh Bog pNHA and cSAC. The geomorphological environment is characterised by undulating lowland interspersed with a low lying flat terrain. There are more pronounced topographic elevations and slopes to the north of Bunbrosna. Soils are dominated by “well-drained mineral soils”. The subsoil recorded along this section of the Route Corridor comprises tills derived from limestone and chert. This is considered to be generally composed of clay and gravelly clay. From Heathland (Node 18A) the Route Corridor passes through to Loughanstown (Node

18B) and Ballynagall (800m south of Node 18B) and is occupied by a cherty limestone. From Ballynagall to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone. This Route Corridor ties into the existing Mullingar dual carriageway at Node 21A to Node 22 (Culleen Beg)

Route Corridor Option 4 (RFig 40.1 to RFig 40.4)

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (Node 04), to the north of Newtown Forbes. The Route Corridor passes largely to the south of the existing N4 at Cloonart North. The geomorphological environment in this area (Node 01 to Node 04) is characterised by generally low-lying flat terrain. There are significant areas of peat, which are of considerable thickness in places, evidenced from peat probing at Tomisky and Edercloon. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate where the peat is absent. Compact till deposits underlie the peat, which are generally composed of clay and gravelly clay. This material is generally of low to moderate permeability. From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprises impure limestones, sandstones and shales. Between Clooniher (Node 03) and Lissagernal (Node 03A) the Route Corridor traverses over a unit of conglomerate and sandstone. This zone occupies approximately 800m wide and between Lissagernal (Node 03A) and Deerpark (Node 04) the Route Corridor Option is underlain by turbidites and shales.

From Deerpark to Lackan (Node 04 to Node 10A) the Route Corridor runs along the outermost corridor around Longford Town, to the north of the existing N4 alignment. The Route Corridor runs to the north of Carrickglass Demesne. The geomorphological environment in this section of the Route Corridor is characterised by undulating to hilly terrain. There is a general absence of peat material in this section of the Route Corridor, however there are small areas of cutover peat mapped in Drumure, Killoe and Kilmoyle. “Poorly drained mineral soils” and “poorly drained mineral soils with a peaty topsoil” dominate. The dominant subsoil is recorded as Limestone Till, comprising clay and gravelly clay. The subsoil in the environs of the River Camlin is recorded as Alluvium, which comprises a mix of materials varying from clay to gravel. The bedrock along the northern half of this section of the Route Corridor is Pure Carbonate Limestone, with the southern half underlain by impure limestone and shale. In Garrowhill (Node 04A) the bedrock is mapped as limestone as far as Knockloughlin (Node 04B), where it is then mapped as impure limestones. From Knockloughlin to Clanhugh Demesne (Node 04B to just south of Node 20),

approximately 30km, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town.

From Ballynagoshen to Windtown (Node 10A to Node 16) the Route Corridor runs to the south of the existing N4 alignment, running to the south of Edgeworthstown. The geomorphological environment is characterised by rolling lowland and low-lying flat terrain. Significant peat deposits are recorded in this area, most notably in the environs of Derrydooan. The subsoils underlying the peat are dominated by clay and gravelly clay till, of low to moderate permeability. Alluvium deposits are noted along some river channels. The bedrock is dominated by impure limestone.

From Windtown to Ballinalack (Node 16 to Node 17) the Route Corridor runs to the south of the existing N4 alignment. The alignment runs to the south of Rathowen and Ballinalack. The Route Corridor is immediately south of the existing N4 in the environs of the Lough Garr NHA. The geomorphological environment is characterised by rolling lowland interspersed with significant areas of low lying peatlands. The Route Corridor generally avoids the areas of extensive peat in this section. The subsoils are recorded as clay and gravelly clay till. The bedrock is dominated by impure limestones.

From Ballinalack to Culleen Beg (Node 17 to Node 21) the Route Corridor runs close to the existing N4, with a section parallel to the existing Dublin-Sligo railway line to the south of Ballynafid Lake and Fen pNHA and south of Scragh Bog pNHA and cSAC. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel pNHA, cSAC and SPA. The Route Corridor endeavours to avoid areas of peat, however short sections may encounter thin deposits along the Route Corridor. Soils are dominated by “well-drained mineral soils”. The mineral subsoil material varies from a till derived from limestone to a till derived from chert. The composition of both tills will be similar and will be dominated by clay, however the chert till may be composed of more granular lenses. In Clanhugh Demesne the bedrock mapping shows a change from an impure limestone to a cherty limestone and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg)

the bedrock is occupied by an impure limestone. This Route Corridor ties into the existing Mullingar dual carriageway at Node 21A to Node 22 (Culleen Beg).

Route Corridor Option 5 (RFig 50.1 to RFig 50.4)

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (Node 04), to the north of Newtown Forbes. The Route Corridor passes largely to the south of the existing N4 at Cloonart North. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The geomorphological environment in this area (Node 01 to Node 04) is characterised by generally low-lying flat terrain. There are significant areas of peat, which are of considerable thickness in places, evidenced from peat probing at Tomisky and Edercloon. “Poorly drained mineral soils” and “poorly drained minerals with a peaty topsoil” dominate where the peat is absent. Compact till deposits underlie the peat, which are generally composed of clay and gravelly clay. This material is generally of low to moderate permeability.

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprises impure limestones, sandstones and shales. Between Clooniher (Node 03) and Lissagernal (Node 03A) the Route Corridor traverses over a unit of conglomerate and sandstone. Between Lissagernal (Node 03A) and Deerpark (Node 04) the Route Corridor Option is underlain by turbidites and shales that extend as far as Carrickmoyragh.

From Deerpark to Lackan (Node 4 to Node 14) the Route Corridor runs to the east of Newtown Forbes, in an orbital Route around the west and south of Longford Town, running along the proposed N5 Longford Bypass. Within this section, the Route Corridor between Node 4 to Node 5A is to the north of the existing N4 alignment, whilst Node 5A to Node 14 passes to the south of the existing N4 alignment. The Route Corridor then continues to the south of the existing N4 alignment to Lackan. The Route Corridor runs to the north of Derrymore pNHA. The geomorphological environment is characterised by gently undulating lowland to low lying areas to the west and south of Longford Town, particularly along the River Camlin floodplain. The topographic gradient immediately to the east of the N63 road and the Royal Canal is quite pronounced in relation to the surrounding landform. There are areas of peat recorded to the west and southwest of Longford Town and at Cooleeny/Cartronawar (south of Straid on RFig 4.7.18). “Poorly drained mineral soils” and “poorly drained

minerals with a peaty topsoil" dominate outside the main peat areas. The dominant subsoil is recorded as a Limestone Till, although a Sandstone Till is recorded west of Longford Town. Generally the composition of the till will consist of clay and gravelly clay.

The bedrock underlying the subsoil between Deerpark and Mullagh (close to the N5 to west of Longford Town) is recorded as pure bedded limestone. In Carrickmoyragh, between Node 04 and Lismoy (Node 05) as far as the northern limits of Longford Town at Node 05B (Aghareagh/Ballyminion) the bedrock is mapped as limestone. From Ballyminion to Clanhugh Demesne (Node 05B to just south of Node 20), approximately 30km, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town.

From Lackan to Windtown (Node 14 to Node 16) the Route Corridor runs to the south of Edgeworthstown, to the south of the existing N4 alignment. The geomorphological environment is characterised by rolling lowland and low-lying flat terrain. Significant peat deposits are recorded in this area, most notably in the environs of Derrydooan. The subsoils underlying the peat are dominated by clay and gravelly clay till, of low to moderate permeability. Alluvium deposits are noted along some river channels.

From Windtown to Ballinalack (Node 16 to Node 17) the Route Corridor runs to the south of the existing N4 alignment. The alignment runs to the south of Rathowen and Ballinalack. The Route Corridor is immediately south of the existing N4 in the environs of Lough Garr NHA. The geomorphological environment is characterised by rolling lowland interspersed in significant areas of low lying peatlands. The Route Corridor generally avoids the areas of extensive peat in this section. The subsoils are recorded as clay and gravelly clay till. The bedrock is dominated by impure limestones.

From Ballinalack to Culleen Beg (Node 17 to Node 21A) the Route Corridor runs close to the existing N4 alignment. The Route Corridor runs immediately to the north of Lough Iron pNHA and SPA, south of Ballynafid Lake and Fen pNHA, south of Scragh Bog pNHA and cSAC and north of Lough Owel pNHA, SPA and cSAC. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel. The Route Corridor endeavours to avoid areas of peat, however short sections may

encounter thin deposits along the Route Corridor. Soils are dominated by “well-drained mineral soils”. The subsoil material varies from a limestone derived till to a chert derived till. The composition of these tills is dominated by clay, however the chert till may be composed of more granular lenses.

In Clanhugh Demesne the bedrock mapping shows a change from an impure limestone to a cherty limestone, and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone. This Route Corridor ties into the existing Mullingar dual carriageway at Node 21A to Node 22 (Culleen Beg).

Route Corridor Option 6 (RFig 60.1 to RFig 60.4)

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (east of Node 3B), to the north of Newtown Forbes. The Route Corridor passes largely to the south of the existing N4 at Cloonart North. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC. The geomorphological environment in this area is characterised by generally low-lying flat terrain. There are significant areas of peat, which are of considerable thickness in places, evidenced from peat probing at Tomisky (Node 01) and Edercloon (Node 02). “Poorly drained mineral soils” and “poorly drained minerals with a peaty topsoil” dominate where the peat is absent. Compact till deposits underlie the peat, which are generally composed of clay and gravelly clay. This material is generally of low to moderate permeability.

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprises impure limestones, sandstones and shales. Between Clooniher (Node 03) and Kilmacannon (Node 03B) the Route Corridor traverses over a unit of conglomerate and sandstone.

From Deerpark this Route Corridor Option passes to the north of Newtown Forbes and Longford Town through Cloonrallagh (Node 6) and Clooncoose (Node 7) to Lisnamuck (Node 7), to the north of the existing N4 alignment. The geomorphological environment is characterised by rolling lowland, with one low lying area at Creenagh,

where peat is recorded. “Poorly drained mineral soils” and “poorly drained minerals with a peaty topsoil” dominate. The subsoil is recorded as till, generally comprising clay and gravelly clay, expected to be of low to moderate permeability. The subsoil materials along the River Camlin are recorded as comprising alluvium deposits. This comprises a mixture of fluvial-granular materials.

From Kilmacannon (Node 03B) to Carrickmoyragh the Route Corridor Option is underlain by turbidites and shales. In Carrickmoyragh, between Node 04 and Cloonrallagh (Node 06) and as far as Clooncoose (Node 07), approximately 5km, the bedrock is mapped as limestone. From Clooncoose to Clanhugh Demesne (Node 07 to Node 20), approximately 30km, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town.

From Clooncoose (Node 7) to Lisfarrell (Node 9D) via Freehalman the Route Corridor runs to the north east of the existing Longford Bypass and then south of the existing N4 from Node 9A onwards. It crosses the Dublin Sligo railway line between Node 9C and Note 9D. The geomorphological environment is characterised by gently rolling lowland. There are no areas of peat recorded along this section of the Route Corridor. “Deep well-drained soils” dominate. The subsoil is recorded as comprising clay to gravelly clay, expected to be of low to moderate permeability. The underlying bedrock in this area is recorded as an alternating succession of limestone, sandstone and shale.

As stated above, the Route Corridor runs to the south of the existing N4 alignment from Freehalman (Node 9A) to Ballinalack, bypassing Edgeworthstown to the south, Windtown (Node 16), Rathowen to the south and Ballinalack (Node 17A, 17) to the south. The geomorphological environment is characterised by rolling lowland interspersed with the low-lying flat terrain. Significant peat deposits are recorded in the environs of Derrydooan. The subsoil is recorded as comprising clay and gravelly clay. The bedrock in this area is recorded as impure limestone.

From Ballinalack to Culleen Beg (Node 22) the Route Corridor runs close to the existing N4 alignment. The Route Corridor runs immediately to the north of Lough Iron pNHA and SPA, south of Ballynafid lake and fen pNHA, south of Scragh Bog pNHA and cSAC and north of Lough Owel pNHA, SPA and cSAC. The

geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel. The Route Corridor endeavours to avoid areas of peat, however short sections may encounter thin deposits along the Route Corridor. Soils are dominated by "well-drained mineral soils". The subsoil material varies from a limestone derived till to a chert derived till. The composition of these tills is dominated by clay, however the chert till may be composed of more granular lenses.

In Clanhugh Demesne (Node 20) the bedrock mapping shows a change from an impure limestone to a cherty limestone, and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone. This Route Corridor ties into the existing Mullingar dual carriageway at Node 21A to Node 22 (Culleen Beg).

4.7.4 Overview of Poor Ground Conditions

Information is presented to highlight the risk of encountering areas of poor ground in the form of peat, soft alluvium and soft till deposits that may require treatment or ground improvement measures along and in the vicinity of the six Route Corridor Options. The information used has been obtained from the following sources with particular emphasis on information obtained during the Phase 1 ground investigation.

- Cobra Probing Investigation Factual Report; Hyder Tobin, June 2008;
- Phase 1 Preliminary Ground Investigation; Irish Drilling Ltd Site Investigation Report, Book 1 of 2 and 2 of 2, November 2008;
- Geological map of peat deposits as mapped by the Geological Survey of Ireland;
- Database of archive boreholes showing rockhead depths obtained from the Geological Survey of Ireland.
- Aerial Photography

This section should be read in conjunction with the interpretation of the stratum depths as detailed in Appendix 14, Volume II. The drawings associated with this are RFig 4.7.21 to RFig 4.7.28. These drawings detail the following for the Six Route Corridor Options;

1. Exploratory hole locations including archive borehole locations;

2. Peat overlay from Geological Survey of Ireland;
3. Poor Ground Areas of soft/loose deposits including peat;
4. Location of main waterways (canals/rivers/streams).

The overall impact levels are summarised in Table 4.7-9.

Route Corridor Option 1

Between Nodes 01 and 02 (Dromod-Roosky tie in) peat varies between 1.8m and 6.9m in thickness and is underlain by soft superficial soils. A maximum depth of 7.3m of soft deposits was encountered in the vicinity of Node 01 in borehole N15 (S).

The archive borehole between Nodes 01 and 02 indicates bedrock at 11m below ground level (m b.g.l). Borehole N15(S) also refuses at 9.3m b.g.l indicating possible bedrock. Between Node 02A and Node 03 a bog feature is encountered with soft deposits (including 4.3m of peat) encountered up to 6.2m.b.g.l (P45).

Limestone bedrock was confirmed at 6.0m b.g.l between Node 02A and the river and one borehole and trial pit terminated on a possible bedrock obstruction within the bog area at N12 and TPN 12.

Just to the west of Node 02A the River Rinn crosses perpendicular to the alignment flowing into Lough Forbes. The closest probes (C8 and C9) shows up to 2.4m of peat deposits on the east bank of the river; the peat and soft alluvial deposits increase to a maximum thickness of 6.2m overlying firmer till deposits as the alignment crosses the bog. Locally probable bedrock (TPN 12 and N12) is noted in the bog area at 3.4-3.6m b.g.l although, as indicated by the probing the alluvium thickens as the Route Corridor crosses the bog.

Limestone bedrock was encountered at 6.0m b.g.l (N13 and N14) close to where the river crosses the alignment.

At Node 03 the peat extends to 4.2m b.g.l and the alluvium to 5.1m b.g.l before firmer deposits are encountered. Further east of Node 03 to Node 06 the available exploratory hole data show no occurrence of soft ground with firm becoming stiff till deposits encountered below ground level. East of Node 04 at borehole N11(S) very strong limestone bedrock is encountered 3m below the top of the railway cutting and

the archive borehole data at the edge of the Route Corridor shows bedrock at depths of 6.0 to 15.0m b.g.l. Close to Node 6 the archive data shows bedrock at 13.0-14.0m b.g.l.

Between Node 6 and Node 8A the Route Corridor crosses the Camlin River and a smaller river. Some softer deposits should be expected, associated with the rivers' floodplains although the probing close to the Camlin River (P40) indicated firm glacial deposits. Between Node 07 and Node 8A one archive borehole shows rock 3.0m b.g.l.

Between Node 8B and Node 10 the Route Corridor crosses 2 small rivers/streams and some softer deposits should be expected. Trial pit N110 close to Node 8B indicates possible bedrock at 0.60m depth and borehole N7 east of Node 10 encountered a very strong limestone at 1.2m b.g.l. The Route Corridor crosses the existing N4 at Node 10A and the railway line at Node 14. Close to the railway line the glacial till deposits extend to depths exceeding 25.4m below ground level as indicated by borehole S25A.

Close to Node 14 the southern edge of the Route Corridor crosses a localised soft area of peat (1m depth) overlying soft till deposits to 3.7m below b.g.l.

Between Nodes 14A and 16 the Route Corridor encroaches on to a large expanse of raised bog to the south. Locally peat up to 2.0m was encountered along the centreline of the Route Corridor although the corridor extends towards the raised peat bog deposits to the south where thicker peat deposits will be encountered. Seepage (TPC, S155 and S156) and locally rapid ingress of water (TPH) into the pits at the interface between the peat and uncompact gravelly sandy silt till deposits was observed in the pits excavated adjacent to the raised bog.

Between Node 16 and Node 17A the Route Corridor runs north of the Black River. The exploratory hole data show till deposits comprising gravelly silt and very silty gravels. Possible bedrock is noted in TPD at 3.20m b.g.l. The Route Corridor crosses the Inny River at Node 17 where bedrock was encountered at 4.0m b.g.l. Probing and borehole data in the vicinity of the east and west banks of the Inny River indicates no soft deposits with firm gravelly silt (till) overlying shaley limestone bedrock.

At Node 20, close to the railway line till deposits extend to a depth of 16.8m (S28), before encountering probable weathered bedrock. The quality of the rock recovered is poor and comprised cobble sized clasts of siltstone and limestone.

Between Node 20 and Node 21 of peat is shown between Nodes 21A and 22.

Route Corridor Option 2

The sub-surface geology is the same as Option 1 between Nodes 01 and 03A with a maximum depth of 7.3m of soft deposits encountered in the vicinity of Node 01 and up to 6.2m of soft deposits between Node 02A and Node 03.

Between Node 02 and 2A stiff/compact till deposits are encountered. At Node 03 peat is encountered to 4.2m (P43) and 4.3m (P45) b.g.l with soft alluvium continuing to 5.1m and 6.2m b.g.l overlying firmer deposits of till.The corridor skirts the southwest edge of a mapped peat outcrop northeast of Newtown Forbes.

Between Node 06 and Node 07A the Route Corridor crosses the Camlin River. Softer deposits are expected to be encountered associated with the river's floodplain. The closest exploratory holes shows till comprising soft silt/clay to 2.0m b.g.l becoming firm/stiff gravelly clays/silts overlying bedrock encountered at 13m and 14.0m (archive holes), 10.9m (N10), 7.2m (N9) and 4.0m (archive hole) b.g.l. The limestone is dolomitised in N9. In N10 probable bedrock (recovered as limestone gravel) is described from 10.9m to the termination depth at 20m b.g.l.

Between Node 07A and 09B the depth of bedrock in four archive holes ranges between 1.0m-4.0m b.g.l. At borehole S26 at Node 08 the bedrock was encountered at 4.5m b.g.l and comprises a very strong dark grey thinly bedded limestone. At Node 08 the first 2.3m of sandy gravelly silt till is soft.

From Node 09B to Node 14A the corridor runs adjacent to the railway. Probing was undertaken where the Route Corridor crosses a stream/small river, close to Node 11, although only 1.0m of soft glacial till (P35) was encountered. Close to Node 11 bedrock was encountered at shallow depth in trial pit S161 at 1.3m b.g.l.

At Node 14 soft glacial till was probed in C15 to 3.7m b.g.l. At borehole S25A, where the corridor passes alongside the railway line, till deposits were recorded to the termination depth of the borehole at 25.4m b.g.l. The SPT tests in S25A often met with refusal indicating a stiff/compact glacial till deposit.

At Node 14A in trial pit S158 the silt and gravel deposits are noted as compact although seepage into the pit caused instability to 2.40m b.g.l. Between Nodes 14A and 16 the Route Corridor follows the same alignement as Option 1 and encroaches onto a large expanse of raised bog to the south. The Route Corridor continues along the same alignment until about midway between Nodes 19 and 21 (East of Clanhugh Demesne)

From this point the Route Corridor detours from Option 1 and runs adjacent to the existing railway and shore of Lough Owel. Between Node 20 and Node 21 peat deposits are shown on the geological mapping adjacent to the Route Corridor in the area occupied by Ballynafid Lake, although exploratory holes did not encounter peat or soft compressible soils. The Route Corridor follows a route south of the lake and therefore softer deposits and peat should be expected associated with the lake as indicated by the peat overlay. Probe C25 encountered a firm alluvium. Exploratory holes C25, S21, S20 and S151 encountered firm/dense glacial till. At Node 20, bedrock was encountered in S28 below glacial till at 16.8m b.g.l. An outcrop of peat is shown between Nodes 21A and 22.

Route Corridor Option 3

From Node 01 to Node 06 the Route Corridor passes over the same strata as detailed for Option 2 and from Node 06 to Node 10 the Route Corridor is the same as that detailed for Option 1.

From Node 10 the Route Corridor runs to the north of Edgeworthstown. Close to Node 10, the borehole N7 encountered very strong limestone at 1.20m b.g.l.

From Node 13 to 13A the Route Corridor crosses 3 areas of mapped peat. Close to Node 13 probing was undertaken in the vicinity of the stream and peat was

encountered to 1.0m b.g.l. Trial pit TP N109 was undertaken in the second mapped area of peat and 1.6m of peat was encountered overlying gravelly silt deposits of glacial till. The trial pits within the till were unstable due to water seepage combined with their uncompact nature. Close to Node 13A at the junction with the N55 the borehole N6 notes thick glacial deposits encountered to the termination depth of the hole at 23.8m b.g.l. The material was recovered as a gravelly sandy silt with assorted mudstone and limestone clasts.

From Node 13A to Node 15 the Route Corridor continues on compact glacial gravelly silt deposits.

Between Nodes 15 and 18 the Route Corridor crosses a large expanse of peat bog, some of which has been cut and now re-forested. The Route Corridor crosses the River Riffey twice between these Nodes. From approximately 700m to 1100m east of Node 15 the peat is encountered up to 2.8m below ground level (C16 and DP5A) and is underlain locally by soft alluvium (C30) up to 4.7m below ground level. From approximately 2400m to 3200m east of Node 15, peat is encountered up to a maximum depth of 2.9m b.g.l. Where the bog has not been cut it rises above the surrounding ground by 1.50m to 2.0m. The bedrock was proven at N5 at 5.3m b.g.l., 100m south of the edge of the Route Corridor close to the River Riffey and probable bedrock was encountered where the Route Corridor crosses the Riffey a second time in TP N103 at 1.8m b.g.l.

South-east of the Route Corridor between Option 3 and Option 6, where the River Riffey crosses the railway, thick extensive deposits of poor ground comprising soft alluvium including yellow/grey silty marl and peat are encountered up to 8.0m b.g.l; this is part of the floodplain of the river.

To the west of Node 18 poorer ground is encountered in the forested area, adjacent to the Route Corridor and in the vicinity of the west bank of the Inny River. Soft alluvial deposits including peat were encountered up to 7.5 m.b.g.l in P4. The thickness of peat ranges between 1.9m and 4.3m. The probing in P6 encountered a very soft white silty marl within the alluvium which is characterised by very soft silts. The till deposits in the area comprised firm gravelly clays with cobbles and boulders and were encountered below the alluvium to a depth exceeding 8.3m b.g.l in P4. The

limestone bedrock was encountered at 1.6m b.g.l in N1(S) close to the east bank of the Inny River.

The probing east of the Inny River up to Node 18 encountered gravelly sandy clay glacial deposits with a localised area of peat and alluvial deposits in P2, adjacent to the stream.

From Node 18 to Node 18A the Route Corridor will cut into the limestone bedrock which is exposed at the disused Fulmont Quarry, east of Node 18. The exposed bedrock in the quarry is a strong bedded limestone. The southern edge of the corridor encroaches onto a lowland marsh area comprising up to 2.5m of peat overlying alluvial deposits including very soft silty marls. The soft alluvium was probed to a maximum depth of 6.5m b.g.l in P58C.

Between Node 18A and 18B the Route Corridor crosses a significant lowland bog area, between two working rock quarries, where soft alluvial deposits were inferred by dynamic probing (DPK01A) up to 4.8m b.g.l including peat up to 3.6m b.g.l. The limestone bedrock exposed in the quarries comprises strong gently dipping limestone strata.

Route Corridor Option 4

Between Node 01 and Node 04 the Route Corridor is the same as Option 1.

Between Node 04 and Node 04A the closest archive borehole data shows a rockhead depth of 4m and 24m b.g.l. At Node 04A the Route Corridor crosses a small river where soft alluvial deposits should be expected.

Midway between Node 04A and 04B the geological mapping shows an area of peat. East of Node 04B the Route Corridor crosses the Camlin River and softer deposits should be expected associated with river's floodplain. Thereafter, up to Node 10A, the Route Corridor crosses three mapped areas of peat and the closest archive borehole data shows bedrock ranging between 1.0m and 3.0m b.g.l.

The corridor crosses the existing N4 Route at Node 10A and the railway just west of Node 14. The Route joins Option 2 at Node 14. Thereafter, from Node 14 to Node 22, the Route Corridor continues on the same alignment as that described for Option 2.

Route Corridor Option 5

Between Nodes 01 and 05 the Route Corridor follows the same alignment as that described for Option 1.

Between Node 05 and Node 05A the Route Corridor crosses an area of mapped peat. At Node 05A the archive borehole data indicates rockhead at 14.0m b.g.l.

Between Node 05A and 05B the corridor crosses the Camlin River and softer alluvial deposits should be expected. Bedrock is indicated at depths of 8m and 24m b.g.l in the vicinity of the Camlin River.

Between Node 05B and Node 05C the mapping shows a large expanse of peat. The probing confirms peat up to 1.7m in thickness underlain by softer alluvial soils extending to depths of between 3.2m and 4.7m b.g.l. Archive data shows bedrock at 14m b.g.l in this locality.

Between Node 05C and 05D the alignment crosses the Royal Canal. Between these Nodes the closest archive borehole data show bedrock at depths of 0-3m b.g.l. The probing data show peat ranging between 0.8m (P47) and 1.4m (P48) in thickness overlying soft becoming firm (firm below 1.5m to 2.0m depth) glacial till.

Close to Node 05D, approximately 500m northeast of where the Route Corridor crosses the R393, peat was encountered up to 3.0m b.g.l (P37) and is underlain by very soft alluvial soils to a depth of 3.8m b.g.l. Firmer till deposits were probed to depths of 4.7m b.g.l in the area and the closest archive borehole data indicate bedrock at 6.0m b.g.l.

Between Node 05D and Node 14 the Route Corridor runs parallel with the railway. The limited probing shows firm gravelly sandy silts and sandy gravels. Possible

bedrock (as an obstruction) was encountered at 1.5m-1.8m b.g.l in trial pits S160 and S162.

At Node 14 soft glacial till was probed to 3.7m b.g.l in probe C15. At S25A, where the Route Corridor crosses the railway line till deposits are recorded to the termination depth of the borehole at 25.4m b.g.l. The SPT tests in S25A often met with refusal indicating a stiff/compact glacial till deposit.

From Node 14 to Node 20 the Route follows the same corridor as that described for Options 1 and 2. From Node 20 to Node 22 the corridor follows Option 2.

Route Corridor Option 6

From Node 01 to Node 03 the Route Corridor follows the same Route as Option 1. Between Nodes 01 and 02 (Dromod-Roosky tie in) peat varies between 1.8m and 6.9m in thickness and is underlain by soft superficial soils. A maximum depth of 7.3m of soft deposits was encountered in the vicinity of Node 01 in borehole N15 (S).

The archive borehole between Nodes 01 and 02 indicates bedrock at 11m below ground level (m b.g.l). Borehole N15(S) also refuses at 9.3m b.g.l indicating possible bedrock. Between Node 02A and Node 03 a bog feature is encountered with soft deposits (including 4.3m of peat) encountered up to 6.2m.b.g.l (P45).

Limestone bedrock was confirmed at 6.0m b.g.l between Node 02A and the river and one borehole and trial pit terminated on a possible bedrock obstruction within the bog area at N12 and TPN 12.

Just to the west of Node 02A the River Rinn crosses perpendicular to the alignment flowing into Lough Forbes. The closest probes (C8 and C9) shows up to 2.4m of peat deposits on the east bank of the river; the peat and soft alluvial deposits increase to a maximum thickness of 6.2m overlying firmer till deposits as the alignment crosses the bog. Locally probable bedrock (TPN 12 and N12) is noted in the bog area at 3.4-3.6m b.g.l although, as indicated by the probing the alluvium thickens as the Route Corridor crosses the bog. Limestone bedrock was encountered at 6.0m b.g.l (N13 and N14) close to where the river crosses the alignment.

From Node 03 to Node 06 the Route Corridor predominantly follows the same line as Option 2. At Node 03 peat is encountered to 4.2m (P43) and 4.3m (P45) b.g.l with soft alluvium continuing to 5.1m and 6.2m b.g.l overlying firmer deposits of till. The corridor encroaches onto an area of mapped peat northeast of Newtown Forbes.

From Node 06 to 08A the Route Corridor predominantly follows the same alignment as Option 1. Between Node 6 and Node 8A the Route Corridor crosses the Camlin River and a smaller river. Some softer deposits should be expected, associated with the rivers' floodplains although the probing close to the Camlin River (P40) indicated firm glacial deposits. Between Node 07 and Node 8A one archive borehole shows rock 3m b.g.l.

From Node 08A to Node 09C the Route Corridor crosses the existing N4, then crosses the railway line immediately before Node 9D where it rejoins Option 5. Between Node 9C and 9D and east of Node 9D the Route passes outcrops of mapped peat. Possible bedrock (as an obstruction) was encountered at 1.5m – 1.8m b.g.l in trial pits S160 and S162.

At Node 14 soft glacial till was probed in C15 to 3.7m b.g.l. At borehole S25A, where the corridor passes alongside the railway line, till deposits were recorded to the termination depth of the borehole at 25.4m b.g.l. The SPT tests in S25A often met with refusal indicating a stiff/compact glacial till deposit.

At Node 14A in trial pit S158 the silt and gravel deposits are noted as compact although seepage into the pit caused instability to 2.40m b.g.l. Between Nodes 14A and 16 the corridor encroaches onto a large expanse of raised bog to the south.

Between Node 16 and Node 17A the Route Corridor runs north of the Black River. The exploratory hole data show till deposits comprising gravelly silt and very silty gravels. Possible bedrock is noted in TPD at 3.20m b.g.l. The Route Corridor crosses the Inny River at Node 17 where bedrock was encountered at 4.0m b.g.l. Probing and borehole data in the vicinity of the east and west banks of the Inny River indicate no soft deposits with firm gravelly silt (till) overlying shaley limestone bedrock.

From Node 17 to Node 20 the corridor crosses outcrops of mapped peat, located east and west of Node 19.

At Node 20, close to the railway line till deposits extend to a depth of 16.8m (S28), before encountering probable weathered bedrock. The quality of the rock recovered is poor and comprised cobble sized clasts of siltstone and limestone.

Between Node 20 and Node 21 peat deposits are shown on the geological mapping adjacent to the Route Corridor in the area occupied by Ballynafid Lake, although exploratory holes did not encounter peat or soft compressible soils. The Route Corridor follows a route south of the lake and therefore softer deposits and peat should be expected associated with the lake as indicated by the peat overlay. Probe C25 encountered a firm alluvium. Exploratory holes C25, S21, S20 and S151 encountered firm/dense glacial till. At Node 20, bedrock was encountered in S28 below glacial till at 16.8m b.g.l. An outcrop of peat is shown between Nodes 21A and 22.

The scaling statements for each of the Route Corridor Options are presented in Tables 4.7.2 – 4.7.7.

4.7.5 Overview of Ground Conditions and Features in Karst Limestone

There are no recorded karst features in the area occupied by the Regionally Important Karst Aquifer within the 500m study area. However, it should be noted that GSI has not yet undertaken karst mapping for this part of the country and the majority of the karst aquifer is mantled by a relatively thick cover of soils and subsoils.

Where there are outcrops present in the Regionally Important Karst Aquifer immediately north of Newtown Forbes and in Bundoon, approximately 4km northeast of Longford Town there may be karst features present. Evidence of karstification in the bedrock would only be available from borehole records in such environments. Heavily fractured and cavernous bedrock is recorded in the pure limestones occurring to the north of Longford Town, at the northwestern end of the Regionally Important Karst Aquifer, as evidenced by the logs for the trial wells drilled in the area for the public water supply.

In the karst area in the southeastern part of the study area, there is rock mapped close to the surface in the vicinity of all Route Corridor Options; for example at Knightswood, Rathlevanagh, Clanhugh Demesne and Culleendarragh. These areas of rock close to the surface correspond to the highest portions of the landscape.

There are karst features recorded in a small number of locations northeast of the study area. Pollnagat Cave, is the closest to a Route Corridor – Route Corridor Option 3, approximately 2.5km northeast of Knightswood. Even though the features occur outside the 250m study width, they indicate that there may be further features.

The drill holes from the 2008 site investigation did not identify any cavities within the limestone and this is sometimes qualified by the description of 'no record of cavity' noted in the log description. Drillhole N7 references non intact core between 2.8m b.g.l and 3.23 m b.g.l. There are occasional references to no recovery within the rock in N1 and N9, although this is noted by the drilling contractor as washout of fines or drilling induced.

It is of note that there are two drillholes, S25A and S28 that encountered deep deposits of glacial till indicating a possible karstified profile at depth. Drillhole S25A encountered glacial till to the termination depth at 25.40m b.g.l and S28 encountered till to at least 16.8m b.g.l before encountering probable weathered bedrock described as silt with angular cobbles.

The known karst features are shown on the Aquifer and Groundwater Vulnerability drawings included in Volume III (RFig 4.7.5 to 4.7.8 and 4.7.13 to 4.7.16).

4.7.6 Overview of Historical Land Use

The land use in the study area is predominantly agricultural. Historical land use included the examination of contaminated land sites and review of aerial photographs.

Contaminated land sites are detailed in Table 4.7-1 below and shown on the Aquifer and Groundwater Vulnerability drawings (RFig 4.7.5 and 4.7.6 and 4.7.13 and 4.7.14).

Table 4.7-1 Identified Contaminated Land Sites

Description	Townland	Grid Reference	Closure Date
Mulleady Ltd. Transfer station near Drumlish	Cloonagh	E213824, N284164	Operational Transfer Station
Council Landfill in Longford	Ballymanion	E212350, N275040	1965
Council Landfill in Longford	Ballymanion	E212770, N274820	1958
Council Landfill in Cartron	Cartron Big	E217350, N275885	1989
Oil Depot in Ballynagoshen	Ballynagoshen	E221737, N272777	Operational oil depot
Council Landfill near Edgeworthstown	Lismagoneen	E226000, N276200	1982

Cloonagh and Lismagoneen are located over 2km north of Route Corridor Option 3 are not considered further due to their relative distance.

Both sites located in County Longford (Ballymanion) are located on the south westerly side of Longford Town. The Route Corridor that they are located closest to is Route Corridor Option 5. However they are greater than 250m distant.

Carton Big is over 700m north of Route Corridor Option 6 and it is not considered to have an impact on the Route.

Route Corridor Option 5 and 6 (RFig 4.7.6 in Volume III) run south of existing N4 and south of the railway line in the region of Ballynagoshen where oil tanks are present as part of an oil depot. It has been determined that the extent of contamination in the area is confined and remediation works are on going and are being monitored by Longford County Council. It is therefore considered that this issue will not impact on Option 5 or 6.

4.7.7 Overview of Economic Geology

The assessment has shown that economic mineral locations are only located along Route Corridor Option 3, details are provided below.

Route Corridor Option 3

- Lisnanagh (a lead-zinc deposit not being worked); this is located approximately 100m ENE of Node 13.

- Mineral deposit (a lead-zinc deposit not being worked) in Cappagh (north of Ballinalack) approximately 200m south of Route Corridor Option 3. This site is being put forward as a County Geological Heritage Site under the IGH 15 Economic Geology Theme. Mineralisation is usually localised, thus construction of this Route Corridor Option is likely to destroy the integrity of the site.

4.7.8 Overview of Geological Heritage

Ardnacassagh Quarry is a disused limestone quarry to the east of Longford Town (between Node 07A and Node 08), adjacent to the existing N4 ring road. This is proposed as a County Geological Heritage site (CGS) due to the exposure of a particular rock face. The site is a key location for stratigraphy for the Meath Formation and it has been proposed for CGS designation under the IGH 8 Lower Carboniferous Theme. The quarry has been mostly back-filled. This site is located within Route Corridor Option 2. The impact is likely to be positive due to the fresh exposure of this key locality as a result of construction (RFig 4.7.10, Volume III).

The mineral deposit (unworked lead-zinc deposit) in Cappagh (north of Ballinalack) is located approximately 200 m south of Route Corridor Option 3 which is being put forward as a County Geological Heritage Site under the IGH 15 Economic Geology theme. Mineralisation is usually localised, thus construction of the route is likely to destroy the site (RFig 4.7.11, Volume III).

A bedrock outcrop is present along the River Inny at Ballinalack, approximately 300m north of Route Corridor Options 1, 2, 4, 5 and 6. This is proposed as a County Geological Heritage site due to the exposure of a particular rock face. It is of poor quality but it is the only exposure so far recorded in Co. Westmeath and has therefore been proposed for CGS designation, under the IGH 8 Lower Carboniferous Theme. None of the Route Corridor Options will impact on this site, however the construction of the route may result in further exposures of the rock succession elsewhere in the environs of Ballinalack (RFig 4.7.11, Volume III).

A road cutting of Derravaragh Cherts has been put forward by the GSI as a proposed Natural Heritage Area (pNHA) at the Mullingar Bypass. The N4 Mullingar to Longford (Roosky) Road Scheme will impact on this proposed Natural Heritage Area (pNHA). However, the construction of route may result in the exposure of different rock faces

within the same rock succession and will lead to an overall improvement in the geological understanding of the succession. This site is impacted by all six Route Corridor Options at Cullen More (Node 21A) (RFig 4.7.12, Volume III).

4.7.9 Impact Assessment

Taking account of the overviews provided above, impacts on soils, geology, natural and material assets consist of road cuttings, traversing soft ground (for example, peat, alluvium), potential sterilisation of mineral reserves, and further exposure of rock cuttings. These attributes have been included in the Project Appraisal Balance Sheet (PABS) presented in Appendix 1, Volume II. Preliminary Assessment Tables are provided for each Route Corridor Option below. The impacts are arranged on a sliding scale as follows:

- Minor positive;
- Neutral;
- Minor negative;
- Moderately negative;
- Major Negative;
- Severe Negative.

In general all the Route Corridor Options have been assessed as being 'Moderately negative', primarily due to the widespread occurrence of peat and soft ground. There are minor positives regarding some of the County Geological Heritage Sites in the form of road cuttings, which offer fresh exposures into the bedrock. There are negatives associated with the economic geological sites, as the mineralisation associated with the sites is localised and thus the Route may destroy/sterilise the site. The impact assessment is presented in tabular form; with assessment Tables for each Route Corridor Option.

All six Route Corridor Options cross over and run adjacent to significant areas of peat and soft unconsolidated poor ground which will either require removal or ground improvement measures. Generally peat will be removed and soft ground will either be removed or treated.

A 'Moderately negative' impact has been assigned where poor ground is considered to be in excess of 3m. Removal by mechanical excavation below this depth is often problematic as peat and soft ground slump into the open excavation.

For the purposes of this assessment, waste is not deemed to be a factor in the Route Options Assessment as the implications are considered to be similar for all options. As a result, waste is not discussed further in this section.

Route Corridor Option 1

Table 4.7-2 Route Corridor Option 1: Preliminary Assessment of Geology Impacts

Route Corridor Option 1			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Peat / soft ground/ karst	Moderate	Excavation	Moderate Negative
Mullingar road cutting	High	Further exposure	Minor Positive
Soils/subsoils	Low	Loss of soils/subsoils	Minor Negative

Route Corridor Option 1 has been assessed as having an overall Moderately Negative rating.

Route Corridor Option 2

Table 4.7-3 Route Corridor Option 2: Preliminary Assessment of Geology Impacts

Route Corridor Option 2			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Peat / soft ground/ karst	Moderate	Excavation	Moderate Negative
Ardnacassagh CGS	High	Fresh exposure	Minor Positive
Mullingar road cutting	High	Further exposure	Minor Positive
Soils/subsoils	Low	Loss of soils/subsoils	Minor Negative

Route Corridor Option 2 has been assessed as having an overall Moderately Negative rating.

Route Corridor Option 3

Table 4.7-4 Route Corridor Option 3: Preliminary Assessment of Geology Impacts

Route Corridor Option 3			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Peat / soft ground/ karst	Moderate	Excavation	Moderate Negative
Lisnanagh Mineral deposit	Moderate	Possible Sterilisation of reserve	Minor Negative
Cappagh Mineral Site CGS	Moderate	Possible Sterilisation of reserve	Minor Negative
Mullingar road cutting	High	Further exposure	Minor Positive
Soils/subsoils	Low	Loss of soils/subsoils	Minor Negative

Route Corridor Option 3 has been assessed as having an overall Moderately Negative rating.

Route Corridor Option 4

Table 4.7-5 Route Corridor Option 4: Preliminary Assessment of Geology Impacts

Route Corridor Option 4			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Peat / soft ground/ karst	Moderate	Excavation	Moderate Negative
Mullingar road cutting	High	Further exposure	Minor Positive
Soils/subsoils	Low	Loss of soils/subsoils	Minor Negative

Route Corridor Option 4 has been assessed as having an overall Moderately Negative rating.

Route Corridor Option 5

Table 4.7-6 Route Corridor Option 5: Preliminary Assessment of Geology Impacts

Route Corridor Option 5			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Peat / soft ground/ karst	Moderate	Excavation	Moderate Negative
Mullingar road cutting	High	Further exposure	Minor Positive
Soils/subsoils	Low	Loss of soils/subsoils	Minor Negative

Route Corridor Option 5 has been assessed as having an overall Moderately Negative rating.

Route Corridor Option 6

Table 4.7-7 Route Corridor Option 6: Preliminary Assessment of Geology Impacts

Route Corridor 6			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Peat / soft ground/ karst	Moderate	Excavation	Moderate Negative
Mullingar road cutting	High	Further exposure	Minor Positive
Soils/subsoils	Low	Loss of soils/subsoils	Minor Negative

Route Corridor Option 6 has been assessed as having an overall Moderately Negative rating.

4.7.10 Comparison of Route Corridors

For comparison purposes, each of the Route Corridor Options is assessed for various impacts associated with the construction of a road. Table 4.7-8 summarises the impacts which are given in greater detail in the Project Appraisal Balance Sheets, presented in Appendix 1, Volume II of this report. Due to the similarity in geological terms there is very little to distinguish the Route Corridor Options in respect of geology. Route Corridor option 3 has more negatives than the other Route Corridors and thus stands out as been a less preferable option from a geological perspective. Aspects considered under Hydrogeology differentiate the routes to a greater extent. A summary of ranking of Route Corridor Options in relation to Soils and Geology is given in Table 4.7-9.

Table 4.7-8 Summary of Impacts Soils & Geology

Attribute	Attribute Importance	Potential Impact	Option 1 Level of Impact	Option 2 Level of Impact	Option 3 Level of Impact	Option 4 Level of Impact	Option 5 Level of Impact	Option 6 Level of Impact
Soft Ground/Poor Ground	Low	Road cutting, stone infill	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative	Moderately Negative
Shallow subsoil cover	Low	Road cutting, rock extraction	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative	Minor Negative
Economic Geology	Moderate	Sterilisation of reserve	Neutral	Neutral	Minor Negative	Neutral	Neutral	Neutral
Geological Heritage Areas	High	Disturbance of designated sites	Neutral	Neutral	Minor Negative	Neutral	Neutral	Neutral

Table 4.7-9 Summary Ranking of Route Corridor Options (Soils and Geology)

Route Corridor Option	Scaling Statement	Order of Preference
Route Corridor Option 1	Moderately negative	= 1
Route Corridor Option 2	Moderately negative	= 1
Route Corridor Option 3	Moderately negative	6
Route Corridor Option 4	Moderately negative	=1
Route Corridor Option 5	Moderately negative	=1
Route Corridor Option 6	Moderately negative	=1

Hydrogeology

4.7.11 Introduction

Six Route Corridor Options have been considered in this geological appraisal. With respect to the identified Route Corridor Options, this section provides an overview of the hydrogeology, including relevant karst aspects.

4.7.12 Methodology

This section of the Route Corridor Selection Report has been carried in line with the NRA *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (2008) to fulfil an appraisal of each Route Corridor Option and to carry out a comparative evaluation of the Route Corridors.

The existing hydrogeological environment has been described in the Constraints Report (N4 Mullingar to Longford (Roosky) Constraints Study).

Additional appraisals have been carried out using aerial photos, data from a peat probing survey, and a field survey (May 2008) and data from the Phase 1 ground investigation undertaken in July through to September 2008,

The approach adopted consisted of:

i. Desk study of geological and hydrogeological setting of specific Route Corridor Options;
ii. Evaluation of Route Corridor Options from a visual survey (field survey); and
iii. Evaluation of geotechnical data, using ground investigation data (peat probes, trial pits and borehole data).

Owing to the general similarity of the regional geological and hydrogeological setting across the study area, there are few impacts that differ and would be considered significantly different in an appraisal for ranking particular Route Corridor Options. The geological Route Corridor Option appraisal provided herein provides details of the setting and potential impacts of the six Route Corridor Options.

The main attributes of importance in the appraisal are the karst aquifers, groundwater dependent terrestrial ecosystems (GWDTE) and groundwater resources.

These attributes have been included in the Project Appraisal Balance Sheet (PABS) presented in Appendix 1, Volume II.

In terms of the appraisal, the construction of a new road will impact on the geological and hydrogeological environment. Positive impacts will be brought about from a development of a greater scientific understanding of the geological and hydrogeological setting of this region. Within the appraisal the criteria ranges on a scale from:

- Minor positive;
- Neutral;
- Minor negative;
- Moderately negative;
- Major Negative;
- Severe Negative.

Significant information for the Study Area was collected and collated during the constraints stage of the project, whereby geological and hydrogeological issues were discussed and unacceptable impacts and risks identified. This Route Corridor Selection Stage is a further refinement of the Constraints Study, albeit the study extent is refined to actual Route Corridors.

4.7.13 Overview of Aquifer Type and Classification

The bedrock is classified in terms of its aquifer potential. The classification has been carried out by the Geological Survey of Ireland (GSI). Details of the National Aquifer Classification are provided in Appendix 13, Volume II of this report.

The bedrock distribution and pattern is similar for each Route Corridor Option. Each of the six Route Corridors traverses the same aquifer sequence, thus an overview of aquifer type and classification for one applies equally to the other Route Corridor Options. This is shown on RFig 4.7.5 - RFig 4.7.8, Bedrock Aquifers Overview, which shows the distribution of aquifer units, together with wetland areas.

In summary the Route Corridor Options traverse approximately 50kms predominately occupied by a Locally Important Aquifer, that is moderately productive in Local zones only (Ll). However, in the northwest there is approximately 5kms occupied by a Regionally Important Karst Aquifer (Rk) and smaller segments occupied by a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl) and a Locally Important aquifer that is Moderately Productive (Lm). In the southeast there is approximately 8kms occupied by a Locally Important Karst Aquifer (Lk).

As required under the NRA guidelines (2009) an overview of each Route Corridor is required and provided as follows.

Route Corridor Option 1

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprising impure limestones, sandstones and shales is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

Between Clooniher (Node 03) and Lissagernal (Node 03A) the Route Corridor traverses over a unit of conglomerate and sandstone that is classified as a Locally Important Aquifer that is moderately productive (Lm). This zone is approximately 800m wide.

Between Lissagernal (Node 03A) and Deerpark (Node 04) the Route Corridor is underlain by turbidites and shales that extend as far as Carrickmoyragh which are classified as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl).

In Carrickmoyragh, between Node 04 and Lismoy (Node 05) and as far as Clooncoose (Node 07), approximately 5kms, the bedrock is mapped as limestone and is classified as a Regionally Important Karst Aquifer (Rk).

From Clooncoose to Clanhugh Demesne/Ballynafid (Node 07 to Node 20), approximately 30kms, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town. The bedrock is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

In Clanhugh Demesne (Node 20) the bedrock mapping shows a change from an impure limestone to a cherty limestone, classified as a Locally Important Karst Aquifer (Lk) and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone classified as a Locally Important Aquifer that is moderately productive in local zones (Ll).

Between Node 21A and Node 22 (Cullen Beg) there is a section approximately 700m wide mapped as a Locally Important Karst Aquifer (Lk).

Route Corridor Option 2

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprising impure limestones, sandstones and shales is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

Between Clooniher (Node 03) and Kilmacannon (Node 03B) the Route Corridor traverses over a unit of conglomerate and sandstone that is classified as a Locally Important Aquifer that is Moderately Productive (Lm).

From Kilmacannon (Node 03B) to to Carrickmoyragh the Route Corridor is underlain by turbidites and shales that are classified as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl).

In Carrickmoyragh, between Node 04 and Cloonrallagh (Node 06) and as far as Clooncoose (Node 07A), approximately 5kms, the bedrock is mapped as limestone and is classified as a Regionally Important Karst Aquifer (Rk).

From Clooncoose to Clanhugh Demesne (Node 07A to just south of Node 20), approximately 30kms, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town. The bedrock is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

In Clanhugh Demesne the bedrock mapping shows a change from an impure limestone to a cherty limestone, classified as a Locally Important Karst Aquifer (Lk) and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone classified as a Locally Important Aquifer that is Moderately Productive In Local Zones (Ll).

Between Node 21A and Node 22 (Cullen Beg) there is a section approximately 700m wide mapped as a Locally Important Karst Aquifer (Lk).

Route Corridor Option 3

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprising impure limestones, sandstones and shales is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

Between Clooniher (Node 03) and Kilmacannon (Node 03B) the Route Corridor traverses over a unit of conglomerate and sandstone that is classified as a Locally Important Aquifer that is Moderately Productive (Lm).

From Kilmacannon (Node 03B) to Carrickmoyragh the Route Corridor is underlain by turbidites and shales that are classified as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl). In Carrickmoyragh, between Node 04 and Cloonrallagh (Node 06) and as far as Clooncoose (Node 07), approximately 5kms, the bedrock is mapped as limestone and is classified as a Regionally Important Karst Aquifer (Rk).

From Clooncoose to Heathland (Node 07 to Node 18A), approximately 30kms, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town. The bedrock is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

From Heathland (Node 18A) the Route Corridor passes through to Loughanstown (Node 18B) and Ballynagall (800m south of Node 18B) and is occupied by a cherty

limestone, classified as a Locally Important Karst Aquifer (Lk). From Ballynagall to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone classified as a Locally Important Aquifer that is Moderately Productive in Local Zones (Ll).

Between Node 21A and Node 22 (Cullen Beg) there is a section approximately 700m wide mapped as a Locally Important Karst Aquifer (Lk).

Route Corridor Option 4

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprising impure limestones, sandstones and shales is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

Between Clooniher (Node 03) and Lissagernal (Node 03A) the Route Corridor traverses over a unit of conglomerate and sandstone that is classified as a Locally Important Aquifer that is Moderately Productive (Lm). This zone is approximately 800m wide. Between Lissagernal (Node 03A) and Deerpark (Node 04) the Route Corridor option is underlain by turbidites and shales that are classified as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl).

In Garrowhill (Node 04A) the bedrock is mapped as limestone and is classified as a Regionally Important Karst Aquifer (Rk) as far as Knockloughlin (Node 04B), where it is then mapped as impure limestones classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

From Knockloughlin to Clanhugh Demesne (Node 04B to just south of Node 20), approximately 30km, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town. The bedrock is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

In Clanhugh Demesne the bedrock mapping shows a change from an impure limestone to a cherty limestone, classified as a Locally Important Karst Aquifer (Lk) and extends from this point through to the boundary of Portnashangan and Culleen

More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone classified as a Locally Important Aquifer that is Moderately Productive In Local Zones (Ll).

Between Node 21A and Node 22 (Cullen Beg) there is a section approximately 700m wide mapped as a Locally Important Karst Aquifer (Lk).

Route Corridor Option 5

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprising impure limestones, sandstones and shales is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

Between Clooniher (Node 03) and Lissagernal (Node 03A) the Route Corridor traverses over a unit of conglomerate and sandstone that is classified as a Locally Important Aquifer that is moderately productive (Lm). This zone is approximately 800m wide. Between Lissagernal (Node 03A) and Deerpark (Node 04) the Route Corridor option is underlain by turbidites and shales that extend as far as Carrickmoyragh which are classified as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl).

In Carrickmoyragh, between Node 04 and Lismoy (Node 05) as far as the northern limits of Longford Town at Node 05B (Aghareagh/Ballyminion) the bedrock is mapped as limestone and is classified as a Regionally Important Karst Aquifer (Rk).

From Ballyminion to Clanhugh Demesne (Node 05B to just south of Node 20), approximately 30km, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town. The bedrock is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll), with the exception of a narrow section at Mullaghavorneen (between Node 05C and Node 05D) which is mapped as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl).

In Clanhugh Demesne the bedrock mapping shows a change from an impure limestone to a cherty limestone, classified as a Locally Important Karst Aquifer (Lk) and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone classified as a Locally Important Aquifer that is Moderately Productive only in Local zones (Ll).

Between Node 21A and Node 22 (Cullen Beg) there is a section approximately 700m wide mapped as a Locally Important Karst Aquifer (Lk).

Route Corridor Option 6

From Tomisky (Node 01) to Clooniher (Node 03) the bedrock comprising impure limestones, sandstones and shales is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

Between Clooniher (Node 03) and Kilmacannon (Node 03B) the Route Corridor traverses over a unit of conglomerate and sandstone that is classified as a Locally Important Aquifer that is moderately productive (Lm).

From Kilmacannon (Node 03B) to Carrickmoyragh the Route Corridor is underlain by turbidites and shales that are classified as a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl). In Carrickmoyragh, between Node 04 and Cloonrallagh (Node 06) and as far as Clooncoose (Node 07), approximately 5km, the bedrock is mapped as limestone and is classified as a Regionally Important Karst Aquifer (Rk).

From Clooncoose to Clanhugh Demesne (Node 07 to Node 20), approximately 30kms, the bedrock in this area is recorded as generally impure limestones, with some alternating sequences of limestone, sandstone and shale more dominant close to Longford Town. The bedrock is classified as a Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).

In Clanhugh Demesne (Node 20) the bedrock mapping shows a change from an impure limestone to a cherty limestone, classified as a Locally Important Karst Aquifer

(Lk) and extends from this point through to the boundary of Portnashangan and Culleen More. From this townland boundary through to Node 21A (boundary of Cullen More and Culleen Beg) the bedrock is occupied by an impure limestone classified as a Locally Important Aquifer that is moderately productive in local zones (Ll).

Between Node 21A and Node 22 (Cullen Beg) there is a section approximately 700m wide mapped as a Locally Important Karst Aquifer (Lk).

4.7.14 Overview of Aquifer Characteristics

The aquifer types that occur in the study area are as follows:

- Poor Aquifer which is generally unproductive except for Local Zones (Pl).
- Locally Important Aquifer which is Moderately Productive only in Local Zones (Ll).
- Locally Important Aquifer which is Moderately Productive (Lm).
- Locally Important Karst Aquifer (Lk).
- Regionally Important Karst Aquifer (Rk).

The six Route Corridor Options traverse approximately 50 km predominately occupied by a Locally Important Aquifer, that is moderately productive in Local zones only (Ll). However, in the northwest there is approximately 5kms occupied by a Regionally Important Karst Aquifer (Rk) and smaller segments occupied by a Poor Aquifer which is Generally Unproductive except for Local Zones (Pl) and a Locally Important aquifer that is Moderately Productive (Lm); and, in the southeast there is approximately 8km occupied by a Locally Important Karst Aquifer (Lk).

Hydrogeological data are sparse and the information is presented below for the aquifer types occurring within the study area. The main data sources are the groundwater body descriptions (www.gsi.ie) and augmentation of a water scheme of the Longford Regional Water Supply Scheme.

Locally Important Aquifer which is Moderately Productive in Local Zones only (Ll)

- Transmissivity (2-20m^2/d).
- Porosities (in the order of 1%) No primary Porosity.

- Permeability and Flow is likely to be restricted to the upper most 15m, in the upper weathered fractured zone.
- Flow path lengths are expected to be short, generally no more that a few hundred metres.
- Well yields are generally poor.

Locally Important Aquifer which is Moderately Productive (Lm)

No specific data are available but lithology suggests a well connected weathered and fractured zone up to 30m thick. Hydraulic properties are expected to greater than for the Locally Important Aquifers which are Moderately Productive in Local Zones only (Ll).

Regionally Important Karst Aquifers (Rk)

Data exist for the Karst aquifer that occurs in the northwestern part of the study area. Hydrogeological studies were conducted in the karst aquifer to the northeast of Longford Town to augment the water supplies for the Longford Regional Water Supply Scheme.

Specific data sources are as follows:

- "Longford Central Regional Water Supply Scheme: Groundwater Production well and trial well drilling " TR06 Groundwater Report-D. (August 2006) TOBIN Consulting Engineers;
- "Longford Central Regional Water Supply Scheme Strategic Review: Strategy for well field development at Cloonanny Glebe" TR05 Preliminary Groundwater Report-A. (October 2005) TOBIN Consulting Engineers;
- "Longford Central Regional Water Supply Scheme Strategic Review: Groundwater Resource Assessment" TR03 Preliminary Groundwater Report-B. (July 2005) TOBIN Consulting Engineers;
- "Report on the Drilling and Testing of Trial Wells in the Longford Town, Newtown Forbes Area, Co. Longford" (January 1999). KT Cullen & Co. Ltd.;
- "Report on the Testing of Three Trial Wells at Longford" (1999). KT Cullen & Co. Ltd.;
- "Report on the Trial Well Drilling and Testing Programme at Lough Forbes, Glannagh and Corbeagh" (May 2003). White Young Green (Formerly, KT Cullen & Co. Ltd); and,

- "Trial Well Drilling and Testing in the Greater Longford Area (Drumlish Road)" (April 2004). White Young Green (Formerly, KT Cullen & Co. Ltd).

Aquifer characteristics determined for the aquifer in this area are as follows:

- Boreholes drilled into the limestone bedrock aquifer have yielded significant volumes of groundwater; productivity Class I or II, as per the GSI classification.
- The apparent transmissivity of the aquifer ranges from 10-350 m2/day, with an average of approximately 200 m2/day.
- The bedrock permeability, using an aquifer thickness of 45 m ranges from 1–8m/day.
- Water levels are generally above the top of the rock, within the overlying till unit. Artesian conditions exists in the vicinity of Camlin River. The water levels in the boreholes are lower than the water levels in the small tributary streams.
- The natural hydraulic gradients in the aquifer are low, approximately 0.001, reflecting the generally high transmissivity. The hydraulic gradient induced during pumping increases to 0.005 immediately upgradient of the pumping wells. Observed drawdowns approximately 2km distant suggest confining conditions.

Locally Important Karst Aquifers (Lk)

This aquifer occurs in the southern part of the study area and is within the Derravaragh Groundwater Body. Two recent studies have been in conducted in the region:

- A Hydrogeological Investigation into Elevated Ammonia Concentrations in Lough Owel, Groves, P., unpublished MSc thesis 2009, Cardiff University.
- Groundwater and Surface Water Interactions in Meath – Westmeath Lakelands, Quinlan, C., unpublished Phd Thesis 2009, Trinity College Dublin.

The studies have provided mainly qualitive information on aquifer characteristics, groundwater flow directions, flow rates and karstification. The studies by Groves indicate groundwater catchments to Lough Owel, River Gaine and Lough Derravaragh. Lough Owel has no surface water inflow, thus is assumed to be groundwater fed. The studies by Quinlan are primarily focussed on the lakes lying to the north of Lough Owel and Lough Derravaragh.

Poor Aquifer which is Generally Unproductive except for Local Zones (Pl)

- Transmissivity (generally less than 5m2/d).
- Porosities are in the order of 1% or less with No primary Porosity.
- Permeability and Flow is likely to be restricted to the upper weathered fractured zone (less than 10m).
- Flow path lengths are expected to be short, generally no more that a few hundred metres.
- Well yields are generally poor.

4.7.15 Overview of Groundwater Resources

This section provides an overview of the key groundwater resources within the study area.

- Within the locally important and poor aquifers (Ll, Lm, Pl) there are no known Public or Group Water Supplies. The Route Corridors are principally underlain by locally important aquifers.
- Northeast of Longford Town a groundwater borehole in Moneylagan (400 m east of Node 05A) is proposed to abstract 700 m3/day of groundwater for augmentation of the Longford Public Water Supply. A further groundwater borehole has been constructed in Cloonanny Glebe (approximately 500 m east of Route Corridors (1,2,3 & 6) between Node 06 and 07A) which could yield up to 3,000 m3/day. Both are located in the Regionally Important Karst Aquifer (Rk) and both are considered in all the Route Corridor Options, even though they are outside the 250m study widths. It is considered that the section of all Route Corridor Options overlying the Regionally Important Karst Aquifer occur with the likely zone of contribution of both boreholes. Given the karstified nature of the bedrock it is likely the zones of contributions for both boreholes will overlap and extend north and northeast to include all the karst aquifer. The draft groundwater vulnerability (described in detail in Section 4.7.18) indicates a good protective cover over the majority of the aquifer and within 250 m of the Route Corridors. It is anticipated that this road scheme could be developed without interfering with the operation of the groundwater supply. Spill containment and

capture and diversion of road run-off would be incorporated into the design of the road in the environs of any existing or proposed groundwater supplies.

- Lough Owel is a surface water supply but it is assumed to be primarily groundwater fed from the northern side of the lake. Located to the northeast of Lough Owel in the same aquifer (Locally Important Karst Aquifer – Lk) a spring on the northern side of the River Gaine supplies Multifarnham Group Water Scheme (GWS). This supplies approximately 450 people and abstracts approximately 90 m3/day.

4.7.16 Overview of Hydrogeological Features

The hydrogeological features identified are wetland habits, holy wells and springs. This section presents an overview of the wetlands for each Route Corridor. The wetland areas are extensive and as there are comparatively few holy wells and springs they are covered as group at the end of the section.

Route Corridor Option 1: Wetland habitats

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (Node 04), to the north of Newtown Forbes. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC.

From Lisnamuck to Ballynagoshen (Node 07 to Node 10A) the Route Corridor runs offline to the north of the existing N4 alignment. This section runs approximately 250m to the south of Carrickglass Demesne pNHA.

From Windtown to Ballinalack (Node 16 to 17) the Route Corridor runs to the south of the existing N4 alignment. The alignment runs to the south of Rathowen and Ballinalack. The Route Corridor is immediately south of the existing N4 in the environs of the Lough Garr NHA. The Route Corridor generally avoids the areas of extensive peat in this section.

From Ballinalack to Culleen Beg (Node 17 to 21A) the Route Corridor runs close to the existing N4 alignment. The Route Corridor runs immediately to the north of Lough

Iron pNHA and SPA, north of Ballynafid Lake and Fen pNHA, south of Scragh Bog pNHA, cSAC and north of Lough Owel pNHA, SPA and cSAC.

Route Corridor Option 2: Wetland habitats

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark, to the north of Newtown Forbes. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC.

From Coolnahinch to Ballinalack (Node 08 to Node 17) the Route Corridor runs to the south of the existing N4 alignment, bypassing Edgeworthstown, Rathowen and Ballinalack to the south. The Route Corridor runs to the south of Lough Garr NHA and north of Lough Iron pNHA and SPA.

From Ballinalack to Culleen Beg (Node 17 to Node 21) the Route Corridor runs close to the existing N4, with an offline section parallel to the existing Dublin-Sligo railway line to the south of Ballynafid Lake and Fen pNHA and south of Scragh Bog pNHA and cSAC. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel pNHA, cSAC and SPA.

Route Corridor Option 3: Wetland habitats

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark, to the north of Newtown Forbes. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC. The geomorphological environment in this area is characterised by generally low-lying flat terrain.

From Lisnamuck to Ballynagoshen (Node 07 to Node 10) the Route Corridor runs to the north of the existing N4 alignment. The Route Corridor runs to the south of Carrickglass Demesne pNHA.

From Node 18 to Node 18A the southern edge of the corridor encroaches onto a fen area (Fulmort Fen) (See Section on Poor Ground for further details).

From Curry (Node 15) to Culleen Beg the Route Corridor runs to the north of the existing N4 alignment, bypassing Rathowen, Ballinalack, Bunbrosna, Ballynafid and Portnashangan to the north. The Route Corridor runs to the north of Lough Garr NHA and south of Garriskill Bog pNHA, SPA and cSAC. The Route Corridor also runs to the north of Ballynafid Lake and Fen pNHA and Scragh Bog pNHA and cSAC.

Route Corridor Option 4: Wetland habitats

This Route Corridor Option commences at Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (Node 04), to the north of Newtown Forbes. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC.

From Deerpark to Lackan (Node 04 to Node 10A) the Route Corridor runs along the outermost corridor around Longford. The Route Corridor runs to the north of Carrickglass Demesne.

From Windtown to Ballinalack (Node 16 to Node 17) the Route Corridor runs to the south of the existing N4 alignment. The alignment runs to the south of Rathowen and Ballinalack. The Route Corridor is immediately south of the existing N4 in the environs of the Lough Garr NHA.

From Ballinalack to Culleen Beg (Node 17 to Node 21) the Route Corridor runs close to the existing N4, with a section parallel to the existing Dublin-Sligo railway line to the south of Ballynafid Lake and Fen pNHA and south of Scragh Bog pNHA, SNR and cSAC. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel.

Route Corridor Option 5: Wetland habitats

This Route Corridor Option commences from Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (Node 04), to the north of Newtown Forbes. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC.

From Deerpark to Lackan (Node 4 to Node 14) the Route Corridor runs to the east of Newtown Forbes, in an orbital Route around the west and south of Longford Town, running along the proposed N5 Longford Bypass. The Route Corridor then continues to the south of the existing N4 alignment to Lackan. The Route Corridor runs to the north of Derrymore pNHA.

From Windtown to Ballinalack (Node 16 to Node 17) the Route Corridor runs to the south of the existing N4 alignment. The alignment runs to the south of Rathowen and Ballinalack. The Route Corridor is immediately south of the existing N4 in the environs of Lough Garr NHA.

From Ballinalack to Culleen Beg (Node 17 to Node 21A) the Route Corridor runs close to the existing N4 alignment. The Route Corridor runs immediately to the north of Lough Iron pNHA and SPA, south of Ballynafid pNHA, south of Scragh Bog pNHA, SNR and cSAC and north of Lough Owel pNHA, SPA and cSAC. The geomorphological environment is characterised by low lying peatlands and gently undulating lowland, with more variable slope conditions in the vicinity of Lough Owel.

Route Corridor Option 6: Wetland habitats

This Route Corridor Option commences from Tomisky (Node 01), at the northwest extent, and runs close to the existing N4 alignment as far as Deerpark (east of Node 3B), to the north of Newtown Forbes. The Route Corridor runs west of Aghnamona Bog NHA and east of Clooneen Bog pNHA and cSAC. The Route Corridor runs between the River Rinn NHA and the Lough Forbes Complex pNHA and cSAC.

From Ballinalack to Culleen Beg (Node 22) the Route Corridor runs close to the existing N4 alignment. The Route Corridor runs immediately to the north of Lough Iron pNHA and SPA, south of Ballynafid pNHA, south of Scragh Bog pNHA, SNR and cSAC and north of Lough Owel pNHA, SPA and cSAC.

Holy Wells

There are five Holy Wells identified within the study area on the 1:50,000 OSI Discovery mapping, which forms the background mapping to the drawings referenced

in this section of the report (Hydrogeology). Though none of them occurs within 250m of any of the Route Corridor Options, they are listed as follows:

1. South west of Edgeworthstown in Ballindagny, approximately 380m north of Node 14A, there is a Holy Well, named as St. Marys' Well.
2. In Kilpatrick, south of the Route Corridors between Node 19 and 21. Outside 250m of all Routes. Kilpatrick Well.
3. Knightswood, east of Node 20. This Holy Well is also known as Tobermichael, which is identified also as a spring.
4. Kilmaglish, 1.5km northeast of Node 18B. St. Patricks Well.
5. Culleen More, approximately 800m south of all Route Corridor Options between Nodes 21A and Node 22. St Brigids Well.

Springs

The main springs identified occurring within the study area from the GSI database and a search of the OSi on-line web mapping. The identified springs occur in a discharge zone in the southern part of the study area, north of Lough Owel and discharge to the River Gaine. They occur on the Locally Important Karst Aquifer. The following three occur close to each other, in the townland of Knightswood, approximately 150m south of Route Corridor Option 3:

1. Tobermichael (Holy Well), Knightswood.
2. Tobernachrin, Knightswood, approximately 500m north of Tobermichael (see Holy Wells).
3. Toberslauntia adjacent to Tobermichael which is also identified as a Holy Well.

The fourth spring:

4. Multifarnham Group Water Scheme comprises a spring, approximately 700m north of Route Corridor Option 3, on the northern side of the River Gaine.

4.7.17 Overview of Karst Areas and Karst Features

The section describing the aquifer type provides an overview of the portions of the Route Corridors that are occupied by karst aquifers. There are two distinct areas of karstified aquifers:

- in the northwest there is approximately 5kms occupied by a Regionally Important Karst Aquifer (Rk); and,

- in the southeast there is approximately 8kms occupied by a Locally Important Karst Aquifer (Lk).

There are no recorded karst features in the area occupied by the Regionally Important Karst Aquifer within the study area; this is due to no karst mapping conducted by the GSI in that part of the country and that the majority of the karst aquifer is mantled by a relatively thick cover of soils and subsoils.

The overview of groundwater vulnerability given in the following section indicates the level of protection afforded by the subsoils.

In contrast, in the karst area in the southeastern part of the study area, there is rock mapped close to the surface in the vicinity of the six Route Corridor Options; for example at Knightswood, Rathlevanagh and Culleendarragh (these areas are located between Nodes 18A, 18B, 20). These areas of rock closely correspond to the highest portions of the landscape.

There are karst features recorded in a few places northeast of the study area. Pollnagat Cave, is the closest to a Route Corridor – Route Corridor Option 3, approximately 2.5km northeast of Knightswood. Even though the features occur outside the 250m study width, they indicate that there may be more features.

It should be noted that limestones other than those classified as karst aquifers may also be karstified but to a lesser extent. The karst areas and features are shown on the Aquifer and Groundwater Vulnerability maps (RFig 4.7.5 to 4.7.8 and 4.7.13 to 4.7.16).

4.7.18 Overview of Groundwater Vulnerability

Groundwater vulnerability is dictated by the nature and thickness of the material overlying the uppermost groundwater 'target'. A detailed description of the vulnerability categories can be found in the Groundwater Protection Schemes document (DELG/EPA/GSI, 1999).

The draft Groundwater Vulnerability map (2009) for the region, as mapped by Tobin on behalf of GSI, Longford and Westmeath County Councils are given in the following figures - RFig 4.7.13 to RFig 4.7.16 inclusive.

An overview of the groundwater vulnerability across each Route Corridor Option is provided as follows.

Route Corridor Option 1: Groundwater Vulnerability

From Tomisky (Node 01) to Lissagernal (Node 03A) the groundwater vulnerability is predominantly 'Low'. In the vicinity of Deerpark (Node 04) and Carrickmoyragh, the groundwater vulnerability is mapped as 'Extreme' to 'Moderate', corresponding to an area of shallow rock and a low ridge.

From Carrickmoyragh through to Lismoy (Node 05) the mapping indicates the groundwater vulnerability to be 'high'. This section overlies the karst aquifer that occupies this area.

From Lismoy, through Cloonrallagh (Node 06) to Clooncoose (Node 07) the groundwater vulnerability ranges from 'high' to 'low', though predominantly 'moderate'. From Clooncoose through Cartron Little (Node 08A) to Lackan (Node 10A), north west of Edgeworthstown 'high' groundwater vulnerability is dominated interspersed with areas of 'extreme' groundwater vulnerability.

In Lackan, between Node 10A and Node 14 through to Node 14A at Ballindagny the groundwater vulnerability is dominated by 'moderate' vulnerability. From here through to Windtown (Node 16) 'low' groundwater vulnerability dominates.

From Windtown to Ballinalack 'high' and 'moderate' groundwater vulnerability dominate.

The rest of the Route Corridor is dominated by 'moderate' groundwater vulnerability with exceptions at Rathaniska (Node 19), in the vicinity of Clanhugh Demesne (Node 20), Portnashangan (Node 21) and Culleen More (Node 21A) where there are pockets of 'extreme' and 'high' vulnerability owing to pockets of rock close to the surface.

The Locally Important Karst Aquifer occupies the area between Node 20 and Node 21.

Route Corridor Option 2: Groundwater Vulnerability

From Tomisky (Node 01) to Lissagernal (Node 03A) the groundwater vulnerability is predominantly 'Low'. In the vicinity of Deerpark (Node 04) and Carrickmoyragh, the groundwater vulnerability is mapped as 'Extreme' to 'Moderate', corresponding to an area of shallow rock and a low ridge. From Carrickmoyragh through Cloonrallagh (Node 06) to Clooncoose (Node 07A) the groundwater vulnerability is predominantly 'moderate'. This latter section is underlain by the Regionally Important Karst Aquifer (Rk).

From Clooncoose (Node 07A) through Ardnacassagh, Kilnasavoge (Node 08), Cooleeny, Ballynagoshen (Node 11) to Lackan, 'high' groundwater vulnerability is dominant, interspersed with areas of 'extreme' groundwater vulnerability. In Lackan, in the vicinity of Node 14 the groundwater vulnerability is mapped as 'moderate'. From here through to Windtown (Node 16) 'low' groundwater vulnerability dominates.

From Windtown to Ballinalack 'high' and 'moderate' groundwater vulnerability dominate. The rest of the Route Corridor is dominated by 'moderate' groundwater vulnerability with exceptions at Rathaniska (Node 19), in the vicinity of Clanhugh Demesne (Node 20), Portnashangan (Node 21) and Culleen More (Node 21A) where there are pockets of 'extreme' and 'high' vulnerability owing to pockets of rock close to surface. The Locally Important Karst Aquifer occupies the area between Node 20 and Node 21.

Route Corridor Option 3 – Groundwater Vulnerability

From Tomisky (Node 01) to Lissagernal (Node 03A) the groundwater vulnerability is predominantly 'Low'. In the vicinity of Deerpark (Node 04) and Carrickmoyragh, the groundwater vulnerability is mapped as 'Extreme' to 'Moderate', corresponding to an area of shallow rock and a low ridge. From Carrickmoyragh through Cloonrallagh (Node 06) to Clooncoose (Node 07) the groundwater vulnerability is predominantly 'moderate'. This latter section is underlain by the Regionally Important Karst Aquifer (Rk).

From Clooncoose through Cartron Little (Node 08A), through Corboy (Node 10) to Aghafin (Node 13A), north of Edgeworthstown, 'high' groundwater vulnerability is generally dominant, interspersed with areas of 'extreme' and 'moderate' groundwater vulnerability.

From here through to north of Windtown, in Clonwhelan 'low' and 'moderate' groundwater vulnerability are dominant. North of Rathowen 'high' groundwater vulnerability dominates. From Rathowen to Leny (Node 18) the groundwater vulnerability is recorded as 'moderate'. Between Leny (Node 18) and Heathland (Node 18A) the Route passes through Fulmort where the groundwater vulnerability is mapped generally as 'extreme'.

The rest of the Route Corridor is dominated by 'moderate' groundwater vulnerability with a notable exception at Rathlevanagh (north of Node 18B) where there are pockets of 'extreme' and 'high' vulnerability owing to pockets of rock close to surface. The Locally Important Karst Aquifer occupies the area between Node 18A and Node 18B.

Route Corridor Option 4 – Groundwater Vulnerability

From Tomisky (Node 01) to Lissagernal (Node 03A) the groundwater vulnerability is predominantly 'Low'. In the vicinity of Deerpark (Node 04) and Carrickmoyragh, the groundwater vulnerability is mapped as 'Extreme' to 'Moderate', corresponding to an area of shallow rock and a low ridge. The Route stays on the ridge through Prucklish before descending to Garrowhill (Node 04A). The groundwater vulnerability changes from 'high' to 'low' moving from Prucklish to Garrowhill. From Garrowhill to Knockloughlin (Node 04B) the groundwater vulnerability is generally 'moderate'. The Regionally Important Karst aquifer underlies this section (Node 04A – Node 04B) of 'moderate' vulnerability.

From Drumhaughly (west of Node 04B) through Lisnagh (Node 04C) to Lackan (Node 10A), north west of Edgeworthstown 'high' groundwater vulnerability is dominated interspersed with areas of 'extreme' groundwater vulnerability.

In Lackan, in the vicinity of Node 14 the groundwater vulnerability is mapped as 'moderate'. From here through to Windtown (Node 16) 'low' groundwater vulnerability dominates. From Windtown to Ballinalack 'high' and 'moderate' groundwater vulnerability dominate.

The rest of the Route Corridor is dominated by 'moderate' groundwater vulnerability with exceptions at Rathaniska (Node 19), in the vicinity of Clanhugh Demesne (Node 20), Portnashangan (Node 21) and Culleen More (Node 21A) where there are pockets of 'extreme' and 'high' vulnerability owing to pockets of rock close to surface. The Locally Important Karst Aquifer occupies the area between Node 20 and Node 21.

Route Corridor Option 5 – Groundwater Vulnerability

From Tomisky (Node 01) to Lissagernal (Node 03A) the groundwater vulnerability is predominantly 'Low'. In the vicinity of Deerpark (Node 04) and Carrickmoyragh, the groundwater vulnerability is mapped as 'Extreme' to 'Moderate', corresponding to an area of shallow rock and a low ridge.

From Carrickmoyragh through to Lismoy (Node 05) the mapping indicates the groundwater vulnerability to be 'high'. As the Route Corridor swings south around Longford Town as far as Mullagh/Ballymanion (Node 05B), it is recorded as 'moderate' groundwater vulnerability. This section is underlain by the Regionally Important karst aquifer.

South of Longford Town is recorded as 'extreme' to 'high' groundwater vulnerability as the Route Corridor passes over the ridge. The flanks of the ridge are generally 'low' to 'high' groundwater vulnerability. From the southerly flanks of the ride, to Feraghfad (Node 05D), through Freehalman (Node 9), Cloonahard, Lisfarrell (south of existing railway line), to Lackan (Node 14), 'high' groundwater vulnerability is generally dominant, interspersed with areas of 'extreme' groundwater vulnerability.

In Lackan, in the vicinity of Node 14 the groundwater vulnerability is mapped as 'moderate'. From here through to Windtown (Node 16) 'low' groundwater vulnerability dominates. From Windtown to Ballinalack 'high' and 'moderate' groundwater vulnerability dominate.

The rest of the Route Corridor is dominated by 'moderate' groundwater vulnerability with exceptions at Rathaniska (Node 19), in the vicinity of Clanhugh Demesne (Node 20), Portnashangan (Node 21) and Culleen More (Node 21A) where there are pockets of 'extreme' and 'high' vulnerability owing to pockets of rock close to surface. The Locally Important Karst Aquifer occupies the area between Node 20 and Node 21.

Route Corridor Option 6 – Groundwater Vulnerability

From Tomisky (Node 01) to Lissagernal (Node 03A) the groundwater vulnerability is predominantly 'Low'. In the vicinity of Deerpark (north of Node 04) and Carrickmoyragh, the groundwater vulnerability is mapped as 'Extreme' to 'Moderate', corresponding to an area of shallow rock and a low ridge. From Carrickmoyragh through Cloonrallagh (Node 06) to Clooncoose (Node 07) the groundwater vulnerability is predominantly 'moderate'. This latter section is underlain by the Regionally Important Karst Aquifer (Rk).

From Clooncoose (Node 07) through, Cartron Little/Cooleeny (Node 08A), Ballynagoshen (Node 12) to Lackan, 'high' groundwater vulnerability is generally dominant, interspersed with areas of 'extreme' groundwater vulnerability. In Lackan, in the vicinity of Node 14 the groundwater vulnerability is mapped as 'moderate'. From here through to Windtown (Node 16) 'low' groundwater vulnerability dominates.

From Windtown to Ballinalack 'high' and 'moderate' groundwater vulnerability dominate. The rest of the Route Corridor is dominated by 'moderate' groundwater vulnerability with exceptions at Rathaniska (Node 19), in the vicinity of Clanhugh Demesne (Node 20), Portnashangan (Node 21) and Culleen More (Node 21A) where there are pockets of 'extreme' and 'high' vulnerability owing to pockets of rock close to surface. The Locally Important Karst Aquifer occupies the area between Node 20 and Node 21.

The regional groundwater vulnerability can be summarised as follows:

- Roosky to Newtown Forbes is dominated by 'Low' groundwater vulnerability;
- Newtown Forbes to Longford comprises a mixture of 'High' to 'Low' groundwater vulnerability;

- Longford to Edgeworthstown is dominated by 'High' groundwater vulnerability; Edgeworthstown to Mullingar is generally 'low' and 'moderate' interspersed with areas of 'extreme' and 'high' groundwater vulnerability.

4.7.19 Impact Assessment

Taking account of the overviews given above, the significant hydrogeological impacts considered are on aquifer and groundwater vulnerability, wetlands, groundwater resources and hydrogeological features. These attributes have been included in the Project Appraisal Balance Sheet (PABS) presented in Appendix 1, Volume II. Preliminary Assessment tables are given for each Route. The impacts, as set out in the NRA Guidelines (Table 4.2), are arranged on a sliding scale as follows:

- Minor positive;
- Neutral;
- Minor negative;
- Moderately negative;
- Major Negative;
- Severe Negative.

The Node points referred to in the appraisal reflect the key points within each Route Corridor identified in RFig 10.1-10.4; RFig 20.1-20.4; RFig 30.1-30.4; RFig 40.1-40.4; RFig 50.1-50.4 and RFig 60.1-60.4 of Volume III of this report.

This section should be read in conjunction with RFig 4.7.1 to RFig 4.7.24 presented in Volume III.

The majority of the wetlands are 'cutover' peat or raised bogs. The main exceptions are fen peats, which are located in the southern portion of the study area and are: Fulmont Fen, Ballynafid Lake and Fen (pNHA), Scrag Bog (cSAC), Lough Iron SPA, and northern and southern extremities of Lough Owel. Wetlands identified as fen peats which are largely groundwater fed, thus are the wetlands that are considered of 'higher' value from a hydrogeological perspective and are also referred to as GWDTEs. It is difficult to assess or predict the risk to the local hydrogeology and integrity of these fens posed by the routes. The level of impacts is given as a Moderate Negative.

All the Routes are Moderately Negative overall, except for Route Corridor Option 4, which is Minor Negative overall.

Table 4.7-10 Preliminary Assessment Table (Hydrogeology)

Route Corridor 1			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Karst Aquifers / Groundwater resources	HIGH	Potential Impact on Water Quality and Resource	Moderate Negative
Poorly Productive Aquifers	LOW	Potential local effects	Neutral
Wetlands	HIGH	Potential impact on water quality and ecology	Moderate Negative
Route Corridor 2			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Karst Aquifers / Groundwater resources	HIGH	Potential Impact on Water Quality and Resource	Moderate Negative
Poorly Productive Aquifers	LOW	Potential local effects	Neutral
Wetlands	HIGH	Potential impact on water quality and ecology	Moderate Negative
Route Corridor 3			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Karst Aquifers / Groundwater resources	HIGH	Potential Impact on Water Quality and Resource	Moderate Negative
Poorly Productive Aquifers	LOW	Potential local effects	Neutral
Wetlands	HIGH	Potential impact on water quality and ecology	Moderate Negative
Route Corridor 4			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Karst Aquifers / Groundwater resources	HIGH	Potential Impact on Water Quality and Resource	Minor Negative
Poorly Productive Aquifers	LOW	Potential local effects	Neutral
Wetlands	HIGH	Potential impact on water quality and ecology	Moderate Negative
Route Corridor 5			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Karst Aquifers / Groundwater resources	HIGH	Potential Impact on Water Quality and Resource	Moderate Negative
Poorly Productive Aquifers	LOW	Potential local effects	Neutral
Wetlands	HIGH	Potential impact on water quality and ecology	Moderate Negative

Route Corridor 6			
Attribute	**Attribute Importance**	**Impact**	**Level of Impact**
Karst Aquifers / Groundwater resources	HIGH	Potential Impact on Water Quality and Resource	Moderate Negative
Poorly Productive Aquifers	LOW	Potential local effects	Neutral
Wetlands	HIGH	Potential impact on water quality and ecology	Moderate Negative

4.7.20 Comparison of Route Corridor Options

For comparison purposes, each of the Route Corridor Options is assessed for various impacts associated with the construction of a road.

Table 4.7-11 summarises the hydrogeology impacts which are given in greater detail in the Project Appraisal Balance Sheets, presented in Appendix 1, Volume II of this report. Due to the similarity in geological and hydrogeological terrain there is very little to distinguish the Route Corridor Options in respect of geology and hydrogeology.

All of the Route Corridor Options cross the karst aquifers present in the region and in particular cross the likely zone of contribution to a major public groundwater supply in the northern portion of the region which is undergoing augmentation. The Route Corridors vary in distance offset from the actual abstraction boreholes. As such all the Route Corridors impact negatively on this attribute and are given a 'Moderately' Negative class with the exception of the Option 4 Route Corridor option, which is given a 'Minor' Negative class, due to the significant distance off-set from the actual abstraction borehole locations.

In the northern part of the Study Area, Route Corridor Option 4 is regarded as offering greater protection to the Public Water Supply Borehole at Moneylagan, as the section from Node 04A to Node 04B is in an area of where there is no shallow karst rock mapped. In addition, the section from Node 04 to Node 04C generally avoids peat areas, which in places are thick (greater than 3m).

In addition it should be noted that even though the other Route Corridors have a 'Moderately' Negative, appraisal for traversing the zone of contribution, there are preferences within each of these Route Corridors from a hydrogeological perspective.

For example, Node 04 to Node 05 in Options 1 and 5 is closer to '*rock close to the surface*' in the karst aquifer, than the section from Node 04 to Node 06 in Options 6, 3 and 2. Option 4 is considered the more preferred option in the northern half of the Route Corridors. Thereafter, Option 2, Option 3, and Option 6 are more preferable than Option 1 and Option 5.

Route Corridor Option 5 is the least favourable, as this option is the closest to the Public Water Supply Borehole at Moneylagan.

In the southern portion of the area in the vicinity of Lough Owel, the Route Corridor Options cross a Locally Important Karst Aquifer and weave between Lough Owel (SPA), Ballynafid Lake (pNHA) (fen peat area) and Scragh Bog (cSAC) (fen peat area). The most favourable Route Corridor Options are those which run from Node 14 to Node 22. The least favourable Route Corridor option is Option 3, as this includes the section from Node 15 to Node 18A and sections from Node 18A to Node 21A, which have the potential to impact on Garriskill Bog (pNHA, cSAC and SPA), Ballynafid Lake and Fen (pNHA), Scragh Bog (cSAC) (fen peat area) and Lough Garr (NHA). Fen peats are largely groundwater fed, thus dewatering may affect groundwater levels and volumes discharging to the fen peats.

Route Corridor option 3 is amongst the more favourable options at the northern end of the Route Corridors and amongst the least favourable options at the southern end of the Route Corridors. The opposite is the case with Option 1, which is amongst the more favourable Route Corridors in the southern portion of the area.

Table 4.7-11 Summary Impacts Hydrogeology

Attribute	Attribute Importance	Potential Impact	Option 1 Level of Impact	Option 2 Level of Impact	Option 3 Level of Impact	Option 4 Level of Impact	Option 5 Level of Impact	Option 6 Level of Impact
Groundwater	High to Very High	Infiltration of road run-off	Neutral to Moderate Negative	Neutral to Moderate Negative	Neutral to Moderate Negative	Neutral to Slight Negative	Neutral to Moderate Negative	Neutral to Moderate Negative
Wetlands	High to Very High	Disturbance of designated sites	Slight to Moderate Negative	Slight to Moderate Negative	Slight to Moderate Negative	Slight to Moderate Negative	Slight to Moderate Negative	Slight to Moderate Negative

In summary as detailed in Table 4.7-12 the preferred Route Corridor Options in terms of Geology and Hydrogeology, are Option 4, followed by Option 2 and Option 6. The least favourable Route Corridors are Option 5, Option 3 and Option 1.

Table 4.7-12 Summary Ranking of Route Corridor Options (Hydrogeology)

Route Corridor Option	Scaling Statement	Order of Preference
Route Corridor Option 1	Moderately Negative	6
Route Corridor Option 2	Moderately Negative	2
Route Corridor Option 3	Moderately Negative	5
Route Corridor Option 4	Slightly Negative	1
Route Corridor Option 5	Moderately Negative	4
Route Corridor Option 6	Moderately Negative	3

4.8 Landscape and Visual

The purpose of this appraisal is to determine which Route Corridor presents the least overall landscape and visual impact. Landscape and visual impacts are separate, but related. **Landscape impacts** are defined as changes in the fabric, character and quality of the landscape. **Visual impacts** relate solely to changes in available views of the landscape, including visual amenity, and the effects of those changes on people.

4.8.1 Methodology

The current NRA Guidelines *'Environmental Impact Assessment of National Road Schemes – A Practical Guide'* only accommodate for very limited guidance on landscape and visual impact appraisal at the Route Corridor selection stage of development. Therefore, the methodology used for this appraisal is based upon the guidelines contained in Volume 11 section 3 part 5 of the UK Design Manual for Roads and Bridges. Also referred to are the *'Guidelines for Landscape and Visual Impact Assessment'* published by the Landscape Institute and the Institute of Environmental Management and Assessment (IEMA, 2002). Although more relevant to the later stages of road scheme design, an additional useful reference source is the NRA's *'Guide to Landscape Treatments for National Road Schemes in Ireland'.* Route Corridor appraisals of the landscape and visual impact were prepared with regard to the following:

- Appraisal of the N4 Mullingar to Longford (Roosky) Constraints Study;
- Appraisal of Ordnance Survey 1:50,000 Discovery Series;
- Review of the Westmeath County Development Plan 2008-2014;
- Review of the Longford County Development Plan 2009 -2015
- A roadside survey of the Study Area carried out in October 2007
- A study area visit to assess Route Corridor Landscape and Visual Impact potential was carried out in August 2008..

Landscape Impact

The significance of Landscape impacts depends on both the sensitivity of the receptor and the magnitude of the impact. The sensitivity of receptors is classified as High,

Medium or Low as defined in the table below. The sensitivity of the landscape is determined by:

- The existing land use on the site and surrounding areas;
- The presence of existing detractors;
- The pattern and scale of the landscape;
- Topography and enclosure;
- The scope for acceptable mitigation i.e. measures in keeping with existing landscape character / the 'capacity for change';
- The perceived value placed on the landscape e.g. as indicated by designations.

Table 4.8-1 Sensitivity of Landscape Receptor

Receptor Sensitivity	Receptor Description
High	High importance / quality and rarity. Strong positive character. No or limited potential for substitution, National or Local Designation (e.g. National Park or Special Landscape Area). Attractive landscape features that are prominent and an essential part of the strong positive character of an area.
Medium	Medium importance / quality and rarity. Undesignated areas of value (perhaps expressed through non-official publications or demonstrable use). Landscape features that are of importance because they contribute to local character but are not the most important feature.
Low	Low importance / quality and rarity. Some features of landscape interest present and/or potential for improvement. Could accommodate change without being adversely affected. Landscape features that are of minor value to local character.

The magnitude of landscape impact depends on the degree of deterioration or improvement in landscape character as outlined in the table below:

Table 4.8-2 Magnitude of Landscape Impact

Magnitude of Impact	Description of Impact
Substantially negative / adverse	Significant deterioration in landscape character
Moderately negative / adverse	Noticeable deterioration in landscape character
Slight negative / adverse	Barely perceptible deterioration in landscape character
Negligible impact	Imperceptible change in landscape character
Slight positive	Barely perceptible improvement in landscape character
Moderately positive	Noticeable improvement in landscape character
Substantially positive	Significant improvement in landscape character

The table below outlines the significance of landscape effects in relation to the sensitivity of the receptor and the magnitude of the impact. The appraisal will use this table as the basis for the significance of impact; however, the assessment of significance will be adjusted as necessary, and justified, to reflect site characteristics and conditions.

Table 4.8-3 Significance of Landscape Effects

Receptor Sensitivity	Magnitude of Impact						
	Deterioration			Negligible Impact	Improvement		
	SUB	**MOD**	**SL**	**None**	**SL**	**MOD**	**SUB**
High	HS	HS	S	NS	S	HS	HS
Medium	HS	S	MS	NS	MS	S	HS
Low	S	MS	MS	NS	MS	MS	S

HS = Highly Significant, S = Significant, MS = Minor Significance, NS = Not Significant, SUB = Substantial, MOD = Moderate, SL = Slight, NEG = Negligible

Visual Impact

The sensitivity of visual receptors depends on the location and context of the viewpoint, the expectation of the receptor and the importance of the view. The most sensitive receptors are those in areas of scenic beauty especially in relation to recreational activities, either people or potential views from properties, for example. Those at their place of work are typically regarded as least sensitive visual receptors, while those travelling through an area are considered to be of medium receptor sensitivity.

Table 4.8-4 Sensitivity of Visual Receptors

Receptor Sensitivity	Receptor Description
High	Users of all outdoor recreational activities facilities, including public rights of way, recognised viewpoints and views from residential properties.
Medium	People engaged in outdoor sport or recreation (not directly focused on the surrounding landscape), views from those travelling through an area.
Low	People at their place of work or engaged in similar activities

The magnitude of visual impact will be determined by:

- The degree of change in the view with respect to the elements seen, the proportion of view affected (this varies with distance from the proposed development);
- The appropriateness of new features in the wider landscape context (in terms of form, texture, colour, height and materials) and existing detractors;
- The nature, duration and possible frequency of any effects (this may be linked to climate and typical weather conditions as long-distance views are often prevented by rain and haze);
- The relative position of the visual receptor and the change (e.g. developments that break the skyline generally have a greater impact than those which do not).

Table 4.8-5 Magnitude of Visual Impact

Magnitude of Impact	Description of Impact
Substantially negative / adverse	Significant deterioration in existing view
Moderately negative / adverse	Noticeable deterioration in existing view
Slight negative / adverse	Barely perceptible deterioration in existing view
Negligible impact	Imperceptible change in view
Slight positive	Barely perceptible improvement in existing view
Moderate positive	Noticeable improvement in existing view
Substantially positive	Significant improvement in existing view

The significance of visual impacts is defined by a combination of the sensitivity of the visual receptor and the magnitude of visual impact, as set out in the table below. The visual impact appraisal will use this table as the initial basis for significance of impact

but the assessments of significance will be adjusted if necessary, and justified, to reflect site based characteristics and conditions.

Table 4.8-6 Significance of Visual Impact

Sensitivity of Visual Receptor	Magnitude of Impact						
	Deterioration			Negligible Impact	Improvement		
	SUB	**MOD**	**SL**	**None**	**SL**	**MOD**	**SUB**
High	HS	S	MS	NS	MS	S	HS
Medium	HS	MS	MS	NS	MS	MS	HS
Low	S	MS	MS	NS	MS	MS	S

HS = Highly Significant, S = Significant, MS = Minor Significance, NS = Not Significant, SUB = Substantial, MOD = Moderate, SL = Slight, NEG = Negligible

Given that this report appraises Route Corridor options, no visual envelope has been set. Therefore, the appraisal envelope is loosely guided by the anticipated 300 metre impact corridor, though local topography and land cover have also been considered. All impact appraisal has been made without mitigation measures and effects; however, a summary of impacts from potential and assumed mitigation is also made for each overall route option. Note that the summary table in the conclusion is based upon the Project Appraisal Balance Sheet (PABS) assessment matrix criteria and impact categories, but results between Nodes have been considered against the above methodology.

The Landscape and Visual Impact Appraisal of the route options is described twofold:

1. Existing Environment – including physical characteristics and landscape character
2. Route Option Appraisal – including landscape impacts and visual impacts on amenity and receptors.

4.8.2 Existing Environment

The study area consists primarily of a mixture of undulating drumlins and extensive areas of pastureland with some pockets of bog. The flood plain of the River Camlin is also located within the study area.

Geomorphology

The landscape of the study area has evolved predominantly over underlying carboniferous limestone. The resulting topography is gently undulating, punctuated

with higher ground to the eastern end around Lough Owel (140 – 150m), to the western end at Prucklish (105m) and to the central area at Lackan (127m) east of Edgeworthstown. However, even these are relatively low within the context of the local hills surrounding the study area. For example, to the north west of Prucklish, Corn Hill rises distinctively to 278m just outside of the study area. The general pattern of geomorphology across the study area is in itself distinctive, aligned strongly along a northeast to southwest axis and exaggerated by the parallel pattern of low-lying rivers. See section 4.7 for further information.

Land Use, Settlement & Character

The land use within the study area is predominantly agricultural. This consists of arable land flanking the low-lying rivers and pastoral land occupying steeper gradients. Field boundaries are consistently well vegetated with deciduous natives and include a large number of mature hedgerow trees. Commonly, fields in the western portion of the study area are small and form a tight pattern, where the collective layering of field boundaries and riparian vegetation creates an overall dense screening effect. To the eastern part of the study area the field pattern remains integral but typically larger, in response to the greater topographical variation. Small clusters of mature broadleaf woodland and copses, often associated with the ancient arrangement of Demesnes, are a typical feature of the study area landscape.

The landscape is peppered with enclosures, though these are often easily overlooked on the ground and are a discrete (though historically important) layer of cultural heritage. Today the predominant settlement pattern is similarly scattered, with many isolated dwellings and farms or low density clusters. Recent house building on individual plots, or in very small numbers, is prevalent within the rural landscape. Longer established properties are typically shrouded by evergreen vegetation that offers good screening. Many of the dwellings outside of the larger towns are low-density domestic ribbon development along the limited network of rural lanes. Interestingly, the pattern of these lanes parallels the river pattern and geomorphology alignments. Residential properties are also common adjacent to the carriageway of the existing N4, both individually and in small groups, and occasionally churches are present.

The key conurbations of Longford and Mullingar are significant towns within the study corridor, but are excluded from the study area. Another key settlement within the study corridor (but also excluded from the study area) is Edgeworthstown, through which the existing N4 passes east / west and is where the crossroads of the north / south N55 intersects with the N4. Settlements within the study area include the villages of Ballinalack and Rathowen on the route of the N4 in Westmeath, and the town of Newtown Forbes in Longford.

The study area is also divided along an east / west axis by the Dublin Sligo railway line.

Westmeath County Council have prepared a Landscape Character Assessment (see Westmeath County Development Plan 2008 – 2014) which identifies 11 character areas within the County. Of these the Study Area includes 2:

- Character Area 2 – Inny River Lowlands
- Character Area 4 – Central Hills and Lakes

Recently, Longford have also prepared a Landscape Character Assessment (see Longford County Development Plan 2009 - 2015), which identifies 7 distinct Landscape Character Units within the County. Of these the Study Area includes 5:

- Landscape Character Unit 3 – Shannon Basin/Lough Ree
- Landscape Character Unit 4 – Central Corridor
- Landscape Character Unit 5 – Inny Basin
- Landscape Character Unit 6 – Peatlands
- Landscape Character Unit 7 – Open Agriculture

Views

Views from properties within the study area vary, though most are constrained by local (albeit subtle) topographical changes and the collective screening effect of field boundary and rural lane hedgerows, trees and woodland stands. Many properties are also screened by garden and plot vegetation or boundary structures.

Long views west are afforded from the elevated ground near Lough Owel, and locally panoramic views are experienced from the broad area west of Edgeworthstown.

A number of protected views & prospects are identified in the Westmeath County Development Plan 2008 – 2014, and also in the Longford County Development Plan 2009 - 2015. These have been considered in the visual impact appraisal of the Route Corridor options.

The protected views identified in Westmeath County Development Plan (CDP) 2008 – 2014 are listed in Table 4.8-7 below. It is an objective of current CDP to "preserve, improve and open up places or areas from which views or prospects of high amenity value may be enjoyed".

Table 4.8-7 Westmeath CDP 2008-2014 – Protected Views and Prospects

WCDP Reference	Description
28	Views of Lough Owel from existing N4 between Portnashangan and Tullaghan.
29	Scenic drive with incidental views over Knockdrin Estate.
30	Scenic drive with incidental views on County Road No.117 Lee's Cross-Crazy Corner southwards to Knockdrin.
31	Views of Knockeyon and surrounding countryside from County Road No. 112.
32	Views of Lough Derravaragh and hills at south-western end as seen from R394 between Crookedwood and Gartlandstown.
33	Views of north-west end of Derravaragh and neighbouring countryside from roadside between Ballynafid and Multyfarnham: Road No. 55
34	Views to west and south towards Lough Owel and existing N4, County Road No.130-3 at Kilpatrick.
35	Panoramic view of countryside looking north-west from point on existing N4, Road No. 48 near Bunbrosna.
36	Panoramic view of countryside to north-west and north and excellent view over Lough Derravaragh from Road point No. 47 between Leny & Multyfarnham.
37	Views of Lower Inny with its source. Lough Derravaragh and hills in background from point of County Road No. 31-1/31-2.
38	View of Glen Lough from County Road No. 144

Source: Westmeath County Development Plan 2008 – 2014

The location of the following protected views and prospects, described in Table 4.8-7 above, are shown on RFig 4.8.7 and RFig 4.8.8: WCPD Reference 28, 29, 33, 34, 35 and 36.

The aims for the high amenity areas are quoted in the current Development Plan for County Westmeath. The existing land use of the designated Areas of High Amenity value are mainly agriculture and forestry. Development not directly related to these land uses or to the recreational and amenity function of these areas will normally be excluded through Development Control. The impact of the Options upon High

Amenity Areas has been considered within the planning, landscape and noise assessments.

The protected views and prospects identified in the Longford County Development Plan 2009-2015 are listed in Table 4.8-8 below:

Table 4.8-8 Longford CDP 2009-2015 – Protected Views and Prospects

LCDP Reference	Description
I.S - 11	Cartrongolan, Oghil, Clontumper, Esker South. - Intermittent
I.S -12	Feraghfad, Ballymakeegan, Farnagh, Glebe(Ed. Longford Rural), Townparks(Ardagh By), Farranyoogan, Aghafad, Cartronageeragh.- Intermittent
I.S - 13	Druming, Ballycloghan, Aghnasillagh, Garrycam, Keel(Moydow By), Castlerea Mountain, Bawn Mountain.- Intermittent
F.S - 1	Clontumper,Esker South,Drumnacooha,Derrynacross,Cornafunshin, Lettergonnell, Aghadowry, Glenmore(Longford By),Fostragh, Rathmore(Granard By). - Full

Source: Longford County Development Plan 2009 - 2015

Of the above protected views in County Longford, only I.S – 12 is fully affected by the crossing of Route Corridor Option 5. All views potentially affected by either one or more of the route options are illustrated on the landscape drawings (RFig 4.8.1 – RFig 4.8.8, Volume III) to be referred to in conjunction with this chapter.

Hydrology

A network of streams and rivers striate the study area, the most prominent being the Inny River, the Rinn River and the Camlin River, the latter of which passes through the north side of Longford Town. The study area also contains a number of water bodies, including Lough Owel to the east, Lough Iron, Lough Garr, Glen Lough, and Lough Forbes to the west.

Another distinctive feature is the presence of expansive raised peat bogs, including the Clooneen Bog in the west of the study area, Derrymore Bog, Garriskil Bog and Scragh Bog to the east. Furthermore, localised fens and water meadows are abundant. See Section 4.9 for further information.

Cultural Heritage

The landscape is rich in historic features, archaeological monuments, buildings, ruins, ancient boundaries, enclosures and demesnes. Of these, the most significant impact on the landscape character are the many demesnes. The Demesnes of Castleforbes and Carrickglass in Co Longford, and those of Baronstown, Clanhugh, Newpass and Crumlin or Rockfield in Co. Westmeath are considered to be of significant architectural merit. See Section 4.6 for further information.

Designations

There are 17 Natural Heritage Areas/proposed Natural Heritage Areas (NHA/pNHA), six candidate Special Areas of Conservation (cSAC), seven Special Protection Areas (SPA) and the Scragh Bog Statutory Nature Reserve (SNR). There are also a multitude of Areas of Ecological Value throughout the Study Area, though these are not recognised as formal designations. All of these designations are illustrated on the sequence of landscape and visual impact drawings (RFig 4.8.1 – 4.8.8) together with all 6 Route Corridor options, to be read in conjunction with this chapter. They are also described in more detail in section 4.10, Natural Environment.

There are no National Monuments located within the study area, however, there are 161 recorded archaeological sites listed in the Records of Monuments and Places.

Longford County Development Plan identifies a number of 'Important Stands of Trees' (Policy NHB10). The following stands are relevant to the study corridor:

2 – Woods at Carriglass, Castleforbes & Newcastle Demesnes

7 – Trees along Regional Road R393 at Knockahaw

11 – Wood at Farragh, Killoe

4.8.3 Route Corridor Option Appraisal

The Nodes points referred to in each of the Route Corridor descriptions reflect the key points within each Route Corridor identified in RFig 10.1-10.4; RFig 20.1-20.4; RFig 30.1-30.4; RFig 40.1-40.4; RFig 50.1-50.4 and RFig 60.1-60.4 of Volume III of this report. RFig 4.9.1 to 4.9.8, Hydrology Detail should also be referenced.

Route Corridor Option 1

Route Corridor Option 1 comprises the sections shown in Table 4.8-9 below. From Roosky this corridor runs close to the existing N4 as far as Carrickmoyragh, bypassing Cloonart North to the south side of the settlement. It then generally runs towards the settlements of Lismoy Upper and Lismoy Lower (RFig 4.8.2, Volume III), approximately following the former emerging preferred Route Corridor which was identified in the Drumsna to Longford scheme. It does not follow the same alignment as the existing N4 Longford Bypass; instead it passes Longford Town further to the north. Between Longford and Edgeworthstown it crosses over the N4 near Ballynagoshen and bypasses to the south of Edgeworthstown, Rathowen and Ballinalack. It runs close to the existing N4 through Bunbrosna, Ballynafid and Portnashangan as far as the R394 junction near Mullingar.

Table 4.8-9 Route Corridor Option 1: Landscape and Visual

Start Nodes	End Note	Comments
01 (02, 02A, 03)	03A	From Roosky, runs close to existing N4, Bypass to South of Cloonart North.
03A (04, 05)	06	Runs between Lismoy Upper and Lismoy Lower. Nodes 06 is R198.
06	07	Nodes 07 is R194 (Clooncoose) (RFig 4.8.2)
07 (08A, 08B, 10, 10A)	14	Runs to north of existing Longford Bypass, then crosses existing N4 near Ballynagoshen.
14 (14A, 16)	17A	Bypasses Edgeworthstown, Rathowen and Ballinalack on south side.
17A (17)	19	Runs close to existing N4 through Bunbrosna.
19 (20 on-line)	21	Runs close to existing N4 through Ballynafid, on-line from Nodes 20.
21 (21A on-line)	22	Runs on line on existing N4 through Portnashangan up to R394.

From the existing N4 Tomisky roundabout (near Roosky) at Nodes 1 (the Dromod-Roosky scheme tie in) the short off-line section circumvents any landscape impact on the Aghnamona Bog NHA to the northeast, before rejoining the existing N4 on-line to

avoid / minimise impact on Clooneen Bog (pNHA & cSAC). The route passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit where landscape sensitivity is deemed to be medium to high. This section runs between Nodes 2 and 2A and arcs southwest of Cloonart North, on a counterintuitive line through local high ground. This would require cutting and a resultant locally significant adverse landscape impact. Furthermore, the route passes close to nearby properties causing moderate adverse visual impact, albeit on a local scale.

From Node 02A (east of Bornacoola) the Route Corridor passes through the south western edge of the Rinn River NHA but, in doing so, avoids the more highly sensitive landscape of the Lough Forbes Complex cSAC & pNHA and the Ballykenny-Fishertown Bog SPA to the south. The Route Corridor generally takes advantage of the local terrain, avoiding the higher ground east of the Carrickmoyragh junction (Node 4). This junction harbours the potential for a moderate adverse impact on views from surrounding residential properties, and some intrusion on the landscape of the adjacent Deerpark to accommodate the junction footprint. However, a local lime tree avenue to the south flank of the Deerpark would remain preserved, retaining its beneficial contribution to the local landscape character. The western end of the Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit, and on into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity.

Between Nodes 4 and 5, a gentle local depression in the landform creates a shallow valley just to the southwest at St. Anne's Glebe. The Route Corridor favourably avoids historic enclosures and nearby properties.

At Node 6, Cloonrallagh (RFig 4.8.2, Volume III), slight to moderate adverse impact will be caused to views. The landscape impact of this portion of the Route Corridor between Nodes 5 and 6 will be slightly adverse, as the route is low-lying, however, the tight grain of the local field patterns will be further dissected, with the loss of some vegetation.

Between Nodes 6 and 7 the route is entirely within the Central Corridor Landscape Character Unit (low sensitivity), (see RFig 4.8.2). Views from the small cluster of

properties between Cloonahard and Freehalman (RFig 4.8.3) are well screened by surrounding hedgerows. This section benefits from the good cumulative screening effect of hedgerows and hedgerow trees. The visual impact here is therefore likely to be of minor significance. Although the section between Nodes 6 and 7 will cause severance of field boundaries the vegetation structure is sufficiently robust to accommodate this without significant impact. No landscape designations are affected and enclosures are avoided, resulting in negligible landscape impact for this section of the route.

Considering the extensive length of the next portion of the Route Corridor (Nodes 7 to 10) there are relatively few visual receptors, though it may adversely affect properties near Whiterock, at the western end of this section, due to close proximity. In addition key visual impact locations are properties at Cloonahussey, and some of the properties at Agharickard (RFig 4.8.4, adjacent to Node 08B). Where the route is likely to be on embankment and then cutting at Nodes 10, Ballynagoshen, a greater degree of visual impact will be caused than along the rest of the Route Corridor, to local properties. The visual impact of this section is likely to cause a locally significant deterioration from local receptors.

From Node 10, avoiding flanking properties, the Route Corridor passes parallel to the north side of the existing N4 at Ballynagoshen, before reaching Node 10A where the Route Corridor heads south to Node 14, most likely on embankment and crosses the Dublin- Sligo Railway Line. It does not offer a best-fit to the landscape compared with other parts of the Route Corridor. Although an Area of Ecological Value (51 – scrub/ woodland and small raised bog) is severed on the north slope of Lackan, this section will result in minor landscape impact, but in some locations impacts will be locally significant. The route between Nodes 10 and 14 is entirely within the Central Corridor Landscape Character Unit (low sensitivity).

The immediate 300m impact corridor is likely to affect a number of enclosures, though none directly by the road footprint land-take. Although parts of this Route Corridor utilise the undulations in the terrain, cuttings and embankments would be required for some sections and it does not offer a best-fit to the landscape compared with other Route Corridor options.

From Node 14 in the west to 22 in the east, the next section of the Route Corridor is long, passing through two Landscape Character Units within County Longford, the Central Corridor and the Inny Basin, both of generally low sensitivity. It also passes through two Landscape Character Units within County Westmeath, the Inny River Lowlands and the Central Hills and Lakes. The latter is valued for its high scenic quality and amenity value to the lake edges.

From Node 14 (just to the eastern edge of an Area of Ecological Value (45 - Plantation at Lisduff), the Route Corridor passes east taking advantage of low ground south of the Dublin Sligo railway line and the existing N4. The Route Corridor passes through a tight patchwork of small fields where the boundaries offer a dense layered screening effect. However, the characteristic pattern of the agrarian grain here will be severed, resulting in even greater fragmentation of the field plots. Visual impact here will be locally significantly adverse as the Route Corridor runs parallel to the linear settlements of Ballindagny and Cullyvore, Shanturn and Liscahill. The Route Corridor then runs close to the existing N4, avoiding the large Area of Ecological Value (40) at Derrydoonan Lower.

To the south east of Node 16 the Route Corridor passes between two distinct earthworks of archaeological importance near Ballydorey, between Ballygarran and Rathowen. These earthworks, illustrated as AH87 and AH88 on RFig 4.6.6 (Volume III) are in close proximity and the footprint of this Route Corridor will adversely affect at least one. Furthermore, these earthworks are sited on locally prominent high ground, and the Route Corridor is likely to be highly visible and in shallow cutting at this point. To the immediate north of this location there is a large area of locally low, wet ground, just south of the existing N4. The Route Corridor avoids the Area of Ecological Value (31) at Ballinalack but passes close to two properties here. On crossing the Inny River from Node 17A the Route Corridor converges toward the existing N4 at Node 19, capitalising on the crease in local topography toward the gap between Rathbennett and Bunbrosna. Immediately parallel to the existing N4 this option then shares the low valley on its climb up to Ballynafid, then crossing the Dublin Sligo railway line along the course of the existing N4.

From Nodes 20 to 22, the Route Corridor runs along the gap corridor of the existing N4 to the eastern end north of Lough Owel. The roadside vegetation here is a mixture of well established and mature screening, mostly deciduous. The existing road is also

flanked with scattered detached properties either side, many of which would be significantly affected or demolished as a result of the widening requiring additional cutting into the hillside, especially at Ballynafid. In addition the widening would affect several adjacent designations, namely the Ballynafid Lake and Fen pNHA and Areas of Ecological Value (8 and 10). The on-line Route Corridor would yield highly significant adverse visual impact and significant adverse landscape impact, the majority of the Route Corridor being within the highly scenic Central Hills and Lakes landscape character area.

Overall, without accounting for potential mitigation measures and effects Route Corridor Option 1 will cause a high to moderate negative landscape impact and moderately negative visual impact. With mitigation, however, such as replacement hedgerow and tree planting negative visual impact is likely to be moderate to slight. As the Route Corridor Option 1 passes through a number of sensitive and protected landscape designations, even with mitigation the landscape impact will remain moderately negative at best.

Route Corridor Option 2

Route Corridor Option 2 comprises the sections shown in Table 4.8-10 below. From Roosky it runs close to the existing N4 to Carrickmoyragh, bypassing Cloonart North on the north side of the settlement. From Carrickmoyragh it passes to the north side of the settlement of Lismoy to the R198. Between the R194 and the R393 it runs along the alignment of the existing N4 Longford Bypass. From the R393 it runs to the south of the existing N4, bypassing Edgeworthstown, Rathowen and Ballinalack on the south side. It then runs close to the existing N4 through Bunbrosna, Ballynafid and Portnashangan to the R394 junction near Mullingar.

Table 4.8-10 Route Corridor Option 2: Landscape and Visual

Start Nodes	End Note	Comments
01	02	Runs close to existing N4
02	02A	Bypass to north of Cloonart North
02A	03	Runs close to existing N4
03	03A	Runs close to existing N4
03A (03B)	06	Runs to north of Lismoy, Nodes 06 is R198 (RFig 4.8.2)

06 (07A)	08	Runs along line of eastern section of existing Longford Bypass from south of Nodes 07A the R194 to Nodes 08 the R393.
08 (09B, 09C, 11)	14	Runs to south of existing N4
14 (14A, 16)	17A	Bypasses Edgeworthstown, Rathowen, Ballinalack on south side
17A (17, 19, 21, 21A)	22	Runs close to existing N4 through Bunbrosna, Ballynafid and Portnashangan to R394 junction

From the existing N4 Tomisky roundabout (near Roosky) at Node 1 (the Dromod-Roosky scheme tie in) the short off-line section circumvents any landscape impact on the Aghnamona Bog NHA to the northeast, before rejoining the existing N4 on-line to avoid / minimise impact on Clooneen Bog (pNHA & cSAC).

Between Nodes 2 and 2A the Route Corridor then offers an intuitive topographical fit, off-line to the northeast of the settlement of Cloonart North. Although this section would cause moderate adverse visual impact to a very limited number of residential properties overall there would only be a minor adverse impact to views from properties at this location. The Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit where landscape sensitivity is deemed to be medium to high. However, the overall landscape impact of this portion of the Route Corridor is not significant.

Route Corridor Option 2 erodes a portion of the Rinn River NHA before becoming elevated on embankment toward high ground as it passes through Carrickmoyragh. This will cause significant adverse landscape impact, though the impact to the agrarian pattern, further east, would only be slight. North of Nodes 4 the Route Corridor passes between a cluster of properties and through a notably large field adjacent to the Dublin-Sligo railway line. This will cause field severance and locally the visual impact of the road here would be significantly adverse.

From Node 3A the Route Corridor continues through the Shannon Basin / Lough Ree Landscape Character Unit, but passes into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree

area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity. This portion of the Route Corridor would cause minor to moderate adverse visual and landscape impact.

Between Nodes 6 and 7A the new section of this Route Corridor passes over the Camlin River, and though no landscape designations or ancient monuments are affected and Area of Ecological Value (62) would be severed. From Node 7A several link roads connect the route to the existing N4 and to Node 7 through Clooncoose. Here the link road will cause local visual impact of minor significance. Landscape impact is negligible, as the Route Corridor is entirely within the Central Corridor Landscape Character Unit (low sensitivity).

Much of the length of the next section of the Route Corridor (from Nodes 7A to 08) is on-line on the existing N4, to the north eastern edge of Longford Town. As this portion of the Route Corridor is already close to an area of residential properties there will be negligible adverse visual impact, particularly if the vegetation to this edge of the road corridor is preserved and enhanced.

Much of the next section of the Route Corridor is sandwiched between the existing N4 and the Dublin Sligo railway line. West of Nodes 8 to 14 the route is entirely within the Central Corridor Landscape Character Unit (low sensitivity). Views from the small cluster of properties between Cloonahard and Freehalman are well screened by surrounding hedgerows. Being relatively close and parallel to the Dublin-Sligo railway line the perceived landscape and visual impact of this section may, by association, be less than otherwise anticipated. However, landscape between the existing N4 and the railway line has a high degree of integrity, with a strong field pattern and scattered enclosures. The line of this Route Corridor makes good use of local low spots in the terrain, and benefits from the good cumulative screening effect of hedgerows and hedgerow trees. The local visual impact is therefore likely to be of minor significance.

The Route Corridor then crosses the railway line at the eastern tip of the route at Node 14, and although the route here will cause severance of field boundaries the vegetation structure is sufficiently robust to accommodate this without significant impact. No landscape designations are affected and enclosures are avoided, resulting in negligible local landscape impact.

From Node 14 in the west to 22 in the east, the Route Corridor passes through two Landscape Character Units within County Longford, the Central Corridor and the Inny Basin, both of generally low sensitivity. It also passes through two Landscape Character Areas within County Westmeath, the Inny River Lowlands and the Central Hills and Lakes. The latter is valued for its high scenic quality and amenity value to the lake edges.

From Node 14 (just to the eastern edge of an Area of Ecological Value (45), this section of the Route Corridor takes advantage of low ground south of the Dublin-Sligo railway line and the existing N4. The Route Corridor passes through a tight patchwork of small fields where the boundaries offer a dense layered screening effect. However, the characteristic pattern of the agrarian grain here will be severed, resulting in even greater fragmentation of the field plots. Visual impact here will be significantly adverse as the Route Corridor runs parallel to the linear settlements of Ballindagny and Cullyvore, Shanturn and Liscahill. The Route Corridor then runs close to the existing N4, avoiding the large Area of Ecological Value (40) at Derrydoonan Lower.

To the south east of Node 16 the Route Corridor passes between two distinct earthworks near Ballydorey, between Ballygarran and Rathowen. These earthworks are in close proximity, and the footprint of the Route Corridor will destroy at least one. Furthermore, these earthworks are sited on locally prominent high ground, and the Route Corridor is likely to be highly visible and in shallow cutting at this point. To the immediate north of this location there is a large area of locally low, wet ground, just south of the existing N4.

The Route Corridor avoids the Area of Ecological Value (31) at Ballinalack but passes close to two properties here. On crossing the Inny River from Node 17 the Route Corridor converges toward the existing N4 at Node 19, capitalising on the crease in local topography toward the gap between Rathbennett and Bunbrosna. Immediately parallel to the existing N4 this option then shares the low valley on its climb up to Ballynafid, but turns immediately adjacent to the north side of the Dublin-Sligo railway line as it skirts the bank of Lough Owel. Here, the Route Corridor is likely to be visible from leisure users of Lough Owel, who are considered highly sensitive receptors (see table 4.8-4 Sensitivity of Visual Receptors). Finally, the Route Corridor rejoins the existing N4 at Node 21. This off-line section avoids direct impact to the properties at Portnashangan, unlike the on-line Route Corridor, and also avoids three Areas of

Ecological Value (5, 7 and 9) as well as the Ballynafid Lake and Fen pNHA along the only narrow corridor available. Protected views 28 and 34 (Westmeath CDP) will be affected. However, both Protected views 28 and 34, from the current line of the N4 can be accommodated along the new Route Corridor which would still afford broad views across Lough Owel. Between Nodes 14 and 22 the Route Corridor will generate significant adverse landscape impact, while visual impact is significant to highly significantly adverse, partly due to views from lake users.

Overall, without mitigation, Route Corridor Option 2 will cause moderately negative landscape impact and moderately negative visual impact. Negative landscape and visual impact will be reduced if the line of the Route Corridor avoids key historic and landscape features, such as the twin ancient earthworks near Rathowen, and better utilises the subtle topography to aid visual screening. Assuming mitigation, landscape impact could be moderately to slightly negative, and visual impact would be slightly negative.

Route Corridor Option 3

Route Corridor Option 3 comprises the sections shown in Table 4.8-11 below. From Roosky, it runs close to the existing N4 to Carrickmoyragh, bypassing Cloonart North on the north side of the settlement. From Carrickmoyragh it passes to the north side of the settlement of Lismoy to the R198. It does not follow the same alignment as the existing N4 Longford Bypass, instead it passes Longford further to the north. Between Longford and Edgeworthstown it runs to the north of the existing N4 and bypasses the north side of Edgeworthstown. It bypasses Windtown, Rathowen and Ballinalack to the north. It also bypasses Bunbrosna, Ballynafid and Portnashangan to the north-east, rejoining the existing N4 on the approach to the R394 junction at Mullingar.

Table 4.8-11 Route Corridor Option 3: Landscape and Visual

Start Nodes	End Note	Comments
01	02	Runs close to existing N4
02	02A	Bypass to north of Cloonart North
02A	03	Runs close to existing N4
03	03A	Runs close to existing N4
03A (03B)	06	Runs to north of Lismoy, Node 06 is R198

Start Nodes	End Note	Comments
06	07	Node 07 is R194
07 (08A)	08B	Runs to north of existing Longford Bpass
08B	10	Runs to north of existing N4
10 (13, 13A)	15	Bypasses Edgeworthstown on north side
15	18	Runs to north of existing N4 and bypasses Rathowen to north, Bypasses Ballinalack to north
18	18A	Runs north of Knockmorris
18A (18B)	21A (on-line)	Bypasses Bunbrosna, Ballynafid and Portnashangan to north
21A (on-line)	22 (on-line)	Runs (on-line) close to existing N4 to R394.

From the existing N4 Tomisky roundabout (near Roosky) at Node 1 (the Dromod-Roosky scheme tie in) the short off-line section circumvents any landscape impact on the Aghnamona Bog NHA to the northeast, before rejoining the existing N4 on-line to avoid / minimise impact on Clooneen Bog (pNHA & cSAC).

The Route Corridor offers an intuitive topographical fit, off-line to the northeast of the settlement of Cloonart North. Although this section would cause moderate adverse visual impact to a very limited number of residential properties overall there would be a minor adverse impact to views from properties at this location. The Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit where Landscape sensitivity is deemed to be medium to high. However, overall landscape impact of this portion of the route is not significant.

Route Corridor Option 3 erodes a portion of the Rinn River NHA before becoming elevated on embankment toward high ground as it passes through Carrickmoyragh. This will cause significant adverse landscape impact, though the impact to the agrarian pattern, further east, would be slight. North of Node 4 the route passes between a cluster of properties and through a notably large field adjacent to the

Dublin-Sligo railway line. This will cause field severance and locally the visual impact of the road would be significantly adverse.

The western end of the Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit, and on into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity. This portion of the route would cause minor to moderate adverse visual and landscape impact.

Between Nodes 6 and 7 the Route Corridor lies entirely within the Central Corridor Landscape Character Unit (low sensitivity). Views from the small cluster of properties between Cloonahard and Freehalman are well screened by surrounding hedgerows. This section benefits from the good cumulative screening effect of hedgerows and hedgerow trees. The visual impact here is therefore likely to be of minor significance. Although the section between Nodes 6 and 7 will cause severance of field boundaries the vegetation structure is sufficiently robust to accommodate this without significant impact. No formal landscape designations are affected (the Route Corridor crosses the linear Area of Ecological Value (58) of the Camlin River) and enclosures are avoided, resulting in negligible landscape impact for this section of the Route Corridor.

Considering the extensive length of the next portion of the Route Corridor (Nodes 07 to 10) there are relatively few visual receptors, though it may adversely affect properties near Whiterock, at the western end of this section, due to close proximity. In addition key visual impact locations are properties at Cloonahussey, and some of the properties at Agharickard.

The immediate 300m impact corridor is likely to affect a number of enclosures, though none directly by the road footprint land-take. Although parts of this route utilise the undulations in the terrain, cuttings and embankments are required for some sections and it does not offer a best-fit to the landscape compared with other Route Corridor options. An Area of Ecological Value (51) is avoided on the north slope of Lackan. This section is entirely within the Central Corridor Landscape Character Unit (low sensitivity).

From Node 10 the Route Corridor then takes a wide berth around the north of Edgeworthstown where it cuts perpendicular to the topographical ridge and valley terrain. This will have a significant impact on the character of the landscape here.

The Route Corridor crosses the N55 at Aghafin, Node 13A, where a key junction is proposed. From Node 13A the route passes south across the Dublin-Sligo Railway line from Node 15. Route Corridor Option 3 passes east as a long meandering section north of the existing N4, from near Edgeworthstown (Node 15) in the west to north of Lough Owel at Node 18A at the eastern end. From Node 15 the route skirts the northern edge of the River Riffey and follows low lying ground until it crosses the Dublin-Sligo railway line at Windtown North on embankment. This is within the Central Corridor Landscape Character Unit of Longford, an area of generally low landscape sensitivity. The Route Corridor then cuts into the southern slope of the rise at Windtown South. The Route Corridor also passes through the Inny Basin Landscape Character Unit (to the east of Edgeworthstown) which is also of generally low landscape sensitivity.

No formal landscape designations are affected, though an Area of Ecological Value (43), adjacent to the River Riffey, will be severed down the middle by this Route Corridor. Though the majority of landscape character sensitivity is low, the cumulative effect of ecological impact and the counter intuitive horizontal and vertical alignment of the Route Corridor will cause significant to highly significant adverse landscape impact.

From here the Route Corridor passes east between Lough Garr NHA and Garriskil Bog NHA, SPA and SAC. In doing so the route drives through an Area of Ecological Value (26) and abuts two further Areas of Ecological Value (25 and 24) near Cappagh, before crossing the River Inny. This sees the Route Corridor pass from the Inny Basin Landscape Character Unit (low sensitivity) in County Longford, to the Inny River Lowlands in County Westmeath. Although no particular sensitivity is assigned to the character areas of Westmeath the Inny River Lowlands are recognised as historically important and associated policies offer protection of the Demenses and archaeological sites. This section fits reasonably well into the local terrain, though the line of the Route Corridor between Nodes 18 and 18A cuts into the slopes of Fulmort and the distinctive rise above Knockmorris, and spans the valley between most likely on embankment, but avoids impact to the local ecological designation and the nearby

ringfort. It also puts several field boundaries between the Route Corridor and the highly sensitive nearby receptor, Wilson's Hospital School. Accounting for the whole length of the section between Nodess 15 and 18A the alignment the landscape impact is likely to be significantly adverse, as is the anticipated visual impact, especially as it impacts on protected view 35.

From the level crossing near Heathland at Node 18A Route Corridor 3 then crosses the Dublin- Sligo railway line then through Culleendarragh in deep cutting. In cutting again near Loughanstown from Node 18B to joining the existing N4 at Node 21A this section will cause the greatest local visual impact. Elsewhere along this section there are very few visual receptors. Circumventing all but an Area of Ecological Value (2) adjacent to Scragh Bog, this section has little impact on landscape designations or protected sites, but is entirely within the highly scenic Central Hills and Lakes landscape character area. The whole Route Corridor between Nodes 18A and 21A does not sit well within the natural terrain, except for the eastern end prior to rejoining the existing N4, resulting in a significantly adverse landscape impact. Visual impact will be negligible at the western end but likely to be moderate to significant at the eastern end.

From Nodes 21A to 22 the Route Corridor joins the existing N4 at the eastern end north of Lough Owel (just west of the R394 Junction). The roadside vegetation here is a mixture of well established and mature screening, mostly deciduous, with adjacent scattered properties. This last section of the Route Corridor would yield significant adverse visual impact and significant adverse landscape impact, the majority of the Route Corridor being within the highly scenic Central Hills and Lakes landscape character area.

Overall, without mitigation, Route Corridor Option 3 will cause moderately negative landscape impact and moderately negative visual impact. With assumed mitigation such as tree and hedgerow planting and with a few minor alterations to alignment the visual impact could be reduced to slightly negative. However, even with mitigation, landscape impact is likely to be moderate to slightly negative at best.

Route Corridor Option 4

Route Corridor Option 4 comprises the sections shown in Table 4.8-12 below. From Roosky it runs close to the existing N4 to Carrickmoyragh, bypassing Cloonart North

on the south side of the settlement. From Carrickmoyragh it is the northernmost of the corridors, passing north of the village of Creenagh, Carrickglass Demesne and the village of Corboy. It then crosses over the existing N4 bypassing Edgeworthstown, Rathowen and Ballinalack on the south side. It then runs close to the existing N4 through Bunbrosna, Ballynafid and Portnashangan to the R394 junction near Mullingar.

Table 4.8-12 Route Corridor Option 4: Landscape and Visual

Start Nodes	End Note	Comments
01 (02, 02A, 03)	03A	From Roosky, runs close to existing N4, Bypass to South of Cloonart North
03A	04	Runs close to existing N4 to Carrickmoyragh
04 (04A, 04B)	04C	Northernmost Route Corridor past Longford town, north of Creenagh, Carrickglass and Corboy
04C	10A	Crosses existing N4 heading south-east
10A (14)	14A	Bypasses Edgeworthstown on south side
14A (16)	17A	Bypasses Edgeworthstown, Rathowen, Ballinalack on south side
17A (17, 19, 21, 21A)	22	Runs close to existing N4 through Bunbrosna, bypasses Ballynafid to the south and Portnashangan to R394 junction

From the existing N4 Tomisky roundabout (near Roosky) at Node 1 (the Dromod-Roosky scheme tie in) the short off-line section circumvents any landscape impact on the Aghnamona Bog NHA to the northeast, before rejoining the existing N4 on-line to avoid / minimise impact on Clooneen Bog (pNHA & cSAC).

The Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit where Landscape sensitivity is deemed to be medium to high. This section runs between Nodes 2 and 2A and arcs southwest of Cloonart North, on a counterintuitive line through local high ground. This would require cutting and a resultant locally significant adverse landscape impact. Furthermore, the Route Corridor passes close to nearby properties causing moderate adverse visual impact, albeit on a local scale.

From Node 02A (east of Bornacoola) the Route Corridor passes through the south western edge of the Rinn River NHA but, in doing so, avoids the more highly sensitive landscape of the Lough Forbes Complex cSAC & pNHA and the Ballykenny-Fishertown Bog SPA to the south. The Route Corridor generally takes advantage of the local terrain, avoiding the higher ground east of the Carrickmoyragh junction (Node 4). This junction harbours the potential for moderate adverse impact on views from surrounding residential properties, and some intrusion on the landscape of the adjacent deer park to accommodate the junction footprint. However, a local lime tree avenue to the south flank of the Deer Park would remain preserved, retaining its beneficial contribution to the local landscape character. The western end of the Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit, and on into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity. Locally, the anticipated significance of the landscape and visual impact is minor.

From Node 4 the Route Corridor climbs the rise in cutting at Carrickmoyragh up to Prucklish, perpendicular and counterintuitive to the contours. Elevated properties here will experience views westward along the length of the Route Corridor. The Route Corridor then passes through a wide shallow valley, west of Prucklish and west of Garrowhill. Though topographically this is generally a good Route Corridor option, there are few hedgerow trees in this location to provide screening / land cover. Further east, (north of Gorteenorna), the small field pattern provide good vegetation cover. This landscape pattern has the potential to accommodate the impact of a new road. Similarly, further east still, the agrarian grain north of Carrigglass Bridge (over the Camlin River) is tight, with a high proportion of hedgerow trees providing good collective visual screening. This section of the Route Corridor then skirts south of the Kilnartruan Crossroads (adjacent to Node 04B, RFig 4.8.2) and passes benignly through the detached Area of Ecological Value (54) at Farraghroe woodland (RFig 4.8.4). Apart from the western end and eastern end, the Route Corridor section between Nodes 04 and 04C plots a course through the low terrain, though inevitably some cutting and embankments are required. The section is also entirely within the generally low sensitivity of the Central Corridor Landscape Character Unit. However,

due to its substantial length the local impact to the landscape will be moderate to significantly adverse. The visual impact will also be significantly adverse.

Between Nodes 4C to 10A this stretch of the Route Corridor is in cutting then on embankment and passes through an area of Ecological Value (51) north of Lackan. The landscape impact will therefore be significantly adverse (despite being within the generally low sensitivity of the Central Corridor Landscape Character Unit), but with few properties and visual receptors nearby its visual impact is likely to be only minor. Where the route is likely to be on embankment and then cutting at Node 10A, Lackan, a greater degree of visual impact will be caused here than along the rest of the Route Corridor, to local properties. The visual impact of this section is likely to cause a locally significant deterioration from local receptors.

From Node 10A the Route Corridor heads south to Node 14 on embankment and crosses the Dublin- Sligo Railway Line. It does not offer a best-fit to the landscape compared with other parts of the Route Corridor. Although an Area of Ecological Value (51) is severed on the north slope of Lackan., this section will result in minor landscape impact, but in some locations impact will be locally significant. The route between Nodes 10A and 14 is entirely within the Central Corridor Landscape Character Unit (low sensitivity).

From Node 14 in the west to 22 in the east, the Route Corridor passes through two Landscape Character Units within County Longford, the Central Corridor and the Inny Basin, both of generally low sensitivity. It also passes through two landscape character areas within County Westmeath, the Inny River Lowlands and the Central Hills and Lakes. The latter is valued for its high scenic quality and amenity value to the lake edges.

From Node 14 (just to the eastern edge of an Area of Ecological Value (45)), this section of the Route Corridor takes advantage of low ground south of the Dublin Sligo railway line and the existing N4. The Route Corridor passes through a tight patchwork of small fields where the boundaries offer a dense layered screening effect. However, the characteristic pattern of the agrarian grain here will be severed, resulting in even greater fragmentation of the field plots. Visual impact here will be significantly adverse as the route runs parallel to the linear settlements of Ballindagny and

Cullyvore, Shanturn and Liscahill. The Route Corridor then runs close to the existing N4, avoiding the large Area of Ecological Value (40) at Derrydoonan Lower.

To the south east of Node 16 the Route Corridor passes between two distinct earthworks near Ballydorey, between Ballygarran and Rathowen. These earthworks are in close proximity, and the footprint of Route Corridor option 4 will destroy at least one. These earthworks are sited on locally prominent high ground, and the Route Corridor is likely to be highly visible and in shallow cutting at this point. To the immediate north of this location there is a large area of locally low, wet ground, just south of the existing N4.

The Route Corridor avoids the Area of Ecological Value (31) at Ballinalack but passes close to two properties here. On crossing the Inny River from Node 17 the Route Corridor converges toward the existing N4 at Node 19, capitalising on the crease in local topography toward the gap between Rathbennett and Bunbrosna. Immediately parallel to the existing N4 this option then shares the low valley on its climb up to Ballynafid, but turns immediately adjacent to the north side of the Dublin-Sligo railway line as it skirts the bank of Lough Owel. Without mitigation, the road is likely to be visible from leisure users of Lough Owel, who are considered highly sensitive receptors. Finally, the Route Corridor rejoins the existing N4 at Node 21. This off-line section avoids direct impact to the properties at Portnashangan, unlike the on-line Route Corridor alternative, and also avoids three Areas of Ecological Value (5, 7 and 9) as well as the Ballynafid Lake and Fen pNHA along the only narrow corridor available. Protected views 28 and 34 (Westmeath County Development Plan 2008 - 20014) will be affected. However, both Protected views 28 and 34, from the current line of the N4 can be accommodated along the new Route Corridor which would still afford broad views across Lough Owel. Between Nodes 14 and 22 the Route Corridor will generate significant adverse landscape impact, while visual impact is significant to highly significantly adverse, partly on account of views from lake users. However, impact may be reduced through mitigation and vertical alignment design.

Overall, without mitigation, Route Corridor Option 4 will cause moderately negative landscape impacts and moderately negative visual impacts. Given that significant portions of the Route Corridor pass through sensitive and / or protected landscape and that some of the route alignment is counter intuitive (e.g. perpendicular to contours), even with mitigation the landscape impact is likely to remain moderately negative. However, with tree planting, hedgerow planting and appropriate bunds or

similar earthworks, the mitigated effect on visual impact is likely to be slightly negative.

Route Corridor Option 5

Route Corridor Option 5 comprises the sections shown in Table 4.8-13 below. From Roosky it runs close to the existing N4 to Carrickmoyragh, bypassing Cloonart North on the south side of the settlement. From Carrickmoyragh the route then generally runs towards Lismoy, approximately following the former emerging preferred Route Corridor which was identified in the Drumsna to Longford scheme. The route then heads south crossing the existing N4 and bypassing Longford around the south side of the town. It runs to the south of the existing N4 between Longford and Edgeworthstown, bypassing Edgeworthstown, Rathowen and Ballinalack on the south side. It then runs close to the existing N4 through Bunbrosna, Ballynafid and Portnashangan to the R394 junction near Mullingar.

Table 4.8-13 Route Corridor Option 5: Landscape and Visual

Start Nodes	End Nodes	Comments
01 (02, 02A, 03)	03A	From Roosky, runs close to existing N4, Bypass to South of Cloonart North
03A (04)	05	Runs through Lismoy
05 (05A, 05B, 05C)	05D	Bypass to south of Longford town and runs to south of N4 between Longford and Edgeworthstown
05D	09D	Runs just south of Dublin Sligo Railway Line
09D (12)	14	Runs within immediate southern vicinity of Dublin Sligo Railway Line
14 (14A, 16, 17A)	17	Bypasses Edgeworthstown, Rathowen, Ballinalack on south side
17 (19, 21, 21A)	22	Runs close to existing N4 through Bunbrosna, Ballynafid and Portnashangan to R394 junction

From the existing N4 Tomisky roundabout (near Roosky) at Node 1 (the Dromod-Roosky scheme tie in) the short off-line section circumvents any landscape impact on the Aghnamona Bog NHA to the northeast, before rejoining the existing N4 on-line to avoid / minimise impact on Clooneen Bog (pNHA & cSAC).

The Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit where Landscape sensitivity is deemed to be medium to high. This section runs between Nodes 2 and 2A and arcs southwest of Cloonart North, on a counterintuitive line through local high ground. This would require cutting and a resultant locally significant adverse landscape impact. Furthermore, the route passes close to nearby properties causing moderate adverse visual impact, albeit on a local scale.

From Nodes 02A (east of Bornacoola) the Route Corridor passes through the south western edge of the Rinn River NHA but, in doing so, avoids the more highly sensitive landscape of the Lough Forbes Complex cSAC & pNHA and the Ballykenny-Fishertown Bog SPA to the south. The Route Corridor generally takes advantage of the local terrain, avoiding the higher ground east of the Carrickmoyragh junction (Node 4). This junction harbours the potential for moderate adverse impact on views from surrounding residential properties, and some intrusion on the landscape of the adjacent deer park to accommodate the junction footprint. However, a local lime tree avenue to the south flank of the Deer Park would remain preserved, retaining its beneficial contribution to the local landscape character. The western end of the Route Corridor passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit, and on into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity.

Between Nodes 4 and 5, a gentle local depression in the landform creates a shallow valley to the southwest at St. Anne's Glebe. The Route Corridor avoids historic enclosures and nearby properties here. Locally, the anticipated significance of the landscape and visual impact is minor.

From Nodes 5 to 5A the Route Corridor spurs south in-cutting before reaching grade at the proposed junction in Knockmartin. Views of the road will be experienced from properties on the west side of Cloonbalt (RFig 4.8.2), as it rises on embankment at Node 5A, though the intervening field boundary vegetation will help to screen the impact. This section of the Route Corridor passes through the Central Corridor Landscape Character Unit where Landscape sensitivity is deemed to be medium to high.

At Nodes 5A to 5B the Route Corridor is as the proposed N5 Longford bypass, cutting deeply through the hill at Mullagh before joining the proposed junction with the N5 (Node 5B). The Route Corridor then runs between the settlement of Ballyminion to the east and an Area of Ecological Value (1) to the west, before passing through the existing industrial and retail area flanking the N63 (Killashee Road) at Farranyoogan. Here, the N63 runs parallel to the Royal Canal which forms the southern boundary to the industrial units. Due to the industrial / retail character of this location the landscape and visual impact at this point will be of minor adverse significance.

The Route Corridor then passes through the Peatlands Landscape Character Unit, described as being of high landscape sensitivity within the vicinity of the Royal Canal. Crossing the Royal Canal the Route Corridor then enters a short but deep perpendicular cutting into the Mullaghavorneen ridge, but avoids a cluster of properties to the east. Eastward from here the Route Corridor is within the Open Agriculture Landscape Character Unit. This currently has no landscape sensitivity ranking within the Longford County Development Plan 2009 - 2015, but it is fair to assume that this will be high within the vicinity of the Royal Canal (as the Peatlands Landscape Character Unit) but low elsewhere. From here the Route Corridor sweeps along the lower contours of the hill at Farnagh (to the south of Longford) clipping the Derrymore Bog pNHA before reaching Node 5D (R393 Junction). Views will be afforded down onto the Route Corridor from properties on the Farnagh hill, though these are outside of the study area (within the Longford exclusion boundary). This section of the Route Corridor ends at Node 9D in the Central Corridor Landscape Character Unit, an area of generally low landscape sensitivity.

This is a long, wide arching portion of the Route Corridor (between Nodes 5A and 5D), with some short but deep sections of cutting. Although it mostly avoids sensitive and designated areas, the overall local effect of this Route Corridor will result in a

highly significant adverse landscape impact, as it will also alter the character of the landscape and crosses the highly sensitive area of the Royal Canal. Though some significant adverse views would be experienced from residential properties, this section avoids the majority of potential views of the road, but passes through the protected scenic view of I.S -12, and so visual impact is likely to be of minor to moderate significance overall.

The Route Corridor then runs parallel and in close proximity to the Dublin-Sligo railway line. From Node 9D, this corridor then passes just south of the railway line, consistently no more than 150m away. Although this report does not consider cumulative impacts, there is no doubt that the landscape and visual impact of this section of the Route Corridor would be positively associated with the existing Dublin-Sligo railway line. More specifically, very few properties would suffer significant adverse visual impact, and the local visual impact of the Route Corridor anticipated is of minor significance. By association and proximity to the railway line the landscape impact is reduced, and though some cutting into local topography would be required, no landscape designations are affected other than an Area of Ecological Value (45) just south of Node 14. Anticipated landscape impact would be of minor significance, as this portion of the Route Corridor is entirely within the Central Corridor Landscape Character Unit (low sensitivity).

From Node 14 in the west to 22 in the east, the Route Corridor passes through two Landscape Character Units within County Longford, the Central Corridor and the Inny Basin, both of generally low sensitivity. It also passes through two landscape character areas within County Westmeath, the Inny River Lowlands and the Central Hills and Lakes. The latter is valued for its high scenic quality and amenity value to the lake edges.

From Node 14 (just to the eastern edge of an Area of Ecological Value (45)), this section of the Route Corridor takes advantage of low ground south of the Dublin-Sligo railway line and the existing N4. The Route Corridor passes through a tight patchwork of small fields where the boundaries offer a dense layered screening effect. However, the characteristic pattern of the agrarian grain here will be severed, resulting in even greater fragmentation of the field plots. Visual impact here will be significantly adverse as the Route Corridor runs parallel to the linear settlements of Ballindagny

and Cullyvore, Shanturn and Liscahill. The Route Corridor then runs close to the existing N4, avoiding the large Area of Ecological Value (40) at Derrydoonan Lower.

To the south east of Node 16 the Route Corridor passes between two distinct earthworks near Ballydorey, between Ballygarran and Rathowen. These earthworks are in close proximity, and the footprint of the Route Corridor will destroy at least one. Whatsmore, these earthworks are sited on locally prominent high ground, and the route is likely to be highly visible and in shallow cutting at this point. To the immediate north of this location there is a large area of locally low, wet ground, just south of the existing N4.

The Route Corridor avoids the Area of Ecological Value (31) at Ballinalack but passes close to two properties here. On crossing the Inny River from Nodes 17 the Route Corridor converges toward the existing N4 at Node 19, capitalising on the crease in local topography toward the gap between Rathbennett and Bunbrosna. Immediately parallel to the existing N4 this option then shares the low valley on its climb up to Ballynafid, but turns immediately adjacent to the north side of the Dublin Sligo railway line as it skirts the bank of Lough Owel. Here, the Route Corridor is likely to be visible from leisure users of Lough Owel, who are considered highly sensitive receptors. Finally, the route rejoins the existing N4 at Node 21. This off-line section avoids direct impact to the properties at Portnashangan, unlike the on-line Route Corridor options, and also avoids three Areas of Ecological Value (5, 7 and 9) as well as the Ballynafid Lake and Fen pNHA along the only narrow corridor available. Protected views 28 and 34 (Westmeath County Development Plan 2008 - 2014) will be affected. Protected view 28, from the current line of the N4 can be accommodated along the new Route Corridor which would still afford broad views across Lough Owel. Between Nodes 14 and 22 the route will generate significant adverse landscape impact, while visual impact is significant to highly significantly adverse, partly on account of views from lake users.

Overall, without mitigation, Route Corridor Option 5 will cause highly negative landscape impact and moderately negative visual impact. Given the sometimes highly sensitive landscape areas and features through which this Route Corridor passes, at best landscape impact may be reduced by mitigation to a moderately negative result. Whilst local screening, for example, could reduce visual impact, even with mitigation overall visual impact is likely to remain moderately negative on account

of the extensive length and anticipated changes in vertical alignment of this Route Corridor, yielding views from receptors and protected views and prospect.

Route Corridor Option 6

Route Corridor Option 6 comprises the sections shown in Table 4.8-14 below. From Roosky it runs close to the existing N4 to Carrickmoyragh, bypassing Cloonart North on the south side of the settlement. From Carrickmoyragh it passes to the north side of Lismoy. From Node 9A at Lissardowlan it runs to the south of the existing N4, bypassing Edgeworthstown and the Dublin Sligo Railway Line on the south side. It then bypasses Rathowen on the south side and Ballinalack on the south side. It then runs close to the existing N4 through Bunbrosna, then south of Ballynafid and Portnashangan on the north fringe of Lough Owel to the R394 junction near Mullingar.

Table 4.8-14 Route Corridor Option 6: Landscape and Visual

Start Nodes	End Nodes	Comments
01 (02, 02A, 03)	03A	From Roosky, runs close to existing N4, Bypass to South of Cloonart North
03A (03B)	06	Runs to north of Lismoy, Node 06 is R198
06 (07)	08A	Runs to north of existing Longford Bypass
08A (09A)	09B	Crosses existing N4 from north to south
09B (09C)	09D	Runs to south of existing N4
09D (12, 14, 14A)	16	Runs to south of existing N4
16	17A	Bypasses Rathowen on south side
17A (17, 19)	20	Bypasses Ballinalack on south side, Runs close to existing N4 through Bunbrosna. Runs close to existing N4 , crossing the Dublin Sligo Railway
20	21 (on-line)	Runs north of Lough Owel and south of Ballynafid Lake and Fen
21 (21A on-line)	22 (on-line)	Runs close to existing N4 through Portnashangan up to R394.

From the existing N4 Tomisky roundabout (near Roosky) at Node 1 (the Dromod-Roosky scheme tie in) the Route Corridor clips the southern edge of Aghnamona Bog NHA, before passing across the north edge of Clooneen Bog (pNHA & cSAC). This will cause minor adverse landscape impact.

The Route Corridor then passes through the heart of the Shannon Basin / Lough Ree Landscape Character Unit where Landscape sensitivity is deemed to be medium to high. This section runs between Nodes 2 and 2A and arcs southwest of Cloonart North, on a counterintuitive line through local high ground. This would require cutting and a resultant locally significant adverse landscape impact. Furthermore, the Route

Corridor passes close to nearby properties causing moderate adverse visual impact, albeit on a local scale.

From Node 02A (east of Bornacoola) the Route Corridor then passes through the south western edge of the Rinn River NHA but, in doing so, avoids the more highly sensitive landscape of the Lough Forbes Complex cSAC & pNHA and the Ballykenny-Fishertown Bog SPA to the south. The Route Corridor generally takes advantage of the local terrain before becoming elevated on embankment toward high ground as it passes through Carrickmoyragh. This will cause significant adverse landscape impact, though the impact to the agrarian pattern, further east, would only be slight. North of Node 4, the Route Corridor passes between a cluster of properties and through a notably large field adjacent to the Dublin-Sligo railway line. This will cause field severance and locally the visual impact of the road here would be significantly adverse.

This portion of the Route Corridor passes into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity. An Area of Ecological Value (66) is affected by the Route Corridor south of Creenagh. Between Nodess 3B and 6 the Route Corridor would cause minor to moderate adverse visual and landscape impact.

At Node 6 slight to moderate adverse impact will be caused to views. The landscape impact of the Route Corridor around Node 6 will be slightly adverse, as the Route Corridor is low-lying, though the tight grain of the local field patterns will be further dissected, with the loss of some vegetation.

Between Nodes 6 and 7 the Route Corridor passes over the Camlin River and is entirely within the Central Corridor Landscape Character Unit (low sensitivity). Views from the small cluster of properties between Cloonahard and Freehalman are well screened by surrounding hedgerows. This section benefits from the good cumulative screening effect of hedgerows and hedgerow trees. The visual impact here is therefore likely to be of minor significance. Although the section between Nodes 6 and 7 will cause severance of field boundaries the vegetation structure is sufficiently robust to accommodate this without significant impact. Between Nodes 7 and 8A the

Route Corridor clips the property at Ballymacwilliam and the edge of the Route Corridor passes over two enclosures. Benefically the Route Corridor passes across the crease of the contour here, which would create a good landscape fit into the local terrain. No landscape designations are affected and enclosures are avoided, though the potential impact upon local enclosures and isolated properties would result in minor landscape impact for this section of the Route Corridor.

From Node 8A this option passes south across the existing N4, at Node 9A and following the agrarian grain whilst avoiding properties either side of the corridor. A short distance from here, Nodes 09B and 09C, lie just north of the Dublin Sligo Railway Line. Between Nodes 9B and 09D the Route Corridor meanders south through Node 09C before crossing the Dublin Sligo railway line at Lisfarrel, leaving a parcel of existing land between the railway and the existing N4 to the north, unaffected. However, a number of local enclosures are potentially affected by the Route Corridor as it runs south of the railway line from Nodes 09D to 14.

East of Node 09B (to Node 14) the Route Corridor is entirely within the Central Corridor Landscape Character Unit (low sensitivity). Being close and parallel to the Dublin-Sligo railway line the perceived landscape and visual impact of this section may, by association, be less than otherwise anticipated. The landscape between the existing N4 and the railway line has a high degree of integrity, with a strong field pattern and scattered enclosures. This would remain preserved. The line of this Route Corridor option benefits from the good cumulative screening effect of hedgerows and hedgerow trees. The local visual impact is therefore likely to be of minor significance.

Although from east of Node 14 the Route Corridor will cause severance of field boundaries the vegetation structure is sufficiently robust to accommodate this without significant impact. No landscape designations are affected though some enclosures are as well as an Area of Ecological Value at Node 14, resulting in minor local landscape impact.

From Node 14 in the west to 22 in the east the Route Corridor passes through two Landscape Character Units within County Longford, the Central Corridor and the Inny Basin, both of generally low sensitivity. It also passes through two landscape character areas within County Westmeath, the Inny River Lowlands and the Central

Hills and Lakes. The latter is valued for its high scenic quality and amenity value to the lake edges.

From Node 14 (just to the eastern edge of an Area of Ecological Value (45)), the Route Corridor passes east taking advantage of low ground south of the Dublin-Sligo railway line and the existing N4. The Route Corridor passes through a tight patchwork of small fields where the boundaries offer a dense layered screening effect. However, the characteristic pattern of the agrarian grain here will be severed, resulting in even greater fragmentation of the field plots. Visual impact here will be locally significantly adverse as the route runs parallel to the linear settlements of Ballindagny and Cullyvore, Shanturn and Liscahill. The Route Corridor then runs close to the existing N4, potentially skimming the north of the large Area of Ecological Value (40) at Derrydoonan Lower.

To the south east of Node 16 the Route Corridor passes between two distinct earthworks near Ballydorey, between Ballygarran and Rathowen. These earthworks are in close proximity, and the footprint of this Route Corridor will destroy at least one. Furthermore, these earthworks are sited on locally prominent high ground, and the Route Corridor is likely to be highly visible and in shallow cutting at this point. To the immediate north of this location there is a large area of locally low, wet ground, just south of the existing N4. The Route Corridor clips the Area of Ecological Value (31) at Ballinalack and passes close to two properties here. On crossing the Inny River from Node 17 the Route Corridor converges toward the existing N4 at Node 20, capitalising on the crease in local topography toward the gap between Rathbennett and Bunbrosna. Immediately parallel to the existing N4 this option then shares the low valley on its climb up to Ballynafid, then crossing the Dublin Sligo railway line before diverting off the course of the existing N4 to run parallel and immediately to the north of the railway line. No landscape designations are affected by this line, thereby limiting the landscape impact to moderate to significant adverse. Limited adverse visual impact will be experienced from properties along the existing N4 and from outliers of Rathowen. Visual impact is likely to be minor, as many of the properties along the N4 have good garden boundary screening.

The Route Corridor is likely to be visible from leisure users of Lough Owel, who are considered highly sensitive receptors. This off-line section avoids direct impact to most properties at Portnashangan, unlike the on-line Route Corridor, but potentially

affects the fringes of Ballynafid Lake and Fen pNHA. Protected views 28 and 34 (Westmeath CDP) will be affected. Protected view 28, from the current line of the N4 can be accommodated along the new Route Corridor which would still afford broad views across Lough Owel. Between Nodes 16 and 22 the Route Corridor will generate significant to highly significant adverse landscape impact, while visual impact is significant to highly significantly adverse, partly due to views from lake users, the majority of the Route Corridor being within the highly scenic Central Hills and Lakes landscape character area.

Overall, without mitigation, Route Corridor Option 6 will cause moderately negative landscape impact and moderately negative visual impact. With mitigation, however, this Route Corridor will cause slightly negative landscape impact and slight to moderately negative visual impact.

4.8.4 Conclusions

The pervading landscape character of the study area, with its rolling landform, dense field pattern and associated hedgerow vegetation generally has capacity to accommodate road corridor development. The Route Corridor options that yield the least landscape impact are those that meander sensitively through the shallow valleys, avoid cutting through high ground, with minimal effect to landscape designations and minimal construction footprint. Although it should be stressed that all Route Corridor options have sections that will cause varying degrees of landscape and visual impact, of the six route options assessed the one with least landscape impact (slightly adverse, post mitigation) is the Route Corridor Option 6. Route Corridor Options 2 and 3 will yield moderately adverse to slightly adverse landscape impact (post mitigation), whilst Route Corridor Options 1, 4 and 5 will result in moderately negative landscape impacts, post mitigation.

Note that although both the off-line and on-line Route Corridors between Nodes 19 and 22 will generate a significant adverse landscape impact, on balance the off-line Route Corridor affects fewer properties. Although it is likely to be visible from Lough Owel, it offers open views across the Lough for road users, enhancing visitor experience of the journey within the County.

Of the six Route Corridors, Options 5 is likely to generate an overall moderately negative adverse impact on visual quality, accounting for the assumed effect of potential mitigation. Options 1 and 6 generates moderate to slight visual impact, post mitigation. All other Route Corridor options (2, 3 and 4) yield slightly negative impact on visual quality, post mitigation. Of these Route Corridors 2 and 6 pass close to the Dublin-Sligo Railway line between Nodes 09B and 14 and, therefore by association, visual impact could be considered less significant than it might without such association. Route Corridor Options 3 is the only option that offers an important and preferable alternative northern route to avoid the two earthworks / enclosures near Rathowen to the south of the existing N4, locally prominent on the skyline (between Nodes 16 and 17A). However, Route Corridor option 3 takes a meandering route to the north through the heart of highly scenic Central Hills and Lakes landscape character area.

From Node 19 both the off-line and on-line Route Corridors are surrounded by sensitive visual receptors. The on-line Route Corridor is flanked with residential properties on either side, whose visual experience will be affected by the widening of the road through highly significant deterioration in views and proximity to passing traffic. The off-line Route Corridor will be seen from a much smaller number of properties but also (and critically sensitive) from leisure users of Lough Owel. It is considered, however, that the off-line option here will cause marginally less impact than the on-line alternative. Although overall Route Corridor Option 3 has a slightly negative visual impact, this is as a result of large areas of the Route Corridor that has few visual receptors to experience views of the route. However, there are some clusters or isolated receptors to which the Route Corridor would cause highly adverse visual impact.

Of the six Route Corridor options the Route Corridor with least landscape impact is Route Corridor Option 6. However, the Route Corridors with least visual impact are 2, 3 and 4. closely followed by options 1 and 6.

A summary of the aggregate Landscape and Visual Impact of each Route Corridor option is presented below, this allows for the assumed effect of potential mitigation.

Table 4.8-15 Summary of Impacts: Landscape and Visual

Route Corridor Option	Landscape Impact	Order of Preference	Visual Impact	Order of Preference
1	Moderately Negative	4th	Moderately - Slightly Negative	4th
2	Moderately – Slightly Negative	2nd	Slightly Negative	1st
3	Moderately – Slightly Negative	2nd	Slightly Negative	1st
4	Moderately Negative	4th	Slightly Negative	1st
5	Moderately Negative	4th	Moderately Negative	6th
6	Slightly Negative	1st	Moderately - Slightly Negative	4th

4.9 Hydrology and Drainage

4.9.1 Introduction

This section of the Route Corridor Option Selection Report has been carried out to fulfil an appraisal of each Route Corridor Option within the existing hydrological setting of the study area for the N4 Road Improvement Scheme in order to establish the likely drainage and hydrological impacts and to carry out a comparative evaluation of the Route Corridor Options.

4.9.2 Methodology

The appraisal has consisted of the collation and interrogation of available published information from the Environmental Protection Agency (EPA), the Office of Public Works (OPW), Ordnance Survey Ireland (OSI), the Shannon Regional Fisheries Board (ShRFB), Longford County Council, Westmeath County Council, Water Framework Directive Ireland (WFD Ireland), the Shannon International River Basin District project (SIRBD), a 'roadside' survey, and an evaluation of the hydrological features along the proposed Route Corridor Options. A meeting was held with the regional fisheries board to find out their views on the hydrological and ecological aspects of the Route Corridor Options.

The EPA EnVision (http://maps.epa.ie/InternetMapViewer/mapviewer.aspx) dataset provided the river locations and some names, but most of the rivers in the study area are unnamed in this database and on OSI mapping. The SIRBD project office and the EPA also provided data sets collected by the River Basin District project teams showing water quality, abstractions, river sub-basins, IPPC facilities, and EPA licensed discharges. Flow data was collected from the OPW Hydro Data website (www.opw.ie/hydro) and the EPA HydroNet website (hydronet.epa.ie). The OPW also provided GIS datasets from their flood mapping website (www.floodmaps.ie) and GIS datasets showing the extent of Arterial Drainage schemes in the country. The relevant Local Authorities provided details of licensed discharges to surface waters.

The main hydrological areas of interest in terms of assessing potential impact include the presence or absence of surface watercourses, areas of known flood risk, known

surface water abstractions, and sensitivity of rivers to any drainage induced pollution. The watercourses have a high amenity value, particularly for fishing, but the construction of crossings will take account of this and should not reduce this amenity value outside of the construction period when there may be some access difficulties. Where watercourses shown on the Environmental Protection Agency (EPA) database are crossed, the 'Order' of the watercourse is given. Increasing 'Order' gives an indication of increasing size.

Current best practice for road drainage requires oil interceptors and treatment/attenuation ponds, before discharge of runoff at greenfield runoff rates to local watercourses. The best practice measures proposed and implemented to comply with the EU Water Framework Directive (WFD) will also require these treatment/attenuation ponds. The drainage system would be designed to avoid impacts, thereby limiting the effect road drainage will have on water quality or flow into the receiving waters.

The appraisal has been carried out to inform the Project Appraisal Balance Sheet (PABS) approach from the NRA Project Appraisal Guidelines. The PABS is provided in Appendix 1, Volume II of this report. This states that the impacts to be outlined are those that will remain after mitigation measures have been devised and implemented, and that impacts which will be fully mitigated should not be included. The impacts expected and the significance of these impacts was determined using the procedure set out in the December 2008 NRA publication titled "Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes" (hereafter referred to as the 'NRA Guidelines'). It is likely that some of the impacts noted in this section will be fully mitigated, but this will not become clear until the detailed design is undertaken.

The summary PABS in Appendix 1 ranks the likely hydrological impacts of the Route Corridor Options using scaling statements on a seven point scale between Highly Positive and Highly Negative. As noted in Section 4.4 of the NRA Guidelines, until detailed design is undertaken the appraisals are based on a qualitative judgement of the likely impacts. There will be no net positive impact on the hydrological environment as a result of the road construction, owing to the disturbance of the environment, however there may be subsidiary positive impacts, in terms of a greater flood protection to properties and greater scientific understanding of the hydrological

features of this region. There may be an improvement in water quality due to road runoff from the proposed road being treated before discharge, removing hydrocarbons and heavy metals which currently drain directly from the existing road. It is currently too early in the design process to determine if this will give an overall positive impact to any segment of a Route Corridor Option in a hydrological sense.

4.9.3 Overview of Catchments and Sub-Catchments Crossed

All Route Corridor Options are wholly contained within the Shannon Catchment. The sub-catchments crossed by the Route Corridor Options are shown on RFig 4.9.1 to RFig 4.9.4 in Volume III and are discussed below. A summary of the information is contained in Tables 4.9-1 and 4.9-2 below.

Table 4.9-1 Length of Corridor within Sub-Catchments

Sub-Catchment	LENGTH OF ROUTE CORRIDOR OPTIONS (km)					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
Shannon Main 1	1.6	1.6	1.6	1.6	1.6	1.6
Rinn	2.7	2.7	2.7	2.7	2.7	2.7
Shannon Tributary	2	2.7	2.7	4	2	2.7
Shannon Main 2	1.7	1	1	0	1.7	1
Camlin	14	14	14	14	18	14
Inny	20	20	28	20	20	20
Brosna	9	9	4	9	9	9

Table 4.9-2 Catchment Area to Major Watercourse Crossings

River	AREA TO ROUTE CORRIDOR OPTION CROSSINGS (km^2)					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
Rinn	288	288	288	288	288	288
Camlin	163	165	163	128	253	165
Inny	682	682	667	682	682	682

Route Corridor Option 1

At the north-western end of this Route Corridor Option Option (RFig 4.9.1) the first major sub-catchment crossed is the River Rinn Catchment. This sub-catchment is crossed just upstream of its confluence with the Shannon in Lough Forbes. The catchment area upstream of the proposed crossing point is approximately 288km^2. There are two minor tributaries with catchment areas less than 10km^2 discharging directly into the Shannon east and west of the Rinn River. The Route Corridor Option

then passes through a part of the River Shannon main channel catchment for approximately 1.5km in the townland of Carrickmoyragh, north of Newtown Forbes. Route Corridor Option 1 is within these four sub-catchments for approximately 8km.

East of Newtown Forbes (RFig 4.9.1) the Route Corridor Option crosses into the Camlin sub-catchment. The Route Corridor Option is within the Camlin sub-catchment for approximately 14km. The upstream catchment area to the proposed crossing of the Camlin is approximately 163km^2. In the townland of Lackan approximately 4km west of Edgeworthstown (RFig 4.9.2) the Route Corridor Option passes into the Inny sub-catchment. The Route Corridor Option is within the Inny sub-catchment for approximately 20km. The upstream catchment area to the proposed crossing of the Inny is approximately 682km^2. In the vicinity of node 19 at Bunbrosna (RFig 4.9.4) the Route Corridor Option passes into the Brosna sub-catchment. The remaining 9km of the Route Corridor Option crosses the Brosna sub-catchment. The Brosna River is not crossed by the Route Corridor Option 1.

Route Corridor Option 2

At the north-western end of this Route Corridor Option (RFig 4.9.1) the first major sub-catchment crossed is the River Rinn Catchment. This sub-catchment is crossed just upstream of its confluence with the Shannon in Lough Forbes. The catchment area upstream of the proposed crossing point is approximately 288km^2. There are two minor tributaries with catchment areas less than 10km^2 discharging directly into the Shannon east and west of the Rinn River. The Route Corridor Option then passes through a part of the River Shannon main channel catchment for approximately 1km in the townland of Carrickmoyragh, north of Newtown Forbes. The Route Corridor Option is within these four sub-catchments for approximately 8km.

East of Newtown Forbes (RFig 4.9.1) the Route Corridor Option crosses into the Camlin sub-catchment. The Route Corridor Option is within the Camlin sub-catchment for approximately 14km. The upstream catchment area to the proposed crossing of the Camlin is approximately 165km^2. In the townland of Aghanageeragh approximately 4km west of Edgeworthstown (RFig 4.9.2) the Route Corridor Option passes into the Inny sub-catchment. The Route Corridor Option is within the Inny sub-catchment for approximately 20km. The upstream catchment area to the proposed crossing of the Inny is approximately 682km^2. In the vicinity of node 19 at

Bunbrosna (RFig 4.9.4) the Route Corridor Option passes into the Brosna sub-catchment. The remaining 9km of the Route Corridor Option crosses the Brosna sub-catchment. The Brosna River is not crossed by the Route Corridor Option 2.

Route Corridor Option 3

At the north-western end of this Route Corridor Option (RFig 4.9.1) the first major sub-catchment crossed is the River Rinn Catchment. This sub-catchment is crossed just upstream of its confluence with the Shannon in Lough Forbes. The catchment area upstream of the proposed crossing point is approximately 288km^2. There are two minor tributaries with catchment areas less than 10km^2 discharging directly into the Shannon east and west of the Rinn River. The Route Corridor Option then passes through a part of the River Shannon main channel catchment for approximately 1km in the townland of Carrickmoyragh, north of Newtown Forbes. The Route Corridor Option is within these four sub-catchments for approximately 8km.

East of Newtown Forbes (RFig 4.9.1) the Route Corridor Option crosses into the Camlin sub-catchment. The Route Corridor Option is within the Camlin sub-catchment for approximately 14km. The upstream catchment area to the proposed crossing of the Camlin is approximately 163km^2. In the townland of Lisnanagh approximately 4km west of Edgeworthstown (RFig 4.9.2) the Route Corridor Option passes into the Inny sub-catchment. The Route Corridor Option is within the Inny sub-catchment for approximately 28km. The upstream catchment area to the proposed crossing of the Inny is approximately 667km^2. In the townland of Ballynagall, (RFig 4.9.4) east of Scragh Bog, the Route Corridor Option passes into the Brosna sub-catchment. The remaining 4km of the Route Corridor Option crosses the Brosna sub-catchment. The Brosna River is not crossed by the Route Corridor Option.

Route Corridor Option 4

At the northwestern end of this Route Corridor Option (RFig 4.9.1) the first major sub-catchment crossed is the River Rinn Catchment. This sub-catchment is crossed just upstream of its confluence with the Shannon in Lough Forbes. The catchment area upstream of the proposed crossing point is approximately 288km^2. There are two minor tributaries with catchment areas of less than 10km^2 discharging directly into the

Shannon east and west of the Rinn River. The Route Corridor Option is within these three sub-catchments for approximately 8km.

East of Newtown Forbes (RFig 4.9.1) the Route Corridor Option crosses into the Camlin sub-catchment. The Route Corridor Option is within the Camlin sub-catchment for approximately 14km. The upstream catchment area to the proposed crossing of the Camlin is approximately 128km^2. In the townland of Lackan approximately 4km west of Edgeworthstown (RFig 4.9.2) the Route Corridor Option passes into the Inny sub-catchment. The Route Corridor Option is within the Inny sub-catchment for approximately 20km. The upstream catchment area to the proposed crossing of the Inny is approximately 682km^2. In the vicinity of node 19 at Bunbrosna (RFig 4.9.4) the Route Corridor Option passes into the Brosna sub-catchment. The remaining 9km of the Route Corridor Option crosses the Brosna sub-catchment. The Brosna River is not crossed by the Route Corridor Option 4.

Route Corridor Option 5

At the north-western end of this Route Corridor Option (RFig 4.9.1) the first major sub-catchment crossed is the River Rinn Catchment. This sub-catchment is crossed just upstream of its confluence with the Shannon in Lough Forbes. The catchment area upstream of the proposed crossing point is approximately 288km^2. There are two minor tributaries with catchment areas less than 10km^2 discharging directly into the Shannon east and west of the Rinn River. The Route Corridor Option then passes through a part of the River Shannon main channel catchment for approximately 1.5km in the townland of Carrickmoyragh, north of Newtown Forbes. The Route Corridor Option is within these four sub-catchments for approximately 8km.

East of Newtown Forbes (RFig 4.9.1) the Route Corridor Option crosses into the Camlin sub-catchment. The Route Corridor Option is within the Camlin sub-catchment for approximately 18km. The upstream catchment area to the proposed crossing of the Camlin is approximately 253km^2. In the townland of Aghanageeragh approximately 4km west of Edgeworthstown (RFig 4.9.2) the Route Corridor Option passes into the Inny sub-catchment. The Route Corridor Option is within the Inny sub-catchment for approximately 20km. The upstream catchment area to the proposed crossing of the Inny is approximately 682km^2. In the vicinity of node 19 at Bunbrosna (RFig 4.9.4) the Route Corridor Option passes into the Brosna sub-

catchment. The remaining 9km of the Route Corridor Option crosses the Brosna sub-catchment. The Brosna River is not crossed by the Route Corridor Option 5.

Route Corridor Option 6

At the north-western end of this Route Corridor Option (RFig 4.9.1) the first major sub-catchment crossed is the River Rinn Catchment. This sub-catchment is crossed just upstream of its confluence with the Shannon in Lough Forbes. The catchment area upstream of the proposed crossing point is approximately 288km^2. There are two minor tributaries with catchment areas less than 10km^2 discharging directly into the Shannon east and west of the Rinn River. The Route Corridor Option then passes through a part of the River Shannon main channel catchment for approximately 750m in the townland of Carrickmoyragh, north of Newtown Forbes. The Route Corridor Option is within these four sub-catchments for approximately 8km.

East of Newtown Forbes (RFig 4.9.1) the Route Corridor Option crosses into the Camlin sub-catchment. The Route Corridor Option is within the Camlin sub-catchment for approximately 14km. The upstream catchment area to the proposed crossing of the Camlin is approximately 165km^2. In the townland of Aghanageeragh approximately 4km west of Edgeworthstown (RFig 4.9.2) the Route Corridor Option passes into the Inny sub-catchment. The Route Corridor Option is within the Inny sub-catchment for approximately 20km. The upstream catchment area to the proposed crossing of the Inny is approximately 682km^2. In the vicinity of node 19 at Bunbrosna (RFig 4.9.4) the Route Corridor Option passes into the Brosna sub-catchment. The remaining 9km of the Route Corridor Option crosses the Brosna sub-catchment. The Brosna River is not crossed by the Route Corridor Option 6.

4.9.4 Overview of Flows in Watercourses Crossed

The Rinn River is crossed by all Route Corridor Options in the same location in the townland of Cloonart South. The OPW gauging station at Johnstons Bridge (Station no. 26008) is just over 3km upstream of the proposed crossing. This station has flow records from 1955 to 2007, and the maximum flow during this period was 41m^3/s recorded on November 18th, 1965. The second largest flow was 33.5m^3/s recorded on November 3rd 1968, while the third largest flow was 32.6m^3/s recorded on February 6th 2002. There is no significant flow entering the catchment between the gauge and

the proposed crossing, so these recorded flows approximate the flows which can be expected at the crossing.

The flows on the route specific crossings are described below, while all the flows are summarised in Table 4.9-3.

Table 4.9-3 Flows in Watercourses with Catchments > 10km^2

River	FLOW AT ROUTE CORRIDOR OPTION CROSSINGS (m^3/s)					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
Rinn	41	41	41	41	41	41
Camlin	23	23	23	18	36	23
Camlin Tributary 1				2		
Camlin Tributary 2					4.5	
Clooncoose	4.5	4.5	4.5			4.5
Black	7	7		7	7	7
Riffey Tributary			7			
Riffey			14			
Inny	83	83	81	83	83	83

Route Corridor Option 1

The first major watercourse crossed on this Route Corridor Option is the Camlin River (RFig 4.9.1). The OPW have a gauging station at Argar (Station no. 26020) upstream of the crossing site but there is no processed flow data available at this station. The OPW have another station at Mullagh (Station no. 26019) downstream of Longford Town, and for this preliminary assessment we have interpolated flows from this station. The catchment area to the gauge at Mullagh is 260km^2, while the catchment area to the proposed crossing point is 163km^2. This implies that the flows at the proposed crossing will be approximately 63% of those at the gauge. The gauge has records for the period 1953 to 2007, and the maximum flow recorded was 37m^3/s on October 23rd, 1987. Interpolating this flow to the proposed crossing location gives an estimated maximum recorded flow of 23m^3/s.

Route Corridor Option 1 crosses the Clooncoose stream (RFig 4.9.2), a tributary of the Camlin, at a point where it has an upstream catchment area of approximately 31km^2. There are no active automatic recording gauges on the Clooncoose, and the two staff gauge stations on the stream have had measurements suspended. A preliminary estimate of the flow in the stream can be interpolated from the Mullagh gauge. The area to the proposed crossing is 12% of the area to the Mullagh gauge,

the estimated maximum flow which occurred on the Clooncoose stream between 1953 and 2007 was 4.5m^3/s. This is likely to be an underestimate as smaller catchments tend to have greater floods per unit area than larger catchments.

The Black River (RFig 4.9.1), a tributary of the River Inny, is crossed by the Route Corridor Option south of Edgeworthstown. The catchment area to the proposed crossing point is approximately 11km^2. The EPA maintained an automatic gauge at Edgeworthstown from 2004 to 2007. In this period the maximum flow recorded at the gauge was 2.55m^3/s on December 3rd 2006. The catchment area to the gauge is 4.2km^2, scaling this up gives a flow of approximately 7m^3/s at the proposed crossing point.

This Route Corridor Option crosses the River Inny (RFig 4.9.4) south of Ballinalack. The OPW have a gauge on the Inny at Ballinalack which has records from 1981 to 2005, the records are in hardcopy format and have not been processed. The nearest gauge on the Inny with data available is at Ballymahon in County Longford. The catchment area to this gauge is 1071km^2. Data is available from 1975 to 2007, and in this period the maximum flow recorded at Ballymahon was 130m^3/s on December 25th 1999. The catchment area to the proposed crossing of the Inny is 682km^2, or 64% of the area to Ballymahon. Interpolating the flow at Ballymahon gives an estimated maximum flow at Ballinalack during the period of record of approximately 83m^3/s.

Between the Inny crossing and the eastern end of the scheme there are no further watercourses with catchment areas greater than 10km^2.

Route Corridor Option 2

The first major watercourse crossed by this Route Corridor Option is the Camlin River (RFig 4.9.1). The OPW have a gauging station at Argar (Station no. 26020) upstream of the crossing, there is no processed flow data available at this station. The OPW have another station at Mullagh (Station no. 26019) downstream of Longford Town, and for this preliminary assessment we have interpolated flows from this station. The catchment area to the gauge at Mullagh is 260km^2, while the catchment area to the proposed crossing point is 165km^2. This implies that the flows at the proposed crossing will be approximately 63% of those at the gauge. The gauge has records for the period 1953 to 2007, and the maximum flow recorded was 37m^3/s on October

23rd, 1987. Interpolating this flow to the proposed crossing location gives an estimated maximum recorded flow of 23m^3/s.

Route Corridor Option 2 crosses the Clooncoose stream (RFig 4.9.2), a tributary of the Camlin, at a point where it has an upstream catchment area of approximately 32km^2. There are no active automatic recording gauges on the Clooncoose, and the two staff gauge stations on the stream have had measurements suspended. A preliminary estimate of the flow in the stream can be interpolated from the Mullagh gauge. The area to the proposed crossing is 12% of the area to the Mullagh gauge, so the estimated maximum flow which occurred on the Clooncoose stream between 1953 and 2007 was 4.5m^3/s. This is likely to be an underestimate as smaller catchments tend to have greater floods per unit area than larger catchments.

The Black River (RFig 4.9.3), a tributary of the River Inny, is crossed by the Route Corridor Option south of Edgeworthstown. The catchment area to the proposed crossing point is approximately 11km^2. The EPA maintained an automatic gauge at Edgeworthstown from 2004 to 2007. In this period the maximum flow recorded at the gauge was 2.55m^3/s on December 3rd 2006. The catchment area to the gauge is 4.2km^2, scaling this up gives a flow of approximately 7m^3/s at the proposed crossing point.

This Route Corridor Option crosses the River Inny (RFig 4.9.4) south of Ballinalack. The OPW have a gauge on the Inny at Ballinalack which has records from 1981 to 2005, but the records are in hardcopy format and have not been processed. The nearest gauge on the Inny with data available is at Ballymahon in County Longford. The catchment area to this gauge is 1071km^2. Data is available from 1975 to 2007, and in this period the maximum flow recorded at Ballymahon was 130m^3/s on December 25th 1999. The catchment area to the proposed crossing of the Inny is 682km^2, or 64% of the area to Ballymahon. Interpolating the flow at Ballymahon gives an estimated maximum flow at Ballinalack during the period of record of approximately 83m^3/s.

Between the Inny crossing and the eastern end of the scheme there are no further watercourses with catchment areas greater than 10km^2.

Route Corridor Option 3

The first major watercourse crossed by this Route Corridor Option is the Camlin River (RFig 4.9.1). The OPW have a gauging station at Argar (Station no. 26020) upstream of the crossing site but there is no processed flow data available at this station. The OPW have another station at Mullagh (Station no. 26019) downstream of Longford Town, and for this preliminary assessment we have interpolated flows from this station. The catchment area to the gauge at Mullagh is 260km^2, while the catchment area to the proposed crossing point is 163km^2. This implies that the flows at the proposed crossing will be approximately 63% of those at the gauge. The gauge has records for the period 1953 to 2007, the maximum flow recorded was 37m^3/s on October 23rd, 1987. Interpolating this flow to the proposed crossing location gives an estimated maximum recorded flow of 23m^3/s.

Route Corridor Option 3 crosses the Clooncoose stream (RFig 4.9.2), a tributary of the Camlin, at a point where it has an upstream catchment area of approximately 31km^2. There are no active automatic recording gauges on the Clooncoose, and the two staff gauge stations on the stream have had measurements suspended. A preliminary estimate of the flow in the stream can be interpolated from the Mullagh gauge. The area to the proposed crossing is 12% of the area to the Mullagh gauge, the estimated maximum flow which occurred on the Clooncoose stream between 1953 and 2007 was 4.5m^3/s. This is likely to be an underestimate as smaller catchments tend to have greater floods per unit area than larger catchments.

A tributary of the River Riffey at Clonwhelan (RFig 4.9.3) with a catchment area of 11km^2 is crossed by the Route Corridor Option east of Edgeworthstown. The closest gauge data from a similar river comes from an automatic gauge at Edgeworthstown which was operational from 2004 to 2007. In this period the maximum flow recorded at the gauge was 2.55m^3/s on December 3rd 2006. The catchment area to the gauge is 4.2km^2, scaling this up gives a flow of approximately 7m^3/s at the proposed crossing point. The Route Corridor Option crosses the main Riffey channel 1km further east (RFig 4.9.3), where the catchment area is approximately 23km^2. Based on the Edgeworthstown gauge the flow in the river at this proposed crossing would be approximately 14m^3/s.

This Route Corridor Option crosses the River Inny 1.5km north of Ballinalack (RFig 4.9.4). The OPW have a gauge on the Inny at Ballinalack which has records from

1981 to 2005, the records are in hardcopy format and have not been processed. The nearest gauge on the Inny with data available is at Ballymahon in County Longford. The catchment area to this gauge is 1071km^2. Data is available from 1975 to 2007, and in this period the maximum flow recorded at Ballymahon was 130m^3/s on December 25th 1999. The catchment area to the proposed crossing of the Inny is 667km^2, or 62% of the area to Ballymahon. Interpolating the flow at Ballymahon gives an estimated maximum flow at Ballinalack during the period of record of approximately 81m^3/s.

Between the Inny crossing and the eastern end of the scheme there are no further watercourses with catchment areas greater than 10km^2.

Route Corridor Option 4

The first major watercourse crossed by this Route Corridor Option is the Camlin River (RFig 4.9.1). The OPW have a gauging station at Argar (Station no. 26020) upstream of the crossing, there is no processed flow data available at this station. The OPW have another station at Mullagh (Station no. 26019) downstream of Longford Town, and for this preliminary assessment we have interpolated flows from this station. The catchment area to the gauge at Mullagh is 260km^2, while the catchment area to the proposed crossing point is 128km^2. This implies that the flows at the proposed crossing will be approximately 49% of those at the gauge. The gauge has records for the period 1953 to 2007, and the maximum flow recorded was 37m^3/s on October 23rd, 1987. Interpolating this flow to the proposed crossing location gives an estimated maximum recorded flow of 18m^3/s.

Route Corridor Option 4 crosses an unnamed tributary of the Camlin (RFig 4.9.2), at a point where it has an upstream catchment area of approximately 13km^2. A preliminary estimate of the flow in the stream can be interpolated from the Mullagh gauge. The area to the proposed crossing is 5% of the area to the Mullagh gauge, the estimated maximum flow which occurred on this tributary between 1953 and 2007 was 2m^3/s. This is likely to be an underestimate as smaller catchments tend to have greater floods per unit area than larger catchments. If the data from the Edgeworthstown gauge (below) is used the estimated flow is 8m^3/s.

The Black River (RFig 4.9.3), a tributary of the River Inny, is crossed by the Route Corridor Option south of Edgeworthstown. The catchment area to the proposed crossing point is approximately 11km^2. The EPA maintained an automatic gauge at Edgeworthstown from 2004 to 2007. In this period the maximum flow recorded at the gauge was 2.55m^3/s on December 3rd 2006. The catchment area to the gauge is 4.2km^2, scaling this up gives a flow of approximately 7m^3/s at the proposed crossing point.

This Route Corridor Optioncrosses the River Inny south of Ballinalack (RFig 4.9.4). The OPW have a gauge on the Inny at Ballinalack which has records from 1981 to 2005, the records are in hardcopy format and have not been processed. The nearest gauge on the Inny with data available is at Ballymahon in County Longford. The catchment area to this gauge is 1071km^2. Data is available from 1975 to 2007, and in this period the maximum flow recorded at Ballymahon was 130m^3/s on December 25th 1999. The catchment area to the proposed crossing of the Inny is 682km^2, or 64% of the area to Ballymahon. Interpolating the flow at Ballymahon gives an estimated maximum flow at Ballinalack during the period of record of approximately 83m^3/s.

Between the Inny crossing and the eastern end of the scheme there are no further watercourses with catchment areas greater than 10km^2.

Route Corridor Option 5

The first major watercourse crossed by this Route Corridor Option is the Camlin River (RFig 4.9.2). The OPW have a gauging station at Mullagh (Station no. 26019) just downstream of the proposed crossing point. The catchment area to the gauge at Mullagh is 260km^2, while the catchment area to the proposed crossing point is 253km^2. This implies that the flows at the proposed crossing will be approximately 97% of those at the gauge. The gauge has records for the period 1953 to 2007, and the maximum flow recorded was 37m^3/s on October 23rd, 1987. Interpolating this flow to the proposed crossing location gives an estimated maximum recorded flow of 36m^3/s. Approximately 1km south of the proposed Camlin crossing the Route Corridor Option crosses an unnamed river at a point where it has an upstream catchment area of approximately 32km^2. There are no active automatic recording gauges on this river. A preliminary estimate of the flow in the stream can be interpolated from the Mullagh gauge. The area to the proposed crossing is 12% of the

area to the Mullagh gauge, so the estimated maximum flow which occurred on the unnamed river between 1953 and 2007 was 4.5m^3/s. This is likely to be an underestimate as smaller catchments tend to have greater floods per unit area than larger catchments.

The Black River (RFig 4.9.3), a tributary of the River Inny, is crossed by the Route Corridor Option south of Edgeworthstown. The catchment area to the proposed crossing point is approximately 11km^2. The EPA maintained an automatic gauge at Edgeworthstown from 2004 to 2007. In this period the maximum flow recorded at the gauge was 2.55m^3/s on December 3rd 2006. The catchment area to the gauge is 4.2km^2, scaling this up gives a flow of approximately 7m^3/s at the proposed crossing point.

This Route Corridor Option crosses the River Inny south of Ballinalack (RFig 4.9.4). The OPW have a gauge on the Inny at Ballinalack which has records from 1981 to 2005, the records are in hardcopy format and have not been processed. The nearest gauge on the Inny with data available is at Ballymahon in County Longford. The catchment area to this gauge is 1071km^2. Data is available from 1975 to 2007, and in this period the maximum flow recorded at Ballymahon was 130m^3/s on December 25th 1999. The catchment area to the proposed crossing of the Inny is 682km^2, or 64% of the area to Ballymahon. Interpolating the flow at Ballymahon gives an estimated maximum flow at Ballinalack during the period of record of approximately 83m^3/s.

Between the Inny crossing and the eastern end of the scheme there are no further watercourses with catchment areas greater than 10km^2.

Route Corridor Option 6

The first major watercourse crossed by this Route Corridor Option is the Camlin River (RFig 4.9.1). The OPW have a gauging station at Argar (Station no. 26020) upstream of the crossing site but there is no processed flow data available at this station. The OPW have another station at Mullagh (Station no. 26019) downstream of Longford Town, and for this preliminary assessment we have interpolated flows from this station. The catchment area to the gauge at Mullagh is 260km^2, while the catchment area to the proposed crossing point is 163km^2. This implies that the flows at the

proposed crossing will be approximately 63% of those at the gauge. The gauge has records for the period 1953 to 2007, and the maximum flow recorded was 37m^3/s on October 23rd, 1987. Interpolating this flow to the proposed crossing location gives an estimated maximum recorded flow of 23m^3/s.

The Route Corridor Option crosses the Clooncoose stream (RFig 4.9.2), a tributary of the Camlin, at a point where it has an upstream catchment area of approximately 32km^2. There are no active automatic recording gauges on the Clooncoose, and the two staff gauge stations on the stream have had measurements suspended. A preliminary estimate of the flow in the stream can be interpolated from the Mullagh gauge. The area to the proposed crossing is 12% of the area to the Mullagh gauge, the estimated maximum flow which occurred on the Clooncoose stream between 1953 and 2007 was 4.5m^3/s. This is likely to be an underestimate as smaller catchments tend to have greater floods per unit area than larger catchments.

The Black River (RFig 4.9.3), a tributary of the River Inny, is crossed by the Route Corridor Option south of Edgeworthstown. The catchment area to the proposed crossing point is approximately 11km^2. The EPA maintained an automatic gauge at Edgeworthstown from 2004 to 2007. In this period the maximum flow recorded at the gauge was 2.55m^3/s on December 3rd 2006. The catchment area to the gauge is 4.2km^2, scaling this up gives a flow of approximately 7m^3/s at the proposed crossing point.

This Route Corridor Optioncrosses the River Inny south of Ballinalack (RFig 4.9.4). The OPW have a gauge on the Inny at Ballinalack which has records from 1981 to 2005, the records are in hardcopy format and have not been processed. The nearest gauge on the Inny with data available is at Ballymahon in County Longford. The catchment area to this gauge is 1071km^2. Data is available from 1975 to 2007, and in this period the maximum flow recorded at Ballymahon was 130m^3/s on December 25th 1999. The catchment area to the proposed crossing of the Inny is 682km^2, or 64% of the area to Ballymahon. Interpolating the flow at Ballymahon gives an estimated maximum flow at Ballinalack during the period of record of approximately 83m^3/s.

Between the Inny crossing and the eastern end of the scheme there are no further watercourses with catchment areas greater than 10km^2.

4.9.5 Overview of Drainage Issues

Each of the main rivers crossed by the Route Corridor Option has been subject to a drainage scheme. The Rinn River is part of the Rinn and Black Drainage District, while the Camlin is part of the Longford Drainage District, both administered by Longford County Council. The Inny and its tributaries were the subject of an arterial drainage scheme between 1960 and 1968. The Brosna and its tributaries were subject to an arterial drainage scheme between 1948 and 1955. The OPW maintain the channels which were part of the arterial drainage schemes on an approximately 4 year cycle.

As part of the above drainage schemes maps were compiled of lands which were deemed to have benefited from drainage. The design criteria used in preparing arterial drainage schemes was that lands should be protected from flooding at a three year return period. These benefiting lands are indicative of potential flood plains at return periods greater than 3 years and are shown on RFig 4.9.5 to RFig 4.9.8. They may also indicate areas where waterlogging was reduced due to the improved drainage.

At the western end of the route all of the Route Corridor Options cross benefiting land for approximately 500m at the Rinn River (RFig 4.9.5). Approximately 1 km east of the Rinn River, the corridor crosses an unnamed stream which has a dense network of drains along its banks. Dense drainage networks are usually indicative of land which is prone to waterlogging.

At the eastern end of the route (RFig 4.9.8), all of the Route Corridor Options pass through a final area of benefiting land between nodes 21A and 22 close to where they connect with the existing dual carriageway. Other route specific areas of benefiting land are described below, and Table 4.9-4 below summarises the length of benefiting land traversed by each Route Corridor Option.

Table 4.9-4 Length of Benefiting Land Traversed by Each Route Corridor Option

River Catchment	BENEFITING LAND TRAVERSED BY ROUTE CORRIDOR OPTION (m)					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
Rinn	500	500	500	500	500	500
Camlin	800	950	800	1200	1200	800
Black	200	200	600	200	200	200
Riffey			4000			
Inny	400	400	70	400	400	400
Gaine			600			
Brosna	400	400	400	400	400	400
TOTAL	2,300	2,450	6,970	2,700	2,700	2,300

Route Corridor Option 1

The Route Corridor Option crosses approximately 800m of benefiting land at the River Camlin crossing (RFig 4.9.5). Along the Black River (RFig 4.9.7) the Route Corridor Option 1 incorporates three separate areas of benefiting lands, although two of these areas may be avoided depending on the final alignment of the route within the Route Corridor Option. In the vicinity of the River Inny crossing (RFig 4.9.8) the Route Corridor Option traverses 400m of benefiting land at the crossing and a further two areas of benefiting lands which may be avoided depending on the final alignment of the route within the Route Corridor Option.

Route Corridor Option 2

The Route Corridor Option crosses benefiting land for 950m at the River Camlin crossing (RFig 4.9.5). Along the Black River (RFig 4.9.7) the Route Corridor Option incorporates three separate areas of benefiting lands, although two of these areas may be avoided depending on the final alignment of the route within the Route Corridor Option. In the vicinity of the River Inny crossing (RFig 4.9.8) the Route Corridor Option traverses 400m of benefiting land at the crossing and a further two areas of benefiting lands which may be avoided depending on the final alignment of the route within the Route Corridor Option.

Route Corridor Option 3

The Route Corridor Option crosses benefiting land for 800m at the River Camlin crossing (RFig 4.9.5). Along the Black River (RFig 4.9.6) the Route Corridor Option 3 traverses approximately 600m of benefiting lands at Bracklon, north of Edgeworthstown. East of Edgeworthstown along the River Riffey (RFig 4.9.7) the Route Corridor Option traverses approximately 4km of benefiting lands, some of which may be avoided depending on the final alignment within the Route Corridor Option. The Route Corridor Option partially includes another 1.5km of benefiting lands along the Riffey just upstream of its confluence with the Inny (RFig 4.9.7). The Route Corridor Option crosses the River Inny in a relatively well defined valley traversing only approximately 70m of benefiting lands at the river. At Knockmorris (RFig 4.9.8), north of Bunbrosna, the Route Corridor Option crosses a small area of benefiting lands, while at Culleenabohoge (RFig 4.9.8) north of Ballynafid the route traverses another 600m of benefiting lands close to the River Gaine.

Route Corridor Option 4

The Route Corridor Option crosses approximately 1,200m of benefiting land at the River Camlin crossing (RFig 4.9.5). Along the Black River (RFig 4.9.7) the Route Corridor Option 4 incorporates three separate areas of benefiting lands, although two of these areas may be avoided depending on the final alignment of the route within the Route Corridor Option. In the vicinity of the River Inny crossing (RFig 4.9.8) the Route Corridor Option traverses 400m of benefiting land at the crossing and a further two areas of benefiting lands which may be avoided depending on the final alignment of the route within the Route Corridor Option.

Route Corridor Option 5

The Route Corridor Option crosses approximately 1,200m of benefiting land west of Longford Town (RFig 4.9.6). Along the Black River (RFig 4.9.7) the Route Corridor Option 5 incorporates three separate areas of benefiting lands, although two of these areas may be avoided depending on the final alignment of the route within the Route Corridor Option. In the vicinity of the River Inny crossing (RFig 4.9.8) the Route Corridor Option traverses 400m of benefiting land at the crossing and a further two areas of benefiting lands which may be avoided depending on the final alignment of the route within the Route Corridor Option.

Route Corridor Option Option 6

The Route Corridor Option crosses approximately 800m of benefiting land at the River Camlin crossing (RFig 4.9.5). Along the Black River (RFig 4.9.7) the Route Corridor Option 6 incorporates three separate areas of benefiting lands, although two of these areas may be avoided depending on the final alignment of the route within the Route Corridor Option. In the vicinity of the River Inny crossing (RFig 4.9.8) the Route Corridor Option traverses 400m of benefiting land at the crossing and a further two areas of benefiting lands which be avoided depending on the final alignment of the route within the Route Corridor Option.

4.9.6 Overview of Flooding Aspects and Floodplains

As noted in the previous section, the areas indicated as benefiting lands can be considered to be potential flood plains. There are also several areas where flooding has been reported and these are recorded on the OPW flood mapping website. The extent of floods noted below may increase when the full extent of the November 2009 floods is known. All Route Corridor Options cross the first of these areas at the Rinn River crossing, where the reported maximum flood extent is slightly larger than the area shown as benefiting land (RFig 4.9.5). The Rinn is reported to overflow its banks every year after heavy rain, and substantial floods have been mapped here in 1954 and the winter of 1999-2000. This flooding may be partially dependent on more general Shannon flooding, as the water level in the lower Rinn is likely to be substantially influenced by the water level on Lough Forbes on the Shannon. The southern edge of all the Route Corridor Options encounter another area of reported Shannon flooding at Sory Bridge over the next tributary east of the Rinn River. Other areas of reported flooding along each Route Corridor Option are described below. The extent of existing floodplains was confirmed on a site visit and by a review of aerial photographs.

Route Corridor Option Option 1

At Whiterock east of Longford Town (RFig 4.9.6) there is a reported recurring flood approximately 400m from the centre of the Route Corridor Option. The report states that low lying land, including properties and a road, flood at this location after heavy rain. The other reported flooding along the Route Corridor Option occurs at Leny

(RFig 4.9.8), 2km northwest of Bunbrosna, where it is reported that after heavy rain water flows down the hard shoulder of the existing N4 causing flooding in a farmyard.

Route Corridor Option Option 2

There is a small cluster of reported localised floods east of Longford Town (RFig 4.9.6). At Glack east of Longford Town there is a reported recurring flood approximately 400m from the centre of the Route Corridor Option. At the Driving Range in Knockahaw there is a recurring flood location approximately 250m from the corridor centre line. At Whiterock there is a recurring flood location 600m from the corridor centre. The reports state that low lying land including properties and roads flood at these locations after heavy rain. The other reported flooding along the Route Corridor Option occurs at Leny (RFig 4.9.8), 2km northwest of Bunbrosna, where it is reported that after heavy rain water flows down the hard shoulder of the existing N4 causing flooding in a farmyard.

Route Corridor Option Option 3

At Whiterock (RFig 4.9.6) east of Longford Town there is a reported recurring flood approximately 400m from the centre line of the Route Corridor Option. The report states that low lying land, including properties and a road, flood at this location after heavy rain. At Barratogher (RFig 4.9.7) 1km northeast of Rathowen, and 600m from the centre line of the Route Corridor Option there is a reported recurring flood which occurs annually when heavy rain causes the river to burst its banks and flood the road. At Leny Church, (RFig 4.9.8) 2km due north of Bunbrosna, there is a reported recurring flood which occurs occasionally when heavy rain causes the river to burst its banks and flood the road.

Route Corridor Option Option 4

Reported flooding along the Route Corridor Option occurs at Leny (RFig 4.9.8), 2km northwest of Bunbrosna, where it is reported that after heavy rain water flows down the hard shoulder of the existing N4 causing flooding in a farmyard.

Route Corridor Option Option 5

Reported flooding along the Route Corridor Option occurs at Mullagh, west of Longford Town (RFig 4.9.6). Flooding is reported to occur every year after heavy rain with an extensive flood plain. It is reported that the N5 can flood to its centre line at times. There is a large reported flood extent here from flooding which occurred in 1954 and 1999/2000. Flooding also occurs at Leny (RFig 4.9.8), 2km northwest of Bunbrosna, where it is reported that after heavy rain water flows down the hard shoulder of the existing N4 causing flooding in a farmyard.

Route Corridor Option 6

At Whiterock (RFig 4.9.6) east of Longford Town there is a reported recurring flood approximately 400m from the centre line of the Route Corridor Option. The report states that low lying land including properties and a road flood at this location after heavy rain. The other reported flooding along the Route Corridor Option occurs at Leny (RFig 4.9.8), 2km northwest of Bunbrosna, where it is reported that after heavy rain water flows down the hard shoulder of the existing N4 causing flooding in a farmyard.

4.9.7 Overview of Surface Water Quality

As part of Ireland's obligations under the EU Water Framework Directive (WFD) (2000/60/EC) the interim water quality status of all water bodies has been determined. River basin management projects have been undertaken and as part of these each water body has been assigned to one of five status categories; High, Good, Moderate, Poor, and Bad. The Shannon catchment comprises the Shannon International River Basin District. The lead authority on the Shannon IRBD project is Limerick County Council. The waterbody status as determined by the project is shown on RFig 4.9.9 to RFig 4.9.12.

The WFD requires that there should be no future deterioration in water status and that all water should be restored to at least good status by 2015.

Lough Forbes (RFig 4.9.9), Glen Lough (RFig 4.9.11) and Lough Owel (RFig 4.9.12) are all classified as being of Moderate status. Looking at the characteristics which are considered in assigning the status, Lough Owel and Lough Forbes were both

assessed as having similar characteristics, but Lough Forbes was assigned a Moderate ecological status while Lough Owel was assigned a Good ecological status. On the basis of the presence of alien fish species the overall status of Lough Owel was then reduced to Moderate status.

All rivers in the Shannon IRBD have been divided into sub-basins and the status of these sub-basins is shown on RFig 4.9.9 to RFig 4.9.12. The length of each Route Corridor Option falling within each status category is shown in Table 4.9-5 below.

Table 4.9-5 Length of each Route Corridor Option Option by Sub-Basin Water Quality Status

WATER QUALITY STATUS	LENGTH OF ROUTE CORRIDOR OPTION (km)					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
HIGH	0	0	0	0	0	0
GOOD	12 (24%)	10 (20%)	12 (22%)	8 (16%)	10.5 (19%)	12 (24%)
MODERATE	13 (25%)	13 (25%)	20 (37%)	13 (25%)	15.5 (28%)	13 (25%)
POOR	26 (51%)	28 (55%)	22 (41%)	30 (59%)	29 (53%)	26 (51%)
BAD	0	0	0	0	0	0

The sub-basins status has been assigned based on the macroinvertebrate communities and the physiochemical status of the rivers. The Rivers Camlin (RFig 4.9.9), Black (RFig 4.9.11), Gaine (RFig 4.9.12), and the part of the Brosna Catchment surrounding Lough Owel (RFig 4.9.12) were all assessed as being of Poor status. Some sub-basins were assigned a status based on results extrapolated from other sub-basins. The River Riffey (RFig 4.9.11) was assigned a Moderate status based on data extrapolated from the River Fallan sub-basin. The Clooncoose Stream (RFig 4.9.10) was assessed as being of Good status, and this was extrapolated to four nearby sub-basins. The River Rinn (RFig 4.9.9) was also assessed as being of Good status.

The main measures proposed to improve the status of the above waterbodies are measures related to unsewered properties and measures related to urban and industrial uses. Other measures proposed in the draft Shannon River Basin District Management Plan which impact on this project are mainly those associated with river

morphology. The measures include recommendations to increase biodiversity in altered channels (meanders, pools, narrow channels), measures to prevent pollution from runoff (implementation of SuDS principles), and measures to remove barriers to migration (removal/alteration of structures, design for fish passage, operational measures). These will form part of the design and will mitigate potential impacts.

Road runoff and accidental spillage was not deemed to be a risk factor for any of the sub-basins crossed, as the drainage system will be designed to remove any risk. Pollutants such as heavy metals and hydrocarbons can be deposited on roads by traffic, and then washed into the drainage system during rainfall events. The drainage from the proposed road will be treated in oil interceptors and attenuation ponds before discharge to the watercourses, which would remove pollutants before entering the watercourse. As many of these pollutants will come from traffic which would otherwise have used the existing N4 where drainage is not treated, this will result in an improvement to the water quality in the watercourses.

While poorly designed culverts or stream diversions could reduce the status of a waterbody, all works will be agreed with the Shannon Regional Fisheries Board and are not expected to impact negatively on surface water quality status.

4.9.8 Overview of Water Supply Sources

There are two large public water supply schemes along this Route Corridor Option. These are the Longford Central Regional Water Supply Scheme and the Mullingar Regional Water Supply Scheme. The Longford Central scheme abstracts water from Lough Forbes on the Shannon (RFig 4.9.1), and can be augmented by boreholes at Moneylagan (Ref 2027SWW12/14, RFig 4.7.23) and Cloonanny Glebe (Ref P40, RFig 4.7.22) north of Longford Town. The scheme supplies drinking water to Longford Town and environs, including Newtown Forbes and Edgeworthstown. Edgeworthstown had previously been supplied from Corbeagh Lough but is being incorporated into the Longford Central Scheme. The Mullingar scheme is supplied from Lough Owel (RFig 4.9.4). This public scheme extends as far west as Rathowen, from where a council supplied group scheme supplies water as far as Windtown on the Longford border. Section 4.7.15 provides an overview of groundwater resources in the area.

Route Corridor Option 1

There are four groundwater supplies close to Route Corridor Option 1. The Route Corridor Option passes close to the augmentation borehole at Cloonanny Glebe (RFig 4.7.5 and RFig 4.9.1). At Cloonahussey (RFig 4.9.2), 6km east of Longford Town on the existing N4 there is a private well 450m south of the centre of the Route Corridor Option. C & D Foods at Edgeworthstown (RFig 4.9.2) has a well approximately 1km from the centre line of the Route Corridor Option. Wilson's Hospital School (RFig 4.9.4) has a borehole approximately 1km northeast of Bunbrosna, approximately 600m from the centre line of the Route Corridor Option.

Route Corridor Option 2

There are four groundwater supplies close to Route Corridor Option 2. The Route Corridor Option passes close to the augmentation borehole at Cloonanny Glebe (RFig 4.7.5 and RFig 4.9.1). At Cloonahussey (RFig 4.9.2), 6km east of Longford Town on the existing N4 there is a private well 450m north of the centre line of the Route Corridor Option. C & D Foods at Edgeworthstown (RFig 4.9.2) has a well approximately 1km from the centre line of the Route Corridor Option. Wilson's Hospital School (RFig 4.9.4) has a borehole approximately 1km northeast of Bunbrosna, approximately 600m from the centre line of the Route Corridor Option.

Route Corridor Option 3

There are nine groundwater supplies close to Route Corridor Option 3. The Route Corridor Option passes close to the augmentation borehole at Cloonanny Glebe (RFig 4.7.5 and RFig 4.9.1). At Cloonahussey (RFig 4.9.2), 6km east of Longford Town on the existing N4 there is a private well 450m south of the centre line of the Route Corridor Option. At Bracklon (RFig 4.9.2), 2km northwest of Edgeworthstown there are two private wells, one of which is on the centre line of the Route Corridor Option and one of which is 200m from the centre line. There are public watermains in this area so it is unclear if these wells are currently in use. Wilson's Hospital School (RFig 4.9.4) has a borehole approximately 1km northeast of Bunbrosna, approximately 600m south of the centre line of the Route Corridor Option. There are futher groundwater supplies in the same area at Ballindurrow (500m from the centre line), Culleendarragh (200m from the centre line) and Knightswood (170m from the centre line), while the supply for the Multyfarnham Group Water Scheme (RFig 4.9.4) comes from a spring at Tyfarnham, approximately 750m north of the Route Corridor Option.

Route Corridor Option 4

There are two groundwater supplies close to Route Corridor Option 4. C & D Foods at Edgeworthstown (RFig 4.9.2) has a well approximately 1km from the centre line of the Route Corridor Option. Wilson's Hospital School (RFig 4.9.4) has a borehole approximately 1km northeast of Bunbrosna, approximately 600m from the centre line of the Route Corridor Option.

Route Corridor Option 5

There are four groundwater supplies close to Route Corridor Option 5. The Route Corridor Option includes the augmentation borehole at Moneylagan (RFig 4.7.23 and RFig 4.9.1), north of Longford Town. At Cloonahard (RFig 4.9.2), 6km east of Longford Town and south of the Dublin to Sligo railway line there is a group water scheme borehole approximately 250m south of the centre line of the Route Corridor Option. C & D Foods at Edgeworthstown (RFig 4.9.2) has a well approximately 1km from the centre line of the Route Corridor Option. Wilson's Hospital School (RFig 4.9.4) has a borehole approximately 1km northeast of Bunbrosna, approximately 600m from the centre line of the Route Corridor Option.

Route Corridor Option 6

There are five groundwater supplies close to Route Corridor Option 6. The Route Corridor Option passes close to the augmentation borehole at Cloonanny Glebe (RFig 4.7.5 and RFig 4.9.1) north of Longford Town. At Cloonahussey (RFig 4.9.2), 6km east of Longford Town on the existing N4 there is a private well 600m north of the centre line of the Route Corridor Option. At Cloonahard (RFig 4.9.2), 6km east of Longford Town and south of the Dublin to Sligo railway line there is a group water scheme borehole approximately 500m south of the centre line. C & D Foods at Edgeworthstown (RFig 4.9.2) has a well approximately 1km from the centre line of the Route Corridor Option. Wilson's Hospital School (RFig 4.9.4) has a borehole approximately 1km northeast of Bunbrosna, approximately 600m from the centre line of the Route Corridor Option.

4.9.9 Overview of Abstractions from Surface Water

The only significant abstractions from surface water occur at Lough Forbes (RFig 4.9.1) at the western end of the study area for the Longford Central Regional Water Supply Scheme and at Lough Owel (RFig 4.9.4) at the eastern end of the study area for the Mullingar Regional Water Supply Scheme. The Central Fisheries Board's Cullion Fish Farm is licensed to abstract up to 3,000,000 gallons/day from the Royal Canal feeder downstream of Lough Owel.

Agricultural uses would also account for a small proportion of the flow in the watercourses, although there are no known licensed abstractions.

4.9.10 Overview of Discharges to Surface Water

Point source discharges to surface water are typically licensed in one of three ways.

- The EPA license local authorities to discharge treated waste water into surface waters.
- Large industries are licensed by the EPA under the Integrated Pollution Prevention and Control (IPPC) system.
- Other commercial enterprises are licensed by the Local Authorities to discharge to surface waters.

There may be unknown unlicensed discharges such as seepage from septic tanks and also diffuse discharges from agricultural sources. In addition, there is potential for indirect impacts resulting from the drainage system.

Route Corridor Option 1

Treated effluent from Longford Town Waste Water Treatment Plant (WWTP) is discharged to the River Camlin approximately 3km downstream of the Route Corridor Option (RFig 4.9.2). Edgeworthstown WWTP discharges to the Black River approximately 1km upstream of the Route Corridor Option (RFig 4.9.3). Ballinalack WWTP discharges treated effluent to the River Inny within the Route Corridor Option (RFig 4.9.4).

There are several IPPC licensed industries close to the Route Corridor Option but only one, Glennon Bros. Timber Ltd., has a surface water component to its licence. The only discharge to surface water from the site is rainwater run-off, but due to the toxic nature of chemicals used on site the adjoining watercourse which receives the run-off from the site requires monitoring under the licence. This industry is located at Kilnasavogue (RFig 4.9.2) on the eastern edge of Longford town, and discharges to a tributary of the Clooncoose Stream approximately 2km upstream from where the Route Corridor Option crosses the Clooncoose Stream.

There are two discharges licensed by the Local Authorities close to the Route Corridor Option (RFig 4.9.4). The Covert Pub at Ballynafid on the Route Corridor Option is licensed to discharge to surface water. The Culleen Fish Farm near Mullingar is also licensed to discharge to surface water at the outlet from Lough Owel on the River Bronsa (RFig 4.9.4) approximately 1km from Route Corridor Option 1.

Route Corridor Option 2

Treated effluent from Longford Town Waste Water Treatment Plant (WWTP) is discharged to the River Camlin approximately 2.75km downstream of the Route Corridor Option (RFig 4.9.2). Edgeworthstown WWTP discharges to the Black River approximately 1km upstream of the Route Corridor Option (RFig 4.9.3). Ballinalack WWTP discharges treated effluent to the River Inny within the Route Corridor Option (RFig 4.9.4).

There are several IPPC licensed industries close to the Route Corridor Option but only one, Glennon Bros. Timber Ltd., has a surface water component to its licence. The only discharge to surface water from the site is rainwater run-off, but due to the toxic nature of chemicals used on site the adjoining watercourse which receives the run-off from the site requires monitoring under the licence. This industry is located at Kilnasavogue (RFig 4.9.2) on the eastern edge of Longford Town, and discharges to a tributary of the Clooncoose Stream approximately 300m downstream from where the Route Corridor Option crosses this tributary.

There are two discharges licensed by the Local Authorities close to the Route Corridor Option (RFig 4.9.4). The Covert Pub at Ballynafid approximately 1km upstream of the Route Corridor Option is licensed to discharge to surface water. The Culleen Fish

Farm near Mullingar is also licensed to discharge to surface water at the outlet from Lough Owel on the River Bronsa (RFig 4.9.4) approximately 1km from the Route Corridor Option 2.

Route Corridor Option 3

Treated effluent from Longford Town Waste Water Treatment Plant (WWTP) is discharged to the River Camlin approximately 3km downstream of the Route Corridor Option (RFig 4.9.2). Edgeworthstown WWTP discharges to the Black River approximately 3km downstream of the Route Corridor Option (RFig 4.9.3). Ballinalack WWTP discharges treated effluent to the River Inny approximately 2.5km downstream from the Route Corridor Option (RFig 4.9.4).

There are several IPPC licensed industries close to the Route Corridor Option but only one, Glennon Bros. Timber Ltd., has a surface water component to its licence. The only discharge to surface water from the site is rainwater run-off, but due to the toxic nature of chemicals used on site the adjoining watercourse which receives the run-off from the site requires monitoring under the licence. This industry is located at Kilnasavogue (RFig 4.9.2) on the eastern edge of Longford Town, and discharges to a tributary of the Clooncoose Stream approximately 2km upstream from where the Route Corridor Option crosses the Clooncoose Stream.

There are two discharges licensed by the Local Authorities close to the Route Corridor Option (RFig 4.9.4). The Wilsons Hospital school 1km northeast of Bunbrosna and approximately 500m from the Route Corridor Option is licensed to discharge to surface water. The Cullion Fish Farm near Mullingar is also licensed to discharge to surface water at the outlet from Lough Owel on the River Bronsa (RFig 4.9.4) approximately 1km from the Route Corridor Option 3.

Route Corridor Option 4

Treated effluent from Longford Town Waste Water Treatment Plant (WWTP) is discharged to the River Camlin approximately 6km downstream of the Route Corridor Option (RFig 4.9.2). Edgeworthstown WWTP discharges to the Black River approximately 1km upstream of the Route Corridor Option (RFig 4.9.3). Ballinalack

WWTP discharges treated effluent to the River Inny within the Route Corridor Option (RFig 4.9.4).

There are several IPPC licensed industries close to the Route Corridor Option but none has a surface water component to its licence.

There are two discharges licensed by the Local Authorities close to the Route Corridor Option (RFig 4.9.4). The Covert Pub at Ballynafid is licensed to discharge to surface water approximately 1km upstream of the Route Corridor Option. The Cullion Fish Farm near Mullingar is also licensed to discharge to surface water at the outlet from Lough Owel on the River Bronsa (RFig 4.9.4) approximately 1km from the Route Corridor Option 4.

Route Corridor Option 5

Treated effluent from Longford Town Waste Water Treatment Plant (WWTP) is discharged to the River Camlin immediately upstream of the Route Corridor Option (RFig 4.9.2). Edgeworthstown WWTP discharges to the Black River approximately 1km upstream of the Route Corridor Option (RFig 4.9.3). Ballinalack WWTP discharges treated effluent to the River Inny within the Route Corridor Option (RFig 4.9.4).

There are several IPPC licensed industries close to the Route Corridor Option but only one, Glennon Bros. Timber Ltd., has a surface water component to its licence. The only discharge to surface water from the site is rainwater run-off, but due to the toxic nature of chemicals used on site the adjoining watercourse which receives the run-off from the site requires monitoring under the licence. This industry is located at Kilnasavogue (RFig 4.9.2) on the eastern edge of Longford Town, and discharges to a tributary of the Clooncoose Stream approximately 2km downstream from where the Route Corridor Option crosses the tributary.

There are two discharges licensed by the Local Authorities close to the Route Corridor Option (RFig 4.9.4). The Covert Pub at Ballynafid is licensed to discharge to surface water approximately 1km upstream of the Route Corridor Option. The Cullion Fish Farm near Mullingar is also licensed to discharge to surface water at the outlet from

Lough Owel on the River Bronsa (RFig 4.9.4) approximately 1km from the Route Corridor Option 5.

Route Corridor Option 6

Treated effluent from Longford Town Waste Water Treatment Plant (WWTP) is discharged to the River Camlin approximately 3km downstream of the Route Corridor Option (RFig 4.9.2). Edgeworthstown WWTP discharges to the Black River approximately 1km upstream of the Route Corridor Option (RFig 4.9.3). Ballinalack WWTP discharges treated effluent to the River Inny within the Route Corridor Option (RFig 4.9.4).

There are several IPPC licensed industries close to the Route Corridor Option but only one, Glennon Bros. Timber Ltd., has a surface water component to its licence. The only discharge to surface water from the site is rainwater run-off, but due to the toxic nature of chemicals used on site the adjoining watercourse which receives the run-off from the site requires monitoring under the licence. This industry is located at Kilnasavogue (RFig 4.9.2) on the eastern edge of Longford Town, and discharges to a tributary of the Clooncoose Stream approximately 2km upstream stream from where the Route Corridor Option crosses the Clooncoose Stream.

There are two discharges licensed by the Local Authorities close to the Route Corridor Option (RFig 4.9.4). The Covert Pub at Ballynafid approximately 1km upstream of the Route Corridor Option is licensed to discharge to surface water. The Cullion Fish Farm near Mullingar is also licensed to discharge to surface water at the outlet from Lough Owel approximately 1km from the Route Corridor Option 6.

4.9.11 Overview of Ecological Issues

Section 4.10 (Natural Environment) of this report lists the important ecological sites along the route. The flood plain of the River Rinn is an NHA and there will be a direct impact upon part of this due to the crossing. The impact is considered Not Significant at a County Level, but may be Significant at a Local Level, as outlined in Tables 4.10-3 to 4.10-8. A clear span crossing will protect as much as possible of the environment. The Camlin, Black, Riffey, and Inny crossings are all listed as sites with

ecological impacts to be minimised in the design of the crossings. There is a small area of fen in the townland of Leny, near Bunbrosna, which lies between the Route Corridor Options. Also it is noted that the Route Corridor Options have the potential to adversely impact on Aghnamona Bog NHA, Clooneen Bog NHA cSAC, Ballykenny Fishertown Bog SPA, Lough Forbes Complex pNHA cSAC, Ballynafid Lake and Fen pNHA, Lough Garr NHA, Lough Iron pNHA SPA and Lough Owel NHA cSAC SPA and Scragh Bog pNHA cSAC (see Tables 4.10-3 to 4.10-8). Where road drainage is discharged upstream of designated sites it will be slowly released from retention ponds where pollutants will settle out prior to discharge. This should ensure that the quality of road drainage entering watercourses from the proposed road is better than that which currently drains from the existing road.

4.9.12 Classification of Scale and Importance of Watercourse Crossings

Table 4.9-6 Number and Order of Watercourse Crossings on each Route Corridor Option

RIVER ORDER	NUMBER OF CROSSINGS					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
5th Order	1	1	1	1	1	1
4th Order	2	2	2	2	2	2
3rd Order	2	1	3	1	1	
2nd Order	4	3	5	3	4	4
1st Order	10	12	10	10	13	10
Total Rivers	19	19	20	17	21	17
Drains	53	48	97	43	83	60

All of the Route Corridor Options cross the same watercourses between node 01 and node 03A (RFig 4.9.1). In this area the Route Corridor Options cross four rivers shown on the EPA EnVision database, two of which are unnamed first order rivers, one unnamed second order river, and the other is the River Rinn, a fifth order river. The Route Corridor Options also crosses eight minor drains/streams shown on 1:5,000 vector mapping. The Rinn will be crossed using a clear span bridge which will span the channel and part of the overbank flood plain. The other three rivers will be culverted and the drains will be piped.

Section 4.10.2 outlines the existing aquatic environment and Section 4.10.3 presents the options appraisal in terms of ecological assets. The NPWS has been closely involved in the assessment process.

Route Corridor Option Option 1

From node 03A to node 06 (RFig 4.9.1) the Route Corridor Option crosses no significant rivers and ten small drains. These drains will be piped as necessary.

Between node 06 and node 07 (RFig 4.9.1) the Route Corridor Option crosses the Camlin River, a fourth order river. This will also be crossed using a clear span bridge.

From node 07 to node 14 (RFig 4.9.2) the Route Corridor Option crosses the Clooncoose Stream (also known as the Racecourse Stream) in two places, once as a third order river and once as a second order river, and also crosses one other unnamed third order river, and four unnamed first order rivers. The Route Corridor Option also crosses 14 minor streams/drains. The Shannon Regional Fisheries Board have requested clear span crossings on the Clooncoose Stream. The other five rivers will be culverted and the drains will be piped.

From node 14 to node 19 (RFig 4.9.2 - RFig 4.9.4) the Route Corridor Option crosses the Black River, a second order river, the River Inny, a fourth order river, and also crosses one unnamed second order river, and three unnamed first order rivers. The Route Corridor Option also crosses 20 minor streams/drains. The crossings of the Black and Inny rivers will be clear span structures, while the remaining rivers will be culverted and the drains piped.

From node 19 to the end of the Route Corridor Option at node 22 (RFig 4.9.4) the route crosses one unnamed first order river which will be culverted. The Route Corridor Option also crosses one minor stream/drain which will be piped.

Route Corridor Option 2

From node 03A to node 06 (RFig 4.9.1) the Route Corridor Option crosses no significant rivers and ten small drains. These drains will be piped as necessary.

Between node 06 and node 08 (RFig 4.9.1 & RFig 4.9.2) the Route Corridor Option will cross the fourth order River Camlin. This will be crossed using a clear span bridge.

From node 07 to node 14 (RFig 4.9.2) the Route Corridor Option crosses the Clooncoose Stream (also known as the Racecourse Stream) twice where it is a first order river, and crosses three other unnamed first order rivers and one other unnamed third order river. The Route Corridor Option also crosses 9 minor streams/drains. The Shannon Regional Fisheries Board have requested clear span crossings on the Clooncoose Stream. The other five rivers will be culverted and the drains will be piped.

From node 14 to node 19 (RFig 4.9.2 - RFig 4.9.4) the Route Corridor Option crosses the Black River, a second order river, the River Inny, a fourth order river, and also crosses one unnamed second order river, and three unnamed first order rivers. The Route Corridor Option also crosses 20 minor streams/drains. The crossings of the Black and Inny rivers will be clear span structures, while the remaining rivers will be culverted and the drains piped.

From node 19 to the end of the Route Corridor Option at node 22 (RFig 4.9.4) the route crosses the first order Portnashangan Stream which will be culverted. The Route Corridor Option also crosses one minor stream/drain which will be piped.

Route Corridor Option 3

From node 03A to node 06 (RFig 4.9.1) the Route Corridor Option crosses no significant rivers and ten small drains. These drains will be piped as necessary.

Between node 06 and node 07 (RFig 4.9.2) the Route Corridor Option will cross the fourth order River Camlin. This will be crossed using a clear span bridge.

From node 07 to node 10 (RFig 4.9.2) the Route Corridor Option crosses the Clooncoose Stream (also known as the Racecourse Stream) twice, once as a third order river and once as a second order river, and the route also crosses one other unnamed third order river. The Route Corridor Option also crosses 12 minor

streams/drains. The Shannon Regional Fisheries Board have requested clear span crossings on the Clooncoose Stream. The other five rivers will be culverted and the drains will be piped. This section of the Route Corridor Option runs immediately on or alongside the second order Clooncoose Stream for approximately 650m. Depending on the final road alignment further crossings or stream diversions may be required. The proximity of the Route Corridor Option gives increased potential for pollution of the watercourse to occur, especially during construction, although mitigation measures will be used to minimise any adverse effects. Any necessary channel diversion will need to reflect the morphology measures required by the Shannon RBD project and the requirements of the Shannon Regional Fisheries Board.

From node 10 to node 13A (RFig 4.9.2 & RFig 4.9.3) the Route Corridor Option crosses the first order Black River upstream of Edgeworthstown and crosses one other unnamed first order tributary of the Riffey in four places. The Route Corridor Option also crosses 29 minor streams/drains. The Shannon Regional Fisheries Board have indicated that they will require clear span bridges for any crossings on the Black River. The remaining river crossings will be culverted, although a stream diversion would remove the need for two of these crossings, and the drains will be piped. The Route Corridor Option runs immediately alongside the unnamed first order river for a total length of approximately 500m. As at the Clooncose Stream this gives increased potential for pollution of the watercourse to occur depending on the final alignment of the route within the Route Corridor Option.

From node 13A to node 18A (RFig 4.9.3 & RFig 4.9.4) the Route Corridor Option crosses the River Inny, a fourth order river, the River Riffey twice, once as a third order river, and once as a second order river, and also crosses two other unnamed second order rivers, and two unnamed first order rivers. The Route Corridor Option also crosses 27 minor drains. The River Inny will be crossed using a clear span bridge, as will the third order crossing of the River Riffey. The remaining rivers will be culverted while the drains will be piped. This section of the Route Corridor Option runs close alongside one unnamed first order river, a tributary of the River Riffey, for a total length of approximately 1.2km. This gives increased potential for pollution of the watercourse to occur depending on the final alignment of the route within the Route Corridor Option.

From node 18A to node 22 (RFig 4.9.4) the Route Corridor Option crosses no significant watercourse. The Route Corridor Option crosses 11 drains. These drains will be piped as necessary.

Route Corridor Option 4

Between node 03A and node 14 (RFig 4.9.1 & Rfig 4.9.2) the Route Corridor Option crosses the River Camlin as a fourth order river, one unnamed third order river, and four unnamed first order rivers. This section of the Route Corridor Option also crosses 14 drains. One diversion would be required near the R198 crossing at Garrowhill where a meander on the unnamed first order river lies under the proposed Route Corridor Option. The River Camlin crossing will use a clear span bridge, while the other crossings will be culverted. The drains will be piped as necessary.

From node 14 to node 19 (RFig 4.9.2 - RFig 4.9.4) the Route Corridor Option crosses the Black River, a second order river, the River Inny, a fourth order river, and also crosses one unnamed second order river, and three unnamed first order rivers. The Route Corridor Option also crosses 20 minor streams/drains. The crossings of the Black and Inny rivers will be clear span structures, while the remaining rivers will be culverted and the drains piped.

From node 19 to the end of the Route Corridor Option at node 22 (RFig 4.9.4) the route crosses the first order Portnashangan Stream which will be culverted. The Route Corridor Option also crosses one minor stream/drain which will be piped.

Route Corridor Option 5

From node 03A to node 05 (RFig 4.9.1) the Route Corridor Option crosses no significant rivers and seven small drains. These drains will be piped as necessary.

Between node 05 and node 14 (RFig 4.9.1 & RFig 4.9.2) The Route Corridor Option crosses seven unnamed first order rivers, one unnamed second order river, one unnamed third order river, and the River Camlin, a fourth order river. The Route Corridor Option also crosses 47 minor streams/drains. The River Camlin crossing and the third order river crossing are located in recorded flood locations and will require clear span crossings. The remaining rivers will be culverted and the drains will

be piped or diverted as necessary. The junction with the existing N4 north of Longford Town is positioned over the confluence of two unnamed first order rivers. This will require two culverts in close proximity to each other or one culvert and one river diversion.

From node 14 to node 19 (RFig 4.9.2 - RFig 4.9.4) the Route Corridor Option crosses the Black River, a second order river, the River Inny, a fourth order river, and also crosses one unnamed second order river, and three unnamed first order rivers. The Route Corridor Option also crosses 20 minor streams/drains. The crossings of the Black and Inny rivers will be clear span structures, while the remaining rivers will be culverted and the drains piped.

From node 19 to the end of the Route Corridor Option at node 22 (RFig 4.9.4) the route crosses the first order Portnashangan Stream which will be culverted. The Route Corridor Option also crosses one minor stream/drain which will be piped.

Route Corridor Option 6

From node 03A to node 06 (RFig 4.9.1) the Route Corridor Option crosses no significant rivers and ten small drains. These drains will be piped as necessary.

Between node 06 and node 07 (RFig 4.9.1) the Route Corridor Option will cross the fourth order River Camlin. This will be crossed using a clear span bridge.

Between node 07 and node 09A (RFig 4.9.2) the Route Corridor Option crosses the Clooncoose Stream, a second order river, and one unnamed first order river. The Route Corridor Option also crosses 8 drains. The Clooncoose Stream will be crossed using a clear span crossing, the other river will be culverted, and the drains will be piped as necessary.

From node 09A to node 14 (RFig 4.9.2) the Route Corridor Option crosses the three unnamed first order rivers. The Route Corridor Option also crosses 13 drains. The rivers will be culverted and the drains will be piped as necessary.

From node 14 to node 19 (RFig 4.9.2 - RFig 4.9.4) the Route Corridor Option crosses the Black River, a second order river, the River Inny, a fourth order river, and also crosses one unnamed second order river, and three unnamed first order rivers. The Route Corridor Option also crosses 20 minor streams/drains. The crossings of the Black and Inny rivers will be clear span structures, while the remaining rivers will be culverted and the drains piped.

From node 19 to the end of the Route Corridor Option at node 22 (RFig 4.9.4) the route crosses the first order Portnashangan Stream which will be culverted. The Route Corridor Option also crosses one minor stream/drain which will be piped.

4.9.13 Impact Assessment

The majority of potential hydrological impacts can be prevented with mitigation measures. In assessing the likely impacts we have assumed that standard mitigation measures will be taken. Further it is assumed that construction practices will comply with the recommendations of the Construction Industry Research and Information Association (CIRIA) publication “Good Environmental Practice on Site”. The NRA Guidelines set out a framework for assessing the importance of attributes and the level of impact on these attributes. These guidelines have been applied in this impact assessment.

All attributes are assigned an importance on the scale; Low, Medium, High, Very High, and Extremely High. Impacts then range in significance on the scale; Imperceptible, Slight, Moderate, Significant, and Profound.

The assessed impacts of each Route Corridor Option are set out in the tables below.

Table 4.9-7 Impact Assessment for Route Corridor Option 1

ROUTE CORRIDOR OPTION 1			
Attribute	Attribute Importance	Impact	Level of Impact
Rinn River NHA	Very High	Loss of aquatic habitat during construction	Slight Negative
Rinn River Flood Plain	High	Obstruction of flood plain	Moderate Negative
Camlin River	High	Obstruction of potential flood plain	Moderate Negative
Clooncoose Stream	High	Corridor running parallel close to river, possible diversion required	Significant Negative
Black River	High	Obstruction of potential flood plain	Moderate Negative
		Corridor running parallel close to river in two locations.	Significant Negative
Lough Garr NHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive [1]
River Inny	High	Loss of potential flood plain	Significant Negative
Lough Iron SPA; pNHA	Extremely High	Improvement in discharged water quality due to removal of traffic from old N4.	Profound Positive [1]
Ballynafid Lake and Fen pNHA	Very High	Improvement in discharged water quality.	Significant Positive[1]
Lough Owel cSAC; pNHA; SPA	Extremely High	Improvement in discharged water quality.	Profound Positive [1]
Tributaries receiving road drainage	Extremely High (some enter designated sites)	Improvement in discharged water quality. Indirect impact on cSACs, NHAs, and downstream abstractions.	Profound Positive [1]
Benefiting Lands	Medium	Loss of potential flood plain	Slight Negative

[1] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight positive

Table 4.9-8 Impact Assessment for Route Corridor Option 2

ROUTE CORRIDOR OPTION 2			
Attribute	Attribute Importance	Impact	Level of Impact
Rinn River NHA	Very High	Loss of aquatic habitat during construction	Slight Negative
Rinn River Flood Plain	High	Obstruction of flood plain	Moderate Negative
Camlin River	High	Obstruction of potential flood plain	Moderate Negative
Black River	High	Obstruction of potential flood plain	Moderate Negative
		Route running parallel close to river, possible diversion required	Significant Negative
Lough Garr NHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive [1]
River Inny	High	Loss of potential flood plain	Significant Negative
Lough Iron SPA; pNHA	Extremely High	Improvement in discharged water quality due to removal of traffic from old N4.	Profound Positive [1]
Ballynafid Lake and Fen pNHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive[1]
Lough Owel cSAC; pNHA; SPA	Extremely High	Improvement in discharged water quality.	Profound Positive [1]
Tributaries receiving road drainage	Extremely High (some enter designated sites)	Improvement in discharged water quality. Indirect impact on cSACs, NHAs, and downstream abstractions.	Profound Positive [1]
Benefiting Lands	Medium	Loss of potential flood plain	Slight Negative

[1] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight positive

Table 4.9-9 Impact Assessment for Route Corridor Option 3

ROUTE CORRIDOR OPTION 3			
Attribute	Attribute Importance	Impact	Level of Impact
Rinn River NHA	Very High	Loss of aquatic habitat during construction	Slight Negative
Rinn River Flood Plain	High	Obstruction of flood plain	Moderate Negative
Camlin River	High	Obstruction of potential flood plain	Moderate Negative
Clooncoose Stream	High	Corridor running parallel close to river, possible diversion required	Significant Negative
River Riffey Tributary north of node 13A	High	Corridor running parallel close to river, possible diversion required	Significant Negative
River Riffey Tributary at node 15	High	Corridor running parallel incorporating river, possible diversion required	Significant Negative
River Riffey	High	Loss of potential flood plain	Significant Negative
Lough Garr NHA	Very High	Road drainage entering from north.	Significant Negative [2]
River Inny	High	Loss of potential flood plain	Moderate Negative
Lough Iron SPA; pNHA	Extremely High	Improvement in discharged water quality due to removal of traffic from old N4.	Profound Positive [1]
River Gaine	High	Loss of potential flood plain	Significant Negative
Ballynafid Lake and Fen pNHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive[1]
Lough Owel cSAC; pNHA; SPA	Extremely High	Improvement in discharged water quality.	Profound Positive [1]
Tributaries receiving road drainage	Extremely High (some enter designated sites)	Improvement in discharged water quality. Indirect impact on cSACs, NHAs, and downstream abstractions.	Profound Positive [1]
Benefiting Lands	Medium	Loss of potential flood plain	Slight Negative

[1] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight positive

[2] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight negative

Table 4.9-10 Impact Assessment for Route Corridor Option 4

ROUTE CORRIDOR OPTION 4			
Attribute	Attribute Importance	Impact	**Level of Impact**
Rinn River NHA	Very High	Loss of aquatic habitat during construction	Slight Negative
Rinn River Flood Plain	High	Obstruction of flood plain	Moderate Negative
Camlin River	High	Obstruction of potential flood plain	Moderate Negative
Black River	High	Obstruction of potential flood plain	Moderate Negative
		Route running parallel close to river, possible diversion required	Significant Negative
Lough Garr NHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive [1]
River Inny	High	Loss of potential flood plain	Significant Negative
Lough Iron SPA; pNHA	Extremely High	Improvement in discharged water quality due to removal of traffic from old N4.	Profound Positive [1]
Ballynafid Lake and Fen pNHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive[1]
Lough Owel cSAC; pNHA; SPA	Extremely High	Improvement in discharged water quality.	Profound Positive [1]
Tributaries receiving road drainage	Extremely High (some enter designated sites)	Improvement in discharged water quality. Indirect impact on cSACs, NHAs, and downstream abstractions.	Profound Positive [1]
Benefiting Lands	Medium	Loss of potential flood plain	Slight Negative

[1] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight positive

Table 4.9-11 Impact Assessment for Route Corridor Option 5

ROUTE CORRIDOR OPTION 5			
Attribute	Attribute Importance	Impact	Level of Impact
Rinn River NHA	Very High	Loss of aquatic habitat during construction	Slight Negative
Rinn River Flood Plain	High	Obstruction of flood plain	Moderate Negative
Camlin River Flood Plain	Very High	Obstruction of potential flood plain	Profound Negative
Royal Canal pNHA	Very High	Possible construction impacts	Slight Negative
Derrymore Bog pNHA	Very High	Possible construction impacts	Slight Negative
Black River	High	Obstruction of potential flood plain	Moderate Negative
		Route running parallel close to river, possible diversion required	Significant Negative
Lough Garr NHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive [1]
River Inny	High	Loss of potential flood plain	Significant Negative
Lough Iron SPA; pNHA	Extremely High	Improvement in discharged water quality due to removal of traffic from old N4.	Profound Positive [1]
Ballynafid Lake and Fen pNHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive[1]
Lough Owel cSAC; pNHA; SPA	Extremely High	Improvement in discharged water quality.	Profound Positive [1]
Tributaries receiving road drainage	Extremely High (some enter designated sites)	Improvement in discharged water quality. Indirect impact on cSACs, NHAs, and downstream abstractions.	Profound Positive [1]
Benefiting Lands	Medium	Loss of potential flood plain	Slight Negative

[1] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight positive

Table 4.9-12 Impact Assessment for Route Corridor Option 6

ROUTE CORRIDOR OPTION 6			
Attribute	Attribute Importance	Impact	Level of Impact
Rinn River NHA	Very High	Loss of aquatic habitat during construction	Slight Profound Negative
Rinn River Flood Plain	High	Obstruction of flood plain	Moderate Negative
Camlin River	High	Obstruction of potential flood plain	Moderate Negative
Clooncoose Stream	High	Corridor running parallel close to river, possible diversion required	Significant Negative
Black River	High	Obstruction of potential flood plain	Moderate Negative
		Route running parallel close to river, possible diversion required	Significant Negative
Lough Garr NHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive [1]
River Inny	High	Loss of potential flood plain	Significant Negative
Lough Iron SPA; pNHA	Extremely High	Improvement in discharged water quality due to removal of traffic from old N4.	Profound Positive [1]
Ballynafid Lake and Fen pNHA	Very High	Improvement in discharged water quality due to removal of traffic from old N4.	Significant Positive[1]
Lough Owel cSAC; pNHA; SPA	Extremely High	Improvement in discharged water quality.	Profound Positive[1]
Tributaries receiving road drainage	Extremely High (some enter designated sites)	Improvement in discharged water quality. Indirect impact on cSACs, NHAs, and downstream abstractions.	Profound Positive[1]
Benefiting Lands	Medium	Loss of potential flood plain	Slight Negative

[1] This is due to the criteria in the NRA Guidelines, qualitatively would say imperceptible to slight positive

4.9.14 Comparison of Route Corridor Options

In assessing the impacts each route had one impact assessed as Significant Positive and three as Profound Positive. This is because the impacts relate to designated sites which under the NRA Guidelines must be given an attribute importance of Extremely High or Very High. Any permanent impact on an attribute with an importance of Extremely High cannot then under the NRA Guidelines be given an impact significance below Profound, and similarly on an attribute with an importance of Very High the significance of a permanent impact must be Profound or Significant. Based on professional judgement the actual impacts expected would be given an impact significance of imperceptible to slight positive. The impact significance in Tables 4.9-7 to 4.9-12 above and Table 4.9-13 below is that based on the Guidelines. It does not alter the ranking of the routes as all routes have the same impacts as assessed at these sites.

The ranking of the Route Corridor Options was based on the number and scale of the negative impacts expected, and is shown in Table 4.9-13.

Table 4.9-13 Summary of Hydrology and Drainage impacts

HYDROLOGY & DRAINAGE						
Impact Level	ROUTE CORRIDOR OPTIONS					
	RCO 1	RCO 2	RCO 3	RCO 4	RCO 5	RCO 6
Profound Negative					1	
Significant Negative	3	2	5	2	2	2
Moderate Negative	3	3	3	3	2	3
Slight Negative	2	2	2	2	4	2
Significant Positive	1	1	1	1	1	1
Profound Positive	3	3	3	3	3	3
Order of Preference	4th	1st (joint)	5th	1st (joint)	6th	1st (joint)

Route Corridor Option 5 is likely to have a Profound Negative impact on the flood plain of the Camlin River downstream of Longford Town (RFig 4.9.6) due to the construction of embankments across the flood plain. This would be likely to increase the flood level upstream of the embankments in Longford Town. Mitigation measures at this location could minimise the impact, but are unlikely to remove it completely. This Route Corridor Option is considered the least preferred from a hydrological perspective.

All Route Corridor Options would have a Slight Negative impact on the River Rinn NHA. This results from temporary impacts affecting only a small proportion of an attribute of 'very high' importance. Best practice design procedures would be applied to avoid placement of the structure within the river channel, so no permanent hydrology impacts would occur. In addition, there would be a positive impact associated with treatment of road run-off before discharge.

Route Corridor Option Option 3 has more Significant Negative impacts than the other Route Corridor Options. These occur due to the large areas of benefiting lands which are crossed by the corridor in the River Riffey (RFig 4.9.7), and River Gaine (RFig 4.9.8) catchments, and due to the proximity of the corridor to the Clooncoose Stream (RFig 4.9.6) for a 500m length. The benefiting lands indicate areas which may be flood plains, while the proximity of the stream to the route for a prolonged distance increases the risk of a pollution incident.

Route Corridor Option Option 1 has one more Significant Negative impact than Route Corridor Options 2, 4, and 6. This occurs due to the proximity of the corridor to the Clooncoose Stream (RFig 4.9.6) for a 500m length. Good construction practices should minimise any construction impact on the stream but due to its proximity there is an increased risk of pollution during construction and operation.

Route Corridor Option Options 2, 4, and 6, will all have similar levels of impact. They are thus given a joint first preference.

The Project Appraisal Balance Sheet (PABS) approach uses different scaling statements on a seven point scale between Highly Positive and Highly Negative for the level of impact. For the PABS approach the hydrological impacts of each Route Corridor Option must be summarised with a single scaling statement. These are shown in Table 4.9-14 below. Although RCO 1, 3, and 5 were the least preferred, we have given RCO 1 the same PABS scaling as RCO 2, 4, and 6 because of the lack of resolution within the 7 point scale to allow us to differentiate further, and because it is closer to RCO 2, 4, and 6 in terms of impact than it is to RCO 3 and 5.

Table 4.9-14 PABS Impact Summary

Route Corridor Option	Scaling Statement	Order of Preference
Route Corridor Option Option 1	Moderately Negative	4
Route Corridor Option Option 2	Moderately Negative	1
Route Corridor Option Option 3	Highly Negative	5
Route Corridor Option Option 4	Moderately Negative	1
Route Corridor Option Option 5	Highly Negative	6
Route Corridor Option Option 6	Moderately Negative	1

4.10 Natural Environment

This section of the Route Corridor Selection Report reviews the ecological constraints and opportunities associated with each of the six proposed route options for the N4 Mullingar to Longford (Roosky) scheme, and evaluates the likely potential significant impacts on the natural environment associated with each of these proposed route options.

This study is underpinned by the Constraints Study, and refers to updated desk study information. Preliminary field surveys of key areas of ecological interest have also been undertaken along the proposed Route Corridor Options.

4.10.1 Methodology

Desk Study and Consultations

A review of OSi Discovery Series 1:50,000 mapping and aerial photography was undertaken to identify likely areas of ecological interest located in close proximity to the proposed route options.

Information was sought from the National Parks and Wildlife Service (NPWS), BirdWatch Ireland (BWI), The Botanical Society of the British Isles (BSBI), the Shannon Regional Fisheries Board (ShRFB), the Irish Peatland Conservation Council (IPCC), Bat Conservation Ireland (BCI), The Irish Wildlife Trust (IWT) and the Irish Dragonfly Society. This information has been incorporated where relevant into this report. Relevant information from the Constraints Study has also been incorporated into this report where appropriate.

A detailed review of information relating to sites designated (or proposed for designation) under European or National legislation has also been undertaken. This involved a review of the citations for each site, and a review of the qualifying interests for which the sites have been designated, or are proposed for designation. Relevant legislation applicable to the proposed Scheme has also been reviewed. The potential implications for the transposition of The Environmental Liability Directive (ELD) into

Irish law has also been assessed. However, given that the ELD would only apply to operations causing "significant adverse changes" and that planning permission for the proposed Scheme would only be expected to be granted in the absence of such impacts, and/or with appropriate mitigation (and derogation licences/appropriate assessment consents, as applicable) for those impacts in place, the Directive is not considered to require detailed consideration at this time.

In the absence of specific targeted mitigation, there is the potential for some of the route corridor options to cause environmental damage, as defined under the Directive, and the RCSR has been written to ensure this is made clear. However, it should be noted that the 2009 EIS Guidance states that impact levels should be considered in the absence of specific targeted mitigation that has not been integrated into the current Scheme design. At the current stage of the project, where detailed designs have not been formulated for each of the routes, it is not possible to identify all possible mitigation measure that may be required for each of the routes as "measures where delivery is unequivocal and success is highly likely" (text from NRA Ecological Impact Assessment Guidelines, 2009). It is therefore necessary to assess the potential impacts of the "unmitigated scheme". It should be noted that whilst the desk study, consultations and surveys undertaken to date would be expected to have identified the locations where "significant adverse effects" to protected species and habitats could occur, as defined under the Directive, there is the potential for small areas of valuable habitats and protected species to be present across the Scheme corridor in previously unidentified locations. In these locations, i) without further detailed survey work to EIS standard; and ii) when considering an 'unmitigated Scheme'; it is not possible to completely rule out all impacts on all protected habitats and species, although these would not be expected to constitute significant adverse impacts. The route corridor selection process which followed, whilst taking into account the other non-ecological constraints across the Scheme, has been undertaken to minimise, so far as possible at this stage of the process, the risk of significant adverse impacts on protected habitats and species.

In addition, following discussion with NPWS staff to discuss the different Route Corridor Options under consideration at that time. Discussions were held, in particular, with regard to route options in the vicinity of designated sites within the Study Area. The concerns raised by NPWS have been identified in this report and addressed within the scope of the existing study.

Field Survey

A field study was undertaken in May and June 2008. This was prior to the publication of the National Roads Authority "Guidelines for Assessment of Ecological Impacts of National Road Schemes" (Revision 2, NRA, 2009 (known as the NRA Guidelines)). The methodology followed for the surveys was broadly in line with that described in the Guidelines, which state "*In those situations where a large number of Route options are still being considered (or during the earlier stages of the process), it will not be appropriate to investigate the full length of each route in the field, but rather to restrict field surveys to key sites, features or route sections that appear to be of particular ecological value, to assess the potential impact of the route(s) upon them*". This was the approach taken during the fieldwork, whereby a detailed aerial photography assessment of the entire route corridor, along with existing knowledge relating to designated sites and desk study and consultation responses received, were used to scope the extent of the field surveys.

The field surveys focussed on all of the areas that had been identified in the Constraints Study as being of known or potential ecological interest within the Route Corridor Study Area. It included visits to designated sites, as well as sites identified as being of potential importance following the review of the aerial photography and the desk study. The site visits also allowed information compiled during the desk study exercise to be verified.

Detailed information about the habitats present, and the potential for these to support valuable or protected species, was recorded during these surveys In addition a number of vantage point surveys were undertaken along the route corridor, in order to gain a more general overview of the natural environment resources within the Survey Area that could be affected by the proposed N4 Road Improvement Scheme.

Zone of Influence

As per the National Roads Authority "Guidelines for Assessment of Ecological Impacts of National Road Schemes" (Revision 2, NRA, 2009), these desk and field based studies, along with input from other disciplines such as hydrology, drainage and hydrogeology, have allowed the 'Zone of Influence' to be established for the project. This includes the ecological resources (designated sites, non-designated ecological sites, and watercourses that would be crossed by the proposed route corridors), likely to be affected by the biophysical changes caused by the project. This Zone of

Influence will be reviewed as the scheme progresses, in accordance with the NRA Guidelines.

Assessment

The value of the habitats present within each site was assessed according to the site evaluation scheme described in Table 1 of the NRA Guidelines (Revision 2, NRA, 2009) on the following scale of importance:

- International Importance;
- National Importance;
- County Importance;
- Local Importance (higher value); and
- Local Importance (lower value).

This assessment was based on information collated during the desk study and during consultations. It has been 'ground-truthed' during the field surveys and further field surveys will be undertaken at EIS stage, as appropriate in order to confirm the assessment. The potential for sites to be of value for protected species, or other species of conservation concern was also assessed.

The significance of impacts was then assessed according to Section 3.4 of the NRA Guidelines (Revision 2 (NRA 2009)) (Impact Assessment). In accordance with these guidelines, impacts on ecological receptors of below Local Importance (higher value) have not been selected as 'key ecological receptors' for which detailed assessment is required. Those receptors considered to be of Local Importance (higher value) and above, are considered to be of sufficient value to be material in the decision making process and are therefore included in the detailed assessment.

The level of likely impacts has been assessed based on the 'unmitigated scheme'; this includes general mitigation measures which are incorporated within the scheme design, for example, the alignment of the route within the corridor to minimise impacts on designated sites, wide-span crossings of significant watercourses and good drainage design etc. Delivery of these mitigation measures is unequivocal and success is highly likely. However, site-specific mitigation measures have been excluded from the assessment, as these will not be devised until the next stage in the assessment process.

Impacts on designated sites – a pragmatic approach to the assessment

A pragmatic approach has been taken to assessing the scale of likely impacts within this assessment, particularly in relation to designated nature conservation sites. In certain cases, the proposed 300m route corridors intersect with the mapped boundaries of Natura 2000 sites (sites designated as Special Protection Areas (SPAs) or candidate Special Areas of Conservation (cSACs)). These sites could potentially be subject to a Significant Impact at the International Level if a route option is located within, or near to, the designated site boundary.

The alignments of all Route Corridor Options within the N4 Mullingar to Longford (Roosky) Scheme have been critically reviewed and further review of the road alignment itself will be undertaken at later stages in the project. In many places where the 300m corridor does overlap with designated sites, the route within the corridor will be aligned so that it is located outside of the Natura 2000 site boundary. Where an alignment within the mapped boundary of a Natura 2000 site cannot be avoided the alignment will continue to be reviewed to ensure that any impacts on the qualifying interests of the Natura 2000 site will be avoided by accommodating the new road alignment within the fenceline of the existing N4 road corridor. In this instance, the level of likely direct and indirect impacts would no longer be significant at an International Level, but could still be significant at a local or County scale. This approach to impact assessment is set out in the NRA Guidelines for Assessment of Ecological Impacts of National Road Schemes (Revision 2, NRA, 2009). These Guidelines allow the user to determine whether impacts on an ecological receptor are significant at a particular geographical scale (International, National etc.). In this case the term ‘significant’ means whether or not there is an adverse effect on the integrity or a likely change in the conservation status of the habitat(s) or species of which the ecological receptor is comprised. This should be assessed at whichever geographical scale is appropriate.

The potential for temporary or permanent impacts associated with changes in hydrological regime for sensitive sites, such as fens and loughs has been assessed and is presented in Section 4.7 (Hydrogeology) and 4.9 (Hydrology and Drainage). Reference has been made to the assessments reached in these sections of the RCSR report when assessing potential ecological impacts in this chapter.

4.10.2 Existing Environment

Designated sites

There are 19 sites internationally and/or nationally designated or proposed for designation within the main Study Area. These, in addition to those adjacent to the Study Area, are shown on RFig 4.10.1 to RFig 4.10.8 in Volume III. Although legally pNHAs are not subject to the same level of protection as officially designated NHAs, for the purpose of this assessment, sites which are proposed for designation are considered to have the same level of protection as designated sites. It should be noted that Article 6(3) and 6(4) of the Habitats Directive, which relate to the protection of European sites from damage, only apply in relation to SACs/cSACs, SPAs and Sites of Community Importance (SCIs).[3] However, it is important to note that the definition of a 'European site' under the transposing regulations includes candidate SACs.[4]

Information has been obtained from the NPWS with regard to the most up-to-date information on statutory designated sites. Of these, 15 are located within 1km of the proposed route options; information on these sites is presented in Table 4.10-1. Information on the remainder of the designated sites which are located up to 10km from the Study Area boundary and within the wider Study Area is provided in Volume II Appendices 15 and 16, respectively.

The reasons for designation of sites are often complex, and where sites hold more than one designation the reasons for each designation may overlap to some extent. The main habitats and species for which sites have been designated within and adjacent to the Study Area are listed below:

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[3] *European Commission Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission* (Office for Official Publications of the European Communities, Luxembourg, 2007) 3n.

[4] See Article 2 of the Habitats Regulations, 1997, as substituted by section 75 of the Wildlife (Amendment) Act, 2000.

- Habitats of international importance, including active raised bogs and bog woodland (both priority habitats under Annex I of the Habitats Directive), sessile oak woodlands, hard water lakes, alkaline fen and transition mire;
- Habitats or assemblages of habitats considered to be of national importance, for example, calcareous grassland, marshy grassland, fen carr and wet woodland;
- Sites of international and national importance for the bird populations and species they support, for example, Greenland white-fronted geese (*Anser albifrons flavirostris*), whooper swan (*Cygnus Cygnus*), merlin (*Falco columbarius)*, hen harrier (*Circus cyaneus*) and kingfisher (*Alcedo atthis*); and
- Sites supporting rare plant and/or animal species of conservation concern, or protected species of plants and/or animals.

Sites that have been designated or are proposed for designation as SPAs or SACs are considered to be of international importance for nature conservation and are key constraints to route selection within the Study Area. SACs receive protection under the European Communities (Natural Habitats) Regulations 1997), which underpin their (proposed) designation.

Regulation 30 of the European Communities (Natural Habitats) Regulations 1997, specifies that "where a proposed road development in respect of which an application for the approval of the Minister for the Environment has been made in accordance with section 51 of the Roads Act, 1993, is neither directly connected with nor necessary to the management of a European site but likely to have a significant effect thereon either individually or in combination with other developments, the Minister for the Environment shall ensure that an appropriate assessment of the implications for the site in view of the site's conservation objectives is undertaken".

The Regulation also states that "an environmental impact assessment as required under subsection (2) of section 51 of the Roads Act, 1993, in respect of a proposed road development referred to in paragraph (1) shall be an appropriate assessment for the purposes of this Regulation."

Given the presence of numerous Natura 2000 sites within and adjacent to the Study Area, it is likely that an Appropriate Assessment would be required for the Scheme. For the purposes of Appropriate Assessment, Ramsar sites are also usually included.

Where mobile species, most notably wintering and breeding birds, are primary reasons for the designation of SPAs, potential impacts on these outside the boundaries of designated sites have also been considered in the course of the development of the proposed route options.

Sites designated as NHAs, or proposed for designation (pNHAs), have also been considered as significant constraints during the route corridor selection stage, and routes that are likely to lead to significant impacts have been avoided, where possible. NHAs are designated under the Wildlife (Amendment) Act 2000, and receive protection from damage under this legislation. In general, pNHAs receive only limited protection, in the form of Local Authority recognition of the ecological value of the site under the County Development Plan, under the Rural Environmental Protection Scheme (REPS) and in the Forest Service requirement for NPWS approval before they will pay afforestation grants on pNHA lands. However, this limited protection notwithstanding, pNHAs are considered to be of equal importance to sites that have been designated, for the purpose of this report. A possible exception to this is Derrymore Bog pNHA, which NPWS has indicated may not be designated due to the level of degradation of the raised bog habitats at the site. More detail relating to the applicable policies is provided in Section 4.1, Land Use and Planning.

Table 4.10-1 Designated Conservation Sites within 1km of the route options (Distances measured from edge of route corridor)

Site name	Site code	Status*	Distance from Route Corridor Options	Description and features of conservation interest
Aghnamona Bog	000422	NHA	Directly affected by Route Corridor Options 1, 2, 3, 4, 5 and 6[1]	Qualifying interest/Reason for designation: Raised Bog (Annex I Habitat) Other habitats/species of importance: birch woodland, and belt of purple moor grass.
Ballykenny Fishertown Bog	004101	pNHA cSAC SPA	Directly affected by Route Corridor Options 1, 2, 3, 4, 5 and 6[1]	Qualifying interest/Reason for designation: Active Raised Bog, Degraded Raised Bog, Old Oak Woodland, Natural Eutrophic Lakes - all listed on Annex I of Habitats Directive. Wild Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted Geese. Other habitats/species of importance: Callow grasslands, also a small band of Deciduous Bog Woodland. Pine marten, badger and bat species reported as present by NPWS.
Ballynafid Lake and Fen	000673	pNHA	Directly affected by Route Corridor Option 1 (to the north of the site) [1] Directly affected by Route Corridor Options 2, 4, 5 and 6 (to the south)	Other habitats/species of importance: Open water, Fen, Reed swamp, Freshwater marsh, Calcareous fen (Annex I Habitat), Woodland. Snipe are reported to use the site, which is also considered important for a variety of invertebrates including Irish damselfly. Marsh Helleborine also recorded.
Carrickglass Demesne	001822	pNHA	Route Corridor Options 1, 3, and 6 are within 450 m. Route Corridor Option 4 within 1km.	Other habitats/species of importance: Mixed woodland (Mature Oak and other broadleaved trees and planted conifers). Likely to be valuable for bats.
Clooneen Bog	000445	pNHA, cSAC	Directly affected by Route Corridor Options 1, 2, 3, 4, 5 and 6[1]	Qualifying interest/Reason for designation: Bog woodland (priority habitat), Degraded Raised Bog and Rynchosporion - all listed on Annex I of Habitats Directive. Other habitats/species of importance: Birch wood growing as flush and wet grassland. Mosses also present including *Hyloconium* and *Sphagnum*. The south of the bog provides additional habitat with a mix of peat areas, Sphagnum, heath and Purple-moor grass.
Derrymore Bog	000447	pNHA	Directly affected by Route Corridor Option 5	Other habitats/species of importance: Degraded Raised Bog (Annex I Habitat). Two notable moss species (*Sphagnum imbricatum and S.fimbriatum)* present. Red grouse present on site.
Garriskil Bog	000679	cSAC, SPA	The southern-most corner of the site is approximately 20m away from Route Corridor Option 3.	Qualifying interest/Reason for designation: Active Raised Bog (Annex I Habitat, priority habitat), Degraded Raised Bog (Annex I Habitat), Greenland white-fronted geese. Other habitats/species of importance: Raised bog (including cutaway area) Birds Directive species including merlin and hen harrier (foraging only)

Site name	Site code	Status*	Distance from Route Corridor Options	Description and features of conservation interest
Lough Forbes Complex	001818	pNHA, cSAC	Directly affected by Route Corridor Options 1, 2, 3, 4, 5 and 6[1]	Qualifying interest/Reason for designation: Active Raised Bog (Annex I Habitat, priority habitat), Other habitats/species of importance: An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Callow grasslands, Reed swamps and Freshwater marshes. Wild Birds Directive species identified as present include Greenland white-fronted geese and merlin.
Lough Garr Bog	001812	NHA	Route Corridor Option 3 is adjacent to the northern corner of the site[1] Route Corridor Options 1, 2, 4, 5 and 6 are within 80 m of the south-eastern corner of the site	Qualifying interest/Reason for designation: Raised Bog (Annex I Habitat) Other habitats/species of importance: Marsh, Wet Woodland, Humid Grassland, Dry Grassland and Fen Carr. NPWS report that the EU has recommended the site be designated as a cSAC.
Lough Iron	000687	pNHA, SPA, Ramsar Site	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6.[1] (Route Corridor Option 6 is slightly further north than the other options above, being 59m north of Lough Iron pNHA)	Qualifying interest/Reason for designation: Greenland white-fronted geese, whooper swan, wigeon, teal, shoveler, coot, golden plover. Other habitats/species of importance: Lowland wet grassland, Open water, Freshwater marsh, Wet grassland, Wet woodland, Reed swamp, Conifer plantation. Birds Directive species identified at present include kingfisher. Otter, marsh fritillary and Irish damselfly reported to use the site.
Lough Owel	000688	pNHA, cSAC, SPA, Ramsar Site	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6 Route Corridor Option 3 is 529 from the site at its nearest point	Qualifying interest/Reason for designation: Hard water lake, Tullaghan (Alkaline) fen, Transition Mire - all listed on Annex I of Habitats Directive. Birds Directive species known to use the site include shoveler and coot. Other habitats/species of importance: Bunbrosna marsh, Greenland white-fronted geese, kingfisher, diving duck, Charophytes, Round-leaved Wintergreen, otter and white-clawed crayfish are also present.
Lough Sheever Fen Slevin's Lough Complex	000690	pNHA	All Route Corridor Options 1, 2, 3, 4, 5 and 6 are within 275 m of the site	Other habitats/species of importance: This site supports a large population of white-clawed crayfish

Site name	Site code	Status*	Distance from Route Corridor Options	Description and features of conservation interest
Rinn River	000691	NHA	The southern-most section of the site is crossed by Route Corridor Options 1, 2, 3, 4, 5 and 6	Qualifying interest/Reason for designation: Raised Bog (Annex I Habitat) Other habitats/species of importance: Wet grassland, Raised bog (at Bellageeher). Birds Directive species known to use the site include whooper swan, and Greenland white-fronted geese. Site is important for a number of other bird species, with large populations present, and is also an important flight line between other sites including Lough Forbes and Lough Rinn. Whooper swan, wigeon, pochard, lapwing, curlew also present.
Royal Canal	002103	pNHA	Crossed by Route Corridor Option 5.	Other habitats/species of importance: Habitats present include Hedgerow, Tall Herbs, Calcareous Grassland, Reed Fringe, Open Water, scrub and woodland. Opposite-leaved pondweed and otter present. Consultations with NPWS suggest site is of value due to range of habitats/species present.
Scragh Bog	000692	pNHA, cSAC, Statutory Nature Reserve	Route Corridor Option 1 is within 140m of the site Route Corridor Options, 2, 4, 5 and 6 are within 215m. Route Corridor Option 3 is within 15m.	Qualifying interest/Reason for designation: Alkaline Fen, Transition Mire- all listed on Annex I of Habitats Directive. Other habitats/species of importance: Calcareous Fen, Open Carr grading to Ombrotrophic Bog. Also marsh /wet grassland. Slender Cotton-grass and Round-leaved Wintergreen present. A number of protected/important species are present, with brook lamprey, marsh fritillary butterfly (Habitats Directive Annex II), and Irish damselfly identified so far. The site is also known to support valuable invertebrate communities.

*A 'p' or 'c' in front of a designation category indicates that the site is proposed or a candidate for designation, and has not yet been formally identified as a SAC/SPA/NHA. For the purposes of this assessment, these should be treated as if they are fully designated.

[1] These route corridor options partly overlap with the mapped boundaries of the designated sites. However at these locations any new road alignment would remain within the boundary fenceline of the existing N4. Please see Section 4.10.3 for the assessment of the potential significant impacts on these ecological receptors.

Non-designated ecological sites

Valuable habitats within the Study Area are not restricted to the designated sites, and include un-designated raised/degraded bogs and other wetland habitats, rivers and their floodplains, loughs, semi-natural and plantation woodlands, and parkland with veteran trees. During the production of the Constraints Study report, a total of 72 'non-designated sites of ecological importance' were identified within the Study Area. These were identified on the basis of desk study information, a 'windshield survey', consultations with NPWS and the Shannon Regional Fisheries Board, and aerial photography and mapping interpretation. This information has been updated during the preliminary field surveys, and a further five sites were identified during the preliminary field surveys, taking the total number of sites to 77.

The sites within the Zone of Influence have been assessed as being either of County Importance, Local Importance (higher value), or Local Importance (lower value). Where these sites occur within 350m of the proposed Route Corridor Options (i.e. 500m from the corridor centreline), they have been included in the impact assessment. In total, 47 such sites occur within 350m of the proposed Route Corridor Options. These 47 sites are listed in Table 4.10-2. The remaining 30 sites of ecological value within the wider Study Area are presented in Appendix 17 (Volume II).

Table 4.10-2 Non-Designated Ecological Sites within 350m of the route options (47 in total) (Distances measured from edge of route corridor)

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
1	Heathland, bog and marshy grassland at Ballyminion	County Importance	Directly affected by Route Corridor Option 5	Complex area of heathland, acid grassland, bog, marshy grassland and scrub. Potential to support otters, common lizards and badgers. Also supports diverse mire vegetation with abundant Devil's-bit Scabious and Sphagnum mosses, potentially suitable for invertebrates, including marsh fritillary.	North of Royal Canal west of Longford (Cloontirm).
2	Woodland south of Scragh Bog	Local Importance (higher value)	Directly affected by Route Corridor Option 3	Woodland block contiguous with Scragh Bog cSAC / NHA / SNR, may support some species of importance also found at Scragh Bog, including notable plants and invertebrates.	Adjacent to the southern margin of Scragh Bog (Ballynagall).
3	River Brosna woodland / scrub	Local Importance (higher value)	Directly affected by all Route Corridor Options	Mosaic of woodland and scrub around River Brosna.	South-western border of Study Area at southern extent (Robinstown Tyrell).
4	Woodland at southern extent of Study Area.	Local Importance (higher value)	Route Corridor Options 1, 2, 3, 4, 5 and 6 pass within 320m.	Deciduous woodland at the southern extent of the Study Area which may be of some ecological value.	Located along the southern extent of the Study Area (Robinstown Tyrell).
5	Woodland east of Lough Owel	Local Importance (higher value)	Directly affected by all Route Corridor Options	Block of deciduous woodland. Block of broad-leaved mixed woodland with scattered conifers (larch etc) on west facing slope. Low canopy of Sycamore, Beech, Pedunculate Oak and Ash, with a shrub layer of Holly, Hawthorn and Rowan. Sparse ground flora of Bluebell, Wood Anemone, Pignut, Wood Sorrel and ferns. Potentially suitable for red squirrel. Likely to be used by foraging / commuting and possibly roosting bats	East of southern end of Lough Owel (Loughanstown).
6	Farmland east of Ballynafid Lake	Local Importance (higher value)	Route Corridor Option 1 is directly adjacent to the eastern edge of the site	Series of small fields with large, wooded / scrubbed field margins. Hillside covered in a mosaic of dense and scattered scrub, and semi-improved grassland, potentially suitable for common lizard, badgers, birds.	East of existing N4 and Ballynafid Lake and Fen NHA (Rathlevanagh).

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
7	Woodland at Clanhugh Demesne	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6	Plantation woodland with Sycamore, Hazel, Beech, Holly, Oak, Ash, Hazel and Sitka Spruce. Margins of woodland could be used by foraging bats.	Clanhugh Demesne.
8	Woodland and scrub west of Ballynafid Lake and Fen NHA	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6	Woodland and dense / scattered scrub, part of which is contiguous with Ballynafid Lake and Fen. Mixed woodland, including Birch, Conifer and Willow.	Contiguous with western margin of Ballynafid Lake and Fen.
9	Woodland north of Lough Owel	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4 and 5. Route Corridor Option 6 is adjacent to the western edge of the site	Mixed woodland north of Lough Owel, including areas of young plantation. Suitable for red squirrel and nesting raptors. The woodland margins were also suitable for use by foraging bats.	West of Clanhugh Demesne, south of Bunbrosna.
10	Woodland at Culleendarragh and north of Ballynafid Lake and Fen	Local Importance (higher value)	The southern part of the site is directly affected by Route Corridor Option 1. Route Corridor Options 2, 3, 4, 5 and 6 pass within 220m of the site	Block of deciduous woodland and scrub running northwest to southeast across the Study Area. Dominated by Ash, Beech and Sycamore.	At Culleendarragh, north of Ballynafid Lake and Fen NHA (Culleendaragh).
11	Scrub and degraded raised bog at Culleenabohoge	Local Importance (higher value)	Directly affected by Route Corridor Option 3	Western margin of worked (degraded) raised bog. Bog may still support habitats species / of ecological value.	Partially inside eastern margin of Study Area (Culleenabahoge).
12	Leny Fens (A) wetland sites	County Importance	Route Corridor Options 1, 2, 4, 5 and 6pass within 260m. Route Corridor Option 3 passes within 540m.	Wetland area forming part of Leny Fens, identified as valuable by NPWS and public consultation. Small stream flows north, and is presumed to feed into Ecological Site 13, which forms the second part of Leny Fens. Round-leaved Wintergreen recorded as present and wetland habitats are likely to be of high importance.	East of existing N4 corridor NW of Bunbrosna (Leny).
13	Leny Fens (B) Marshy grassland and fen	County Importance	The northern tip of the site is directly affected by Route Corridor Option 3	Species-rich fen, situated in a bowl-like depression forms part of Leny Fens, identified as valuable by NPWS and public consultation.	North of Bunbrosna junction and existing N4 corridor (Knockmorris).

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
14	Damp grassland east of Lough Iron SPA	Local Importance (higher value)	Route Corridor Options 1, 2, 4, 5 and 6 pass within 330m.	Damp grassland with scattered scrub contiguous with Lough Iron SPA. May be used by wintering birds.	South of Ballinallack.
18	River Inny between Lough Derravaragh and Lough Iron	County Importance	Route Corridor Option 3 crosses the river, north of Ballinalack. Route Corridor Options 1, 2, 4, 5 and 6 cross the river, south of Ballinalack.	River Inny and associated floodplain of botanical and fisheries interest. Important flight line for birds, including hen harrier, merlin, Greenland white-fronted geese and other wintering birds. Also, banks are suitable for use by kingfishers. Likely to be used by otters and commuting bats.	Between Lough Derravaragh in NE and Lough Iron in SW.
24	Woodland south-west of Garriskil Bog and west of River Inny	Local Importance (higher value)	Directly affected by Route Corridor Option 3	Recently clear-felled plantation, with some Birch remaining.	Southwestern extent of Study Area adjacent to Garriskil Bog and River Inny (Cappagh).
25	Peat bog workings SW of Garriskil Bog	County Importance	Directly affected by Route Corridor Option 3	Area of peat workings, adjacent to Garriskil Bog. Areas of species-rich neutral grassland and marshy grassland which could support marsh fritillaries.	Southwest edge of Garriskil Bog NHA / SPA / cSAC (Cappagh).
26	Woodland between Garriskil Bog and Lough Garr	Local Importance (higher value)	Directly affected by Route Corridor Option 3	Young mixed plantation woodland with limited potential to support breeding Merlin, and provides habitat links between Garriskil Bog and Lough Garr.	Southern portion between Lough Garr and Garriskil Bog (Cappagh).
27	Field Pond 1	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6 Route Corridor Option 3 passes within 135m of the site	Small man-made pond, possibly containing fish, with fringing grasses and rushes. Sub-optimal for use by breeding newts.	South of Culleen . To west of N4 (Culleenmore).
28	Field pond 2	Local Importance (higher value)	Route Corridor Option 3 passes within 12m of the site	Field pond with small area of scrub around margins. Pond may be of some ecological value, and may require further investigation.	South of Brockagh (Culleenmore).

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
29	Field Pond 3	Local Importance (higher value)	Route Corridor Option 3 passes within 310m of the site	Field pond and small area of rough grassland. Pond may be of some ecological value, and may require further investigation.	South of Brockagh (Culleenmore).
30	Fields north of Inny River at Cappagh	Local Importance (higher value)	Route Corridor Option 3 passes within 310m of the site	Damp grassland / grazing marsh, used by Greenland white-fronted geese and other wintering birds.	Adjacent to the north side of Inny River, south of Cappagh.
31	Woodland, scrub and degraded raised bog north of Lough Iron	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6	Woodland, scrub and degraded raised bog.	Adjacent to north-western margin of Lough Iron SPA / NHA (Joanstown).
36	Scrub / plantation adjacent to Black River	Local Importance (higher value)	Route Corridor Options 1, 2, 4 and 5 pass within 160m Route Corridor Option 6 passes within 41m	Floodplain of Black River, with plantation on east side. Most of the fields have been improved, whilst one large area contains rushes. Likely to be used by foraging bats.	North of Kilmacahill.
40	Degraded Raised bog north of Glen Lough	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6	Degraded Raised bog north of Glen Lough, with strip of Birch and Willow woodland adjacent to improved fields. Dry ditches and boundaries with mature Apple trees. Common frog observed. Woodland edge is likely to be valuable for foraging bats. Japanese Knotweed also recorded along the roadside.	N of Glen Lough, S of existing N4 (Kilsallagh).
41	Raised bog around railway at Windtown North	County Importance	Directly affected by Route Corridor Option 3	Raised bog and young conifer plantation, intersected with drains. Areas of species-poor grassland.	W of Windtown North (Clonwhelan).
43	Possible old peat workings east of Edgeworthstown	Local Importance (higher value)	Directly affected by Route Corridor Option 3	Possible old peat workings, within mosaic of scrub habitats. Degraded bog, and areas of plantation woodland with series of ditches.	East of Edgeworthstown Study Area buffer (Cam).

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
45	Plantation at Lisduff	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6	Plantation with small areas that may be naturally regenerating woodland. Areas of recently felled and planted woodland. Area crossed by ditches suitable for use by commuting otters.	South of railway SW of Edgeworthstown (Lisduff).
46	Plantation, raised bog and regenerating scrub / woodland	Local Importance (higher value)	Route Corridor Option 3 passes within 107m.	Worked bog and plantation with scrub around margins of site.	North of Edgeworthstown west of N5 (Brackloon).
50	Raised Bog with scattered scrub at Cartronawar	Local Importance (higher value)	Directly affected by Route Corridor Option 5	Degraded raised bog. Area of species-poor, marshy grassland with dense and scattered scrub, potentially suitable for badgers, common lizards and birds.	NE of Derrymore Bog (Cartronawar).
51	Scrub / woodland & small raised bog	County Importance	Directly affected by Route Corridor Options 1 and 4	Mosaic of woodland and scrub with a small area of raised bog. Area of mixed broadleaved woodland supporting young Ash, Willow and Hawthorn. Woodland margins likely to be used by foraging bats.	S of Lisnanagh, N of existing N4 (Lisanagh).
54	Blocks of managed woodland E of Carrickglass Demesne	County Importance	Directly affected by Route Corridor Option 4 and Route Corridor Options 1 and 3 (southern-most tip of the site only)	Several blocks of mixed plantation woodland. May support roosting bats, red squirrel and pine marten.	East of Carrickglass Demesne to Dumnacros at eastern extent of Study Area (Ballygarve/Kilmoyle).
55	Parkland west of Carrickglass Demesne	Local Importance (higher value)	Route Corridor Option 4 passes within 760m of the site.	Area appears similar to Carrickglass Demesne pNHA. Veteran trees may support invertebrates, and could be used by roosting bats.	Between River Camlin and Carrickglass Demesne.
57	Camlin River west of Longford	National Importance	Route Corridor Option 5 crosses the river.	River Camlin and associated floodplain. Fisheries value, flight line and foraging for Annex 1 bird species including hen harrier, merlin and Greenland white-fronted geese. Suitable for use by commuting otters (and potential holt sites), and commuting bats.	Runs from Longford to W extent of Study Area (Mullagh).

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
58	Camlin River east of Longford	National Importance	Route Corridor Options 1, 2, 3, 4 and 6 cross the river.	River Camlin and associated floodplains. Slow flowing, clear and very good quality river flowing over deep gravel beds. Abundant aquatic vegetation. Fisheries value, flight line and foraging for Annex 1 bird species including hen harrier, merlin and Greenland white-fronted geese. Suitable for use by commuting otters and bats. Known to support white-clawed crayfish.	Runs from Longford to eastern extent of floodplain.
60	Woodland / scrub at Kiltyreher	Local Importance (higher value)	North-western edge directly affected by Route Corridor Option 4	Woodland and scrub mosaic near to the River Camlin. Recently planted Alder woodland.	Kiltyreher, along northern edge of River Camlin.
61	Raised bog & scrub at Drumure	County Importance	Route Corridor Option 4 passes within 182m.	Raised bog & encroaching scrub.	Drumure, north of Knockloughlin.
62	Woodland east of Cloonbolt	Local Importance (higher value)	Directly affected by Route Corridor Option 2 Route Corridor Options 1, 3 and 6 pass within 50m of the site	Block of woodland (possibly plantation).	East of Cloonbalt, north of Longford.
65	Woodland at Deerpark	County Importance	Directly affected by Route Corridor Options 1, 4 and 5 Route Corridor Options 2, 3 and 6 pass within 64m of the site	Mature deciduous woodland, with Ash, Sycamore and Willow, with some areas of conifers. Likely to be of botanical / invertebrate interest, and may support roosting bats, pine marten and red squirrel.	Northeast of Newtown Forbes (Deerpark).
66	Woodland / scrub near Creenagh	Local Importance (higher value)	Directly affected by Route Corridor Options 2, 3 and 6	Large woodland block surrounded by a series of semi-improved and marshy grassland fields; crossed by hedgerows and small ditches. Block of Silver Birch woodland. Canopy comprises pure birch with a sparse understory of holly. Ground flora dominated by Bramble, with Broad-buckler ferns and bryophytes. Likely to support bats and badgers.	Southwest of Creenagh.

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
69	Woodland southeast of Rinn River NHA	Local Importance (higher value)	Directly affected by Route Corridor Options 1, 2, 3, 4, 5 and 6	Ash-dominated woodland with Willow-dominated understory, bisected by drains and wet woodland. Potential for use by commuting otters and foraging bats.	Adjacent to the southeastern margin of Rinn River NHA (Kilmacannon).
70	Woodland between Rinn River and Lough Forbes	County Importance	Directly affected by Route Corridor Options 1, 2, 3, 4, 5 and 6	Mixed wet woodland (dominated by Oak, Ash with Willow and Hawthorn) with a dense understory, which provides additional linkages between the Rinn River NHA and Lough Forbes. The woodland is transected by the existing N4 corridor and bisected by drains. Potential for use by commuting otters and foraging bats.	South of existing N4, northwest of Lough Forbes (Clooniher).
73	River Riffey	County Importance	Route Corridor Option 3 crosses the river twice.	River suitable for use by otters, white-clawed crayfish and foraging bats.	East of Edgeworthstown.
74	Grassland/ disused quarry north of Lough Owel	County Importance	Directly affected by Route Corridor Options 1, 2, 4, 5 and 6	Species-rich semi-improved neutral grassland and adjacent quarry with nesting kestrel, potentially suitable for peregrine and roosting bats. Species-rich rough grassland around quarry edges, potentially suitable for common lizard.	North of Lough Owel (and north of Ecological Site 5) (Loughanstown).
75	Black River	County Importance	Route Corridor Option 3 crosses the river. Route Corridor Options 1, 2, 4, 5 and 6 cross the river.	River consisting of watercourse with stony substrate. Suitable for white-clawed crayfish and otter and supports populations of salmonid and cyprinid .	West of Edgeworthstown flowing south-east towards Lough Glen.
76	Species-rich marshy grassland	County Importance	The northern tip of the site is adjacent to Route Corridor Option 2 The southern edge of the site is adjacent to Route Corridor Option 5	Marshy grassland in these fields was botanically diverse in places. It should be noted that management of many of the fields in this area appeared similar, and that other areas of valuable species-rich grassland may therefore be present between approximately nodes 08 and 11.	Between railway line and existing N4 at Freehalman (Cooleeny).

No.	Site	Provisional Scale of Importance	Distance from Route Sections	Description and features of potential ecological interest	Location (Townland)
77	Concrete-lined reservoir	Local Importance (higher value)	Route Corridor Option 2 passes within 11m of the site	Small man-made reservoir situated immediately south of the existing N4. May be valuable for charophytes and other aquatic flora. Suitable for use by otters, breeding amphibians, kingfisher. Fish noted as present.	South of the existing N4 at Freehalman (Lisfarrell).

Peat Bogs

Ireland contains approximately 60 per cent of the world's known peat bogs, and this habitat type is therefore considered to be of particular nature conservation importance. A number of peat bogs and fens within and adjacent to the Study Area are designated sites (see Table 4.10-1 and Appendix 15 for more information). Peat bog and fen habitats are also present outside the designated sites, and should generally be considered to be of County Importance, despite many being degraded as a result of former extraction or aforestation operations. Some of these sites may support Annex I habitat types, however the majority of the sites visited during the field surveys were degraded to varying degrees due to peat cutting, afforestation and artificial drainage practices. In the majority of cases the alignment of the Route Corridor Options takes these sites into account and the sites have been avoided wherever possible. A number of these areas are holdings of Bord na Móna, (identified on Drawing No 3.2 of the Constraints Study Report). Other smaller areas of peat bog/fen have been identified during aerial photography interpretation, the roadside windshield survey and preliminary survey of the Study Area, and have been identified as non-designated ecologically valuable sites, as shown in Table 4.10.2 and on RFig 4.10.1 to RFig 4.10.8. Where these are degraded or extensively cutover bogs, they are considered to be of Local Importance (higher value).

Aquatic Environment and Fisheries

A number of rivers and lakes/loughs are present within the Study Area, as shown on RFig 4.9.1 to RFig 4.9.8 and RFig 4.10.1 to RFig 4.10.8. The majority of loughs are found in the south-eastern part of the Study Area. The main rivers in the Study Area are the Rivers Camlin and Inny, situated to the west and east of Edgeworthstown respectively, and the River Rinn in the north of the Study Area. The Study Area lies entirely within Hydrometric Area 26 (Shannon Upper). The River Shannon passes adjacent to the north-western limits of the Study Area. These rivers are important fisheries for salmonids (including salmon and brown trout), coarse fish species, and other species such as lamprey, along with white-clawed crayfish and otter. Again, where the potential exists for these to be affected by any of the Route Corridor Options, preliminary site visits have been undertaken during the field surveys. These visits have been used to inform an assessment of potential direct and indirect impacts on these sites. The potential for ecological impacts on watercourses has been assessed for those rivers surveyed during the initial multidisciplinary ecological

surveys and/or those of notable fisheries value, as identified through consultations with the Shannon Regional Fisheries Board. In addition, the potential for direct and indirect impacts on lakes and loughs within the route corridor has also been assessed.

Rare and/or Protected Species

A number of rare and protected species are present within the Study Area, including species protected under international and national legislation, or referenced in Irish policies and plans pertaining to biodiversity. Broad information on the species identified as being of potential concern within the Study Area is presented in Appendix 18 (protected fauna), Appendix 19 identifies fisheries information relevant to the Scheme, Appendix 20 (bird species of conservation concern), whilst Appendix 21 contains information on the rare and protected plant species known to occur within the Study Area. These appendices are all located within Volume II.

Of the species listed in Appendix 18, particular consideration will need to be given to the avoidance of impacts on habitats known to support European protected species, such as otters and bats, which are included under Schedule 1, Part 1 of the Habitat Regulations (1997). Consideration will also need to be given to avoiding impacts wherever possible on those species afforded protection at a national level, such as badger and red squirrel, and impacts on other species of conservation concern should also be minimised as far as possible.

Derogation licences under both the Wildlife Act (1976, as amended) and the Habitats Regulations (1997, as amended) may be required where activities associated with the construction of the proposed Scheme would impact upon protected species. Applications for these licences would be preceded by the further detailed surveys to be undertaken to inform the EIS as well as any necessary pre-construction surveys in order to gather sufficiently robust survey information to underpin the derogation licence applications. Such surveys will be undertaken in accordance with the recommendations set out in the National Roads Authority (NRA) Environmental Assessment and Construction Guidelines series, as well as the Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA 2009) where guidance relating to those species exists.

Fisheries

Several watercourses and lakes within or adjacent to the Study Area have been identified as being of fisheries value, because they support stocks of commercially viable game species and/or species of conservation importance. There is some overlap between these two, with Atlantic salmon, for example, being both a commercially fished species, and protected under the Habitats Regulations (1997). Fish species that are considered to be of particular conservation importance, most of which are not commercially fished, are included in Appendix 19. This table includes details of the main watercourses and lakes considered to be of fisheries value within the Study Area. Information on these has been obtained through consultation with both the Shannon Regional Fisheries Board and the Central Fisheries Board, and updated, where appropriate, following ecological surveys.

Rare and Protected Flora

Protected/rare species of plants are also known to be present within the Study Area. It is likely that some species will be present outside of designated sites and appropriate botanical surveys during the later stages of the project (at EIS stage) will further inform knowledge of their distribution. Appendix 21 details the information that has been collected so far. Many of the species identified in Appendix 21 are species commonly associated with wetlands, and further botanical surveys may be required at EIS stage of lakes, ponds and rivers, raised bogs, bog woodland, wet woodland, fen carr, damp grassland and callows habitats.

4.10.3 Route Option Appraisal

As described in Section 3.4 of this report, six route options have been considered in this study. The Route Corridor Options were compiled from a subset of route sections identified during the early stages of the Route Selection process. Based on the numerous subsets of route sections identified at the scoping and constraints study stage, six Route Corridor Options have been identified.

The assessment of ecological impacts of each of the route options is presented below. RFig 4.10.1 to 4.10.8 show the locations of internationally and nationally designated sites, and the locations of non-designated ecologically valuable sites, in relation to the proposed route options.

Information on each Route Corridor Option is presented below. Text describing the key ecological characteristics of each route option is provided, along with a summary table which details the likely ecological impacts associated with the option. In addition, recommendations are made where minor modifications in the route alignment would further minimise impacts on sites of ecological value, or where particular mitigation will be required to avoid or minimise hydrological impacts on sensitive sites. The severity of impacts has been calculated assuming that best-practice environmental design and management will be used in the construction of the road, but does not consider any further reductions in the scale of impact that may be achieved by mitigation designed during the later stages of the project. This is in accordance with the NRA Guidelines for Ecological Impact Assessment (2009), which state that "…however, for impact assessment purposes the 'unmitigated project' should include those measures where delivery is unequivocal and success is highly likely. Where more uncertainty exists, the measures should be assessed as 'mitigation'".

In order to minimise impacts upon ecological receptors, particularly European sites, the do-minimum and do-nothing scenarios have been given due consideration. Where improvement to the existing N4 is feasible, an online route has been used.

Route Corridor Option 1

A full description of the alignment of this Route Corridor Option can be found in Section 3.4 of this report. The table below summarises the sites of ecological interest affected by this route corridor option.

Table 4.10-3 Route Corridor Option 1

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 01 and 03A			
Aghnamona Bog NHA 000422	Active raised bog with birch woodland and Purple Moor-grass.	National Importance	Not Significant. Between Nodes 01 and 02 the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Clooneen Bog – pNHA and cSAC 000445	Raised bog with bog woodland and important wet grassland.	International Importance	Not Significant. At this location the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Rinn River – NHA 000691	Wet grassland, Raised / degraded bog, callows grassland. Birds Directive Annex I species known to use the site include whooper swan, and Greenland white-fronted geese.	National Importance	Impacts at a National Level are not anticipated; however, significant impacts may occur at the Local Level. An alignment within the Route Corridor at this location would be built as close to the northern edge of the existing N4 as possible, in order to minimise impacts on the site while at the same time avoiding impacts on the Natura 2000 sites to the south.
Lough Forbes Complex – pNHA and cSAC 001818	An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Raised bogs, Callow grasslands, Reed swamps and Freshwater marshes.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballykenny-Fishertown Bog – SPA 004101	Raised bog to Callow grasslands, also a small band of deciduous bog woodland. Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted geese. Pine marten, badger and bat.	International Importance	Not significant. Although impacts at a local level could occur due to disturbance of important bird species during the construction phase, given that the works would be situated adjacent to the existing N4, these impacts are not anticipated to be significant.
Ecological Site 70	Mixed deciduous and wet woodland and carr, grading into margins of adjacent Lough Forbes designated site. Suitable for bats, red squirrel and newts. Channels suitable for otters.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Between Nodes 03A and 06			
Ecological Site 65	Woodland at Deerpark. May support roosting bats, pine marten and red squirrel.	County Importance	Impacts at a County Level are not anticipated; however, significant impacts may occur at the Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 06 and 07			
Ecological Site 54	Blocks of mixed plantation woodland east of Carrickglass Demense. Suitable for pine marten and red squirrel.	County Importance	Not Significant. The route is anticipated to pass to the south of the site.
Ecological Site 58	Camlin River (east of Longford) and associated floodplain. White-clawed crayfish and lamprey (both listed as Annex II species on the EU Habitats Directive). Important for fisheries (wild brown trout). Camlin River constitutes a vital migration route to adult spawning grounds and for juvenile fish	National Importance	Significant impacts will be avoided by the use of a wide span crossing.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
	migrating between the Camlin River and Lough Ree. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.		
Between Nodes 07 and 14			
Ecological Site 51	Mosaic of woodland and scrub with a small area of raised bog.	County Importance	Approximately half of the site is located within the route corridor. Potential exists for Significant impacts at a County level. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Ecological Site 45	Plantation at Lisduff. Areas of recently felled and planted woodland. Area crossed by ditches suitable for use by commuting otters.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 14 and 17A			
Ecological Site 75	Black River south of Edgeworthstown, between Node 14A and 16. River suitable for white-clawed crayfish, otter and salmonids.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 40	Degraded raised bog north of Glen Lough	Local Importance (higher value)	Not Signifcant. The route is anticipated to pass to the north of the site.
Between Nodes 17A and 19			
Ecological Site 31	Woodland, scrub and degraded raised bog north of Lough Iron	Local Importance (higher value)	Not Signifianct. The route is anticipated to pass to the north of the site.
Ecological Site 18	River Inny between Lough Derravaragh and Lough Iron. Important fisheries interest. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Lough Iron – SPA, pNHA and Ramsar Site 000687	Open water, freshwater marsh, wet grassland, wet woodland, reed swamp and conifer plantation. Birds Directive Annex I species include Greenland white-fronted geese, whooper swan and kingfisher. Otter, marsh fritillary and Irish damselfly.	International Importance	There will be no impacts at International or National level. A route here would be aligned to the north within the corridor in order to avoid impacts on the SPA. However, the potential exists for impacts on geese feeding in fields to the north of the site. These impacts may be Significant at either a County or Local Level; this will be determined during more detailed surveys and assement to be undertaken during the next stages of the project. [NPWS has expressed a preference for the route to be moved as far north as possible to reduce ecological impacts, and this has been incorporated into the design as far as other constraints will allow.]
Between Nodes 19 and 21			
Ecological Site 8	Woodland and scrub west of Ballynafid Lake and Fen NHA.	Local Importance (higher value)	Not significant. The road would be built within the land-take area of the existing N4. While this is within the mapped boundary of the ecological site, and includes the grassland strip on either side of the existing road, there are no qualifying features within the road footprint.
Ecological Site 10	Woodland at Culleendarragh. Dominated by Ash, Beech and Sycamore. North of Ballynafid Lake and Fen NHA.	Local Importance (higher value)	Not significant. The road would be built within the land-take of the existing N4. Although this is within the mapped boundary of the ecological site, the new road would be constructed within a species poor grassland strip on either side of the existing road, there would therefore be no features of the ecological receptor within the road footprint.
Ballynafid Lake and Fen pNHA 000673	Open water, reed swamp, freshwater marsh, calcareous fen and woodland. Also known to support particularly diverse invertebrate communities.	National Importance	Not significant. The road would be built within the land-take of the existing N4, within a species-poor grassland strip on either side of the existing road. There are therefore no qualifying features within the proposed road footprint, and direct impacts are therefore avoided. The use of good practice drainage design, including attenuation and treatment facilities, would minimise the risk of significant pollution events during operation, although the potential for some impacts during construction remains. . [NPWS has indicated a preference for the road to be aligned to the south of Ballynafid Lake and Fen (Route Corridor Options 2, 4, 5 and

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
			6) rather than to the north, as is proposed in this Route Corridor Option.]
Scragh Bog – pNHA, cSAC and Statutory Nature Reserve 000692	Calcareous fen, transition mire, open carr grading to ombrotrophic bog. Also marshy/ wet grassland known to support marsh fritillaries and Irish Damselfly, and other invertebrate communities of conservation interest.	International Importance	Not significant. The on-line widening associated with this Route Corridor Option is not anticipated to lead to any hydrological impacts on the site, due to the topography/hydrology of the area and the distance of Scragh Bog from the road. No significant impacts on the site are therefore anticipated.
Ecological Site 74	Grassland/ disused quarry north of Lough Owel. Species-rich semi-improved grassland and adjacent disused quarry, north of Lough Owel, potentially suitable for roosting bats, lizards and birds.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 5	Woodland east of Lough Owel	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the site.
Between Nodes 21 and 22			
Lough Owel – pNHA, cSAC, SPA, and Ramsar Site 000688	Hard water lake, Tullaghan fen, Bunbrosna marsh. Birds Directive Annex I species include Greenland white-fronted geese and kingfisher. Lough also known to be used by otters and supports white-clawed crayfish, Scharff's char and River Lamprey.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 3	River Bronsa woodland / scrub	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the site.

Summary of impacts for Route Corridor Option 1				
Significant at the International Level	Significant at the National Level	Significant at the County Level	Significant at the Local Level	Not Significant
0	**0**	**2**	**3**	**19**

Ecological Considerations

- Improvements to the N4 have already been undertaken as part of the Dromod-Roosky Scheme tie-in between Nodes 1 and 2 (affecting Clooneen Bog pNHA/cSAC and Aghnamona Bog NHA). Although this is within the mapped boundary of the designated site, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. No qualifying interests are present within the road footprint and therefore there would be no impacts on the qualifying features or integrity of this site.

- Alternative alignments of the route in the vicinity of Clooneen Bog pNHA/cSAC have been critically examined in order to minimise impacts as far as possible. The new road would be located within the existing N4 boundary fences and this would avoid affecting qualifying features for which the site is designated.
- Land-take would be minimised within the Rinn River NHA. The crossing footprint of the road at this location would also be minimised. Potential impacts to be reduced by the use of a wide-span structure (around Node 2A). This would also help to ensure that existing flight lines are maintained. The Rinn River crossing constitutes an important flight line for birds, as identified during consultations with NPWS. Further surveys for commuting birds, focussing particularly on Greenland white-fronted goose, whooper swan, and hen harrier will be necessary to inform targeted mitigation in order to reduce any potential impacts.
- Between Nodes 2A and 3A a route would be chosen that avoids any significant impacts on Lough Forbes Complex cSAC/pNHA/Ballykenny-Fishertown Bog SPA.
- Alternative route alignments within the Route Corridor in the vicinity of Lough Iron have been critically examined, and the route would be aligned as far north as possible to avoid impacts on the SPA. Consultations with NPWS have confirmed that this area is of particular importance to the population of Greenland white-fronted geese that are known to overwinter in the area. The potential exists for impacts on geese feeding in fields to the north of the site. These impacts are likely to be at county or local level, however this impact assessment will be further informed by surveys at later stages of the project as part of the iterative assessment process.
- The footprint of works within the mapped designated area boundaries of Lough Owel NHA, cSAC, SPA would be reduced as much as possible. The proposed on-line widening to the east of Lough Owel is located within the boundary of the NHA/cSAC/SPA, however, this boundary includes the existing N4. The existing N4 boundary will not be extended within the designated area, therefore impacts on the qualifying features and integrity of this designated site would be avoided.
- The road would be built within the land-take of the existing N4 at Ballynafid Lake and Fen pNHA. While this is within the mapped boundary of the designated site, and includes the grassland strip (of negligible nature conservation value) on either side of the existing road, there are no qualifying

features of the pNHA within the proposed road footprint. The footprint of works would be reduced as much as possible during construction to avoid direct impacts.

- Potential hydrological impacts on bogs and other wetland habitats will be minimised using appropriate construction techniques and drainage design. These bogs and wetland habitats include: Aghnamona Bog NHA, Clooneen Bog NHA cSAC, Ballykenny Fishertown Bog SPA, Lough Forbes Complex pNHA cSAC, Ballynafid Lake and Fen pNHA, Lough Iron NHA SPA and Lough Owel NHA cSAC SPA and Scragh Bog pNHA cSAC and Ecological Site 51 (County Importance).
- Hydrological impacts on wet woodland (Ecological Site 70 (County Importance)) will be minimised through the use of appropriate construction techniques and drainage design
- The on-line widening associated with this Route Corridor Option is not anticipated to lead to any hydrological impacts on Scragh Bog pNHA, CSAC and SNR, due to the topography/hydrology of the area and the distance of Scragh Bog from the road.
- The footprint of the road at the crossings of the Camlin River (between Nodes 6 and 7), Black River (between Nodes 14A and 16), River Inny (between Nodes 17A and 19) would be minimised. Potential impacts would be reduced by the use of wide-span structures, and this would also help to ensure that existing flight lines are maintained.
- The footprint of the road in vicinity of Ecological Site 65 (County Importance) would be minimised.
- The footprint of on-line widening in the vicinity of Ecological Sites 74 and 54 (County Importance) and Ecological Sites 3, 5, 8 and 10 (Local Importance (higher value)) would be minimised.

Route Corridor Option 2

A full description of the alignment of Route Corridor Option 2 can be found in Section 3.4. The table below summarises the sites of ecological interest affected by this route corridor option.

Table 4.10-4 Route Corridor Option 2

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 01 and 03A			
Aghnamona Bog NHA 000422	Active raised bog with birch woodland and Purple Moor-grass.	National Importance	Not Significant. Between Nodes 01 and 02 the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Clooneen Bog – pNHA and cSAC 000445	Raised bog with bog woodland and important wet grassland.	International Importance	Not Significant. At this location the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Rinn River – NHA 000691	Wet grassland, Raised / degraded bog, callows grassland. Birds Directive Annex I species known to use the site include whooper swan, and Greenland white-fronted geese.	National Importance	Impacts at a National Level are not anticipated; however, significant impacts may occur at the Local Level. An alignment within the Route Corridor at this location would be built as close to the northern edge of the existing N4 as possible, in order to minimise impacts on the site while at the same time avoiding impacts on the Natura 2000 sites to the south.
Lough Forbes Complex – pNHA and cSAC 001818	An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Raised bogs, Callow grasslands, Reed swamps and Freshwater marshes.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ballykenny-Fishertown Bog – SPA 004101	Raised bog to Callow grasslands, also a small band of deciduous bog woodland. Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted geese. Pine marten, badger and bat.	International Importance	Not significant. Although impacts at a local level could occur due to disturbance of important bird species during the construction phase, given that the works would be situated adjacent to the existing N4, these impacts are not anticipated to be significant.
Ecological Site 70	Mixed deciduous and wet woodland and carr, grading into margins of adjacent Lough Forbes designated site. Suitable for bats, red squirrel and newts. Channels suitable for otters.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Nodes 03A and 06			
Ecological Site 66	Woodland/scrub near Creenagh. Large woodland block surrounded by a series of semi-improved and marshy grassland fields; crossed by hedgerows and small ditches.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 06 and 08			
Ecological Site 58 - Camlin River	Camlin River (east of Longford) and associated floodplain. White-clawed crayfish and lamprey (both listed as Annex II species on the EU Habitats Directive) Important for fisheries (wild brown trout). Camlin River constitutes a vital migration route to adult spawning grounds and for juvenile fish migrating between the Camlin River and Lough Ree. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	National Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 62	Woodland east of Cloonbolt.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that more than a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 08 and 14			
Ecological Site 45	Plantation at Lisduff. Areas of recently felled and planted woodland. Area crossed by ditches suitable for use by commuting otters.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 14 and 17A			
Ecological Site 75	Black River south of Edgeworthstown, between Node 14A and 16. River suitable for white-clawed crayfish, otter and salmonids.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 40	Degraded raised bog north of Glen Lough	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Between Nodes 17A and 19			
Ecological Site 31	Woodland, scrub and degraded raised bog north of Lough Iron	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Lough Iron – SPA, pNHA and Ramsar Site 000687	Open water, freshwater marsh, wet grassland, wet woodland, reed swamp and conifer plantation. Birds Directive Annex I species include Greenland white-fronted geese, whooper swan and kingfisher. Otter, marsh fritillary and Irish damselfly.	International Importance	There will be no impacts at International or National level. A route here would be aligned to the north within the corridor in order to avoid impacts on the SPA. However, the potential exists for impacts on geese feeding in fields to the north of the site. These impacts may be Significant at either a County or Local Level; this will be determined during more detailed surveys and assement to be undertaken during the next stages of the project. [NPWS has expressed a preference for the route to be moved as far north as possible to reduce ecological impacts, and this has been incorporated into the design as far as other constraints will allow.]
Ecological Site 18	River Inny between Lough Derravaragh and Lough Iron. Important fisheries interest. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 19 and 21			
Ecological Site 74	Grassland/ disused quarry north of Lough Owel. Species-rich semi-improved neutral grassland and adjacent quarry with nesting kestrel, potentially suitable for peregrine and roosting bats. Species-rich rough grassland around quarry edges.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballynafid Lake and Fen pNHA 000673	Open water, reed swamp, freshwater marsh, calcareous fen and woodland. Also known to support particularly diverse invertebrate communities.	National Importance	Not significant. The Route Corridor Option would pass south of the site and the final alignment of the road within the route corridor would be aligned as far south as possible so as to minimise impacts upon this site. [NPWS has indicated a preference for the road to be aligned to the south of Ballynafid Lake and Fen as is proposed in this Route Corridor Option.]
Scragh Bog –pNHA, cSAC and Statutory Nature Reserve 000692	Calcareous fen, transition mire, open carr grading to ombrotrophic bog. Also marshy/ wet grassland known to support marsh fritillaries and Irish Damselfly, and other invertebrate communities of conservation interest.	International Importance	Not significant. The on-line widening associated with this Route Corridor Option is not anticipated to lead to any hydrological impacts on the site, due to the topography/hydrology of the area and the distance of Scragh Bog from the road. No significant impacts on the site are therefore anticipated.
Ecological Site 8	Woodland and scrub west of Ballynafid Lake and Fen NHA	Local Importance (higher value)	Not significant. The route is anticipated to pass to the south of the Site.
Ecological Site 7	Woodland at Clanhugh Demense. Mixed plantation woodland. Margins of woodland could be used by foraging bats.	Local Importance (higher value)	Not significant. The road alignment within the route corridor would be located north of the existing railway and would not impact on the site.
Ecological Site 5	Woodland east of Lough Owel. Block of broad-leaved mixed woodland. Potentially suitable for red squirrel. Likely to be used by foraging/ commuting and possibly roosting bats.	Local Importance (higher value)	Not significant. The road alignment within the route corridor would pass to the north of the site.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact	
Between Nodes 21 and 22				
Lough Owel – pNHA, cSAC, SPA, and Ramsar Site 000688	Hard water lake, Tullaghan fen, Bunbrosna marsh. Birds Directive Annex I species include Greenland white-fronted geese and kingfisher. Lough also known to be used by otters and supports white-clawed crayfish, Scharff's char and River Lamprey.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.	
Ecological Site 3	River Bronsa woodland / scrub	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.	
Summary of impacts for Route Corridor Option 2				
Significant at the International Level	Significant at the National	Significant at the County Level	Significant at the Local Level	Not Significant
0	**0**	**1**	**4**	**18**

Ecological Considerations

- Improvements to the N4 have already been undertaken as part of the Dromod-Roosky Scheme tie-in between Nodes 1 and 2 (affecting Clooneen Bog pNHA/cSAC and Aghnamona Bog NHA). Although this is within the mapped boundary of the designated site, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. No qualifying interests are anticipated to be present within the road footprint and therefore there would be no impacts on the qualifying features or integrity of this site.
- Alternative alignments of the route in the vicinity of Clooneen Bog pNHA/cSAC have been critically examined in order to minimise impacts as far as possible. The new road would be located within the existing N4 boundary fences and this would avoid affecting qualifying features for which the site is designated.
- Land-take would be minimised within the Rinn River NHA. The crossing footprint of the road over the Rinn River at this location would also be minimised. Potential impacts to be reduced by the use of a wide-span structure (around Node 2A). This would also help to ensure that existing flight lines are maintained. The Rinn River constitutes an important flight line for birds, as identified during consultations with NPWS. Further surveys for commuting birds, focussing particularly on Greenland white-fronted goose, whooper swan, and hen harrier will be necessary to inform targeted mitigation in order to reduce any potential impacts.

- Between Nodes 2A and 3A a route would be chosen that avoids any significant impacts on Lough Forbes Complex cSAC/pNHA/Ballykenny-Fishertown Bog SPA.
- Potential hydrological impacts on bogs and other wetland habitats will be minimised using appropriate construction techniques and drainage design. These bogs and other wetland habitats include: Aghnamona Bog NHA, Clooneen Bog NHA cSAC, Ballykenny Fishertown Bog SPA, Lough Forbes Complex pNHA cSAC, Ballynafid Lake and Fen pNHA, Lough Iron NHA SPA and Lough Owel NHA cSAC SPA and Scragh Bog pNHA cSAC and Ecological Site 51 (County Importance)).
- Hydrological impacts on wet woodland (Ecological Site 70 (County Importance)) will be minimised through the use of appropriate construction techniques and drainage design
- The footprint of the road at the crossings of the Camlin River (between Nodes 6 and 7), Black River (between Nodes 14A and 16), River Inny (between Nodes 17A and 19) would be minimised. Potential impacts would be reduced by the use of wide-span structures, and this would also help to ensure that existing flight lines are maintained.
- Alternative route alignments within the Route Corridor in the vicinity of Lough Iron have been critically examined, and the route would be aligned as far north as possible to avoid impacts on the SPA. Consultations with NPWS have confirmed that this area is of particular importance to the population of Greenland white-fronted geese that are known to overwinter in the area. The potential exists for impacts on geese feeding in fields to the north of the site. These impacts are likely to be at county or local level, however this impact assessment will be further informed by surveys at later stages of the project.
- The footprint of works within the mapped designated area boundaries of Lough Owel NHA, cSAC, SPA would be reduced as much as possible. The proposed on-line widening to the east of Lough Owel is located within the boundary of the NHA/cSAC/SPA, however, this boundary includes the existing N4. The existing N4 boundary will not be extended within the designated area, therefore impacts on the qualifying features and integrity of this designated site would be avoided.
- The footprint of on-line widening in the vicinity of Ecological Site 74 (County Importance) and Ecological Sites 69, 40, 9, 7, 5 and 3 (Local Importance (higher value) will be minimised.

Route Corridor Option 3

A full description of the alignment of this Route Corridor Option 3 can be found in Section 3.4. The table below summarises the sites of ecological interest affected by this route corridor option.

Table 4.10-5 Route Corridor Option 3

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 01 and 03A			
Aghnamona Bog NHA 000422	Active raised bog with birch woodland and Purple Moor-grass.	National Importance	Not Significant. Between Nodes 01 and 02 the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Clooneen Bog – pNHA and cSAC 000445	Raised bog with bog woodland and important wet grassland.	International Importance	Not Significant. At this location the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Rinn River – NHA 000691	Wet grassland, Raised / degraded bog, callows grassland. Birds Directive Annex I species known to use the site include whooper swan, and Greenland white-fronted geese.	National Importance	Impacts at a National Level are not anticipated; however, significant impacts may occur at the Local Level. An alignment within the Route Corridor at this location would be built as close to the northern edge of the existing N4 as possible, in order to minimise impacts on the site while at the same time avoiding impacts on the Natura 2000 sites to the south.
Lough Forbes Complex – pNHA and cSAC 001818	An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Raised bogs, Callow grasslands, Reed swamps and Freshwater marshes.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballykenny-Fishertown Bog – SPA 004101	Raised bog to Callow grasslands, also a small band of deciduous bog woodland. Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted geese. Pine marten, badger and bat.	International Importance	Not significant. Although impacts at a local level could occur due to disturbance of important bird species during the construction phase, given that the works would be situated adjacent to the existing N4, these impacts are not anticipated to be significant.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 70	Mixed deciduous and wet woodland and carr, grading into margins of adjacent Lough Forbes designated site. Suitable for bats, red squirrel and newts. Channels suitable for otters.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Nodes 03A and 06			
Ecological Site 66	Woodland/scrub near Creenagh. Large woodland block surrounded by a series of semi-improved and marshy grassland fields; crossed by hedgerows and small ditches.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 06 and 07			
Ecological Site 58-Camlin River	Camlin River (east of Longford) and associated floodplain. White-clawed crayfish and lamprey (both listed as Annex II species on the EU Habitats Directive) Important for fisheries (wild brown trout). Camlin River constitutes a vital migration route to adult spawning grounds and for juvenile fish migrating between the Camlin River and Lough Ree. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	National Importance	Significant impacts will be avoided by the use of a wide span crossing.
Between Nodes 07 and 10.			
Ecological Site 54	Blocks of mixed plantation woodland east of Carrickglass Demense. Suitable for pine marten and red squirrel.	County Importance	Not Significant. The route is anticipated to pass south of the Site.
Between Nodes 10 and 13A			
Ecological Site 75	Black River north-west of Edgeworthstown, between Node 10 and 13A. River suitable for white-clawed crayfish, otter and salmonids.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Between Nodes 13A and 18B			
Ecological Site 43	Degraded bog, and areas of plantation woodland with series of ditches.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that more than half of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 13	Species-rich fen, situated in a bowl-like depression forms part of Leny Fens, identified as valuable by NPWS and public consultation.	County Importance	Significant impacts at County level may occur at this site, due to the hydrologically sensitive nature of the site.
Ecological Site 73	River Riffey two crossings between Node 13A and 18B. River suitable for use by otters, white-clawed crayfish and foraging bats.	County Importance	Significant impacts will be avoided by the use of wide span crossings.
Ecological Site 41	Raised bog around railway at Windtown North. Young conifer plantation, intersected with drains. Areas of species-poor grassland.	County Importance	The potential exists for a Significant impact at the County Level, given that up to a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Ecological Site 18	River Inny between Lough Derravaragh and Lough Iron. Important fisheries interest. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 26	Recently planted conifer woodland between Garriskil Bog and Lough Garr, although a known merlin breeding site, the woodland currently appeared to have only limited potential to support raptors.	Local Importance (higher value)	Significant impacts at Local Level may occur at this site, due to the hydrologically sensitive nature of the site.
Ecological Site 25	Peat bog workings SW of Garriskil Bog. Areas of species-rich semi-improved grassland, could support marsh fritillaries.	County Importance	Significant impacts at County Level may occur at this site, due to the hydrologically sensitive nature of the site.
Ecological Site 24	Woodland south-west of Garriskil Bog and west of River Inny	Local Importance (higher value)	Not Significant. These will be avoided by aligning the road within the route corridor so as to minimise impacts upon this site as far as possible. The habitats present are less sensitive than the neighbouring Ecological Site 25.
Garriskil Bog – cSAC, SPA and NHA 000679	Raised bog. Birds Directive Annex I species include Greenland white-fronted geese, merlin and hen harrier.	International Importance A	Significant impacts at County level may occur at this site, due to the hydrologically sensitive nature of the site.
Lough Garr Bog - NHA 001812	Small raised bog, marsh, wet woodland, humid grassland, dry grassland and fen carr.	National Importance	Significant impacts at County level may occur at this site, due to the hydrologically sensitive nature of the site.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 11	Scrub and degraded raised bog at Culleenabohoge	Local Importance (higher value)	Not Significant. These will be avoided by aligning the road within the route corridor so as to minimise impacts upon this site as far as is possible
Between Nodes 18B and 22			
Scragh Bog – NHA, cSAC and Statutory Nature Reserve 000692	Calcareous fen, transition mire, open carr grading to ombrotrophic bog. Also marshy/ wet grassland. Valuable invertebrate habitat including marsh fritillary.	International Importance	Significant impacts at National Level may occur at this site, due to the hydrologically sensitive nature of the site. [NPWS has expressed concerns about hydrological impacts on this site, which could occur as a result of this Route Corridor Option]
Ecological Site 2	Woodland south of Scragh Bog	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that almost the entire site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Ecological Site 3	River Bronsa woodland / scrub	Local Importance (higher value)	Not significant. The route is anticipated to pass to the north of the Site.

Summary of impacts for Route Corridor Option 3				
Significant at the International Level	Significant at the National	Significant at the County Level	Significant at the Local Level	Not Significant
0	**1**	**5**	**5**	**13**

Ecological Considerations

- Improvements to the N4 have already been undertaken as part of the Dromod-Roosky Scheme tie-in between Nodes 1 and 2 (affecting Clooneen Bog pNHA/cSAC and Aghnamona Bog NHA). Although this is within the mapped boundary of the designated site, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. No qualifying interests are anticipated to be present within the road footprint and therefore there would be no impacts on the qualifying features or integrity of this site.
- Alternative alignments of the route in the vicinity of Clooneen Bog pNHA/cSAC have been critically examined in order to minimise impacts as far as possible. The new road would be located within the existing N4 boundary fences and this would avoid affecting qualifying features for which the site is designated.
- Land-take would be minimised within the Rinn River NHA. The crossing footprint of the road at this location would also be minimised. Potential

impacts to be reduced by the use of a wide-span structure (around Node 2A). This would also help to ensure that existing flight lines are maintained. The Rinn River crossing constitutes an important flight line for birds, as identified during consultations with NPWS. Further surveys for commuting birds, focussing particularly on Greenland white-fronted goose, whooper swan, and hen harrier will be necessary to inform targeted mitigation in order to reduce any potential impacts.

- NPWS has expressed concerns with regard to the potential for hydrological impacts on Scragh Bog NHA, cSAC and Statutory Nature Reserve, which could occur as a result of this Route Corridor Option. This which would need to be investigated and resolved through further survey and mitigation, should this option be taken forward.
- Potential hydrological impacts on bogs and other wetland habitats will be minimised using appropriate construction techniques and drainage design. Aghnamona Bog NHA, Clooneen Bog NHA cSAC, Ballykenny Fishertown Bog SPA, Lough Forbes Complex pNHA cSAC, Scragh Bog pNHA cSAC Lough Garr Bog NHA, Garriskil Bog cSAC SPA and Ecological Sites 25, 26 and 41).
- Leny Fens (Ecological Site 13) was identified as comprising valuable fen habitats during consultation with NPWS; this was confirmed during the initial surveys undertaken in May 2008. Further detailed investigations would be required in order to fully assess the nature conservation value, which may increase the value of this site from County Importance to National Importance. The site is hydrologically sensitive and a route in close proximity to the site could have significant impacts. NPWS has concerns with regard to the hydrologically sensitive nature of this site and should Route Corridor option 3 be taken forward, further investigations may be required in order to demonstrate that significant impacts would be avoided.
- Hydrological impacts on wet woodland (Ecological Site 70 (County Importance)) will be minimised through the use of appropriate construction techniques and drainage design
- The footprint of the road at the crossings of the Camlin River (between Nodes 6 and 7), Black River (between Nodes 14A and 16), River Riffey (between Nodes 13 and 13A and 15 and 18) River Inny (between Nodes 15 and 18) would be minimised. Potential impacts would be reduced by the use of wide-span structures, and this would also help to ensure that existing flight lines are maintained.

- The footprint on-line widening in the vicinity of Ecological Sites 41 and 70 (County Importance) and Ecological Sites 69 and 3 (Local Importance (higher value)) will be minimised.

Route Corridor Option 4

A full description of the alignment of Route Corridor Option 4 can be found in Section 3.4. The table below summarises the sites of ecological interest affected by this route corridor option.

Table 4.10-6 Route Corridor Option 4

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 01 and 03A			
Aghnamona Bog NHA 000422	Active raised bog with birch woodland and Purple Moor-grass.	National Importance	Not Significant. Between Nodes 01 and 02 the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Clooneen Bog – pNHA and cSAC 000445	Raised bog with bog woodland and important wet grassland.	International Importance	Not Significant. At this location the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Rinn River – NHA 000691	Wet grassland, Raised / degraded bog, callows grassland. Birds Directive Annex I species known to use the site include whooper swan, and Greenland white-fronted geese.	National Importance	Impacts at a National Level are not anticipated; however, significant impacts may occur at the Local Level. An alignment within the Route Corridor at this location would be built as close to the northern edge of the existing N4 as possible, in order to minimise impacts on the site while at the same time avoiding impacts on the Natura 2000 sites to the south.
Lough Forbes Complex – pNHA and cSAC 001818	An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Raised bogs, Callow grasslands, Reed swamps and Freshwater marshes.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballykenny-Fishertown Bog – SPA 004101	Raised bog to Callow grasslands, also a small band of deciduous bog woodland. Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted geese. Pine marten, badger	International Importance	Not significant. Although impacts at a local level could occur due to disturbance of important bird species during the construction phase, given that the works would be situated adjacent to the existing N4, these impacts are not anticipated to be significant.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
	and bat.		
Ecological Site 70	Mixed deciduous and wet woodland and carr, grading into margins of adjacent Lough Forbes designated site. Suitable for bats, red squirrel and newts. Channels suitable for otters.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Between Nodes 03A and 04B.			
Ecological Site 65	Woodland at Deerpark. May support roosting bats, pine marten and red squirrel.	County Importance	Not Significant. The route would pass to the north of the site.
Between Nodes 04B and 10A			
Ecological Site 60	Woodland / scrub at Kiltyreher	Local Importance (higher value)	Not Significant. The route would pass to the north of the site.
Ecological Site 58	Camlin River (east of Longford) and associated floodplain. White-clawed crayfish and lamprey (both listed as Annex II species on the EU Habitats Directive) Important for fisheries (wild brown trout). Camlin River constitutes a vital migration route to adult spawning grounds and for juvenile fish migrating between the Camlin River and Lough Ree. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	National Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 54	Blocks of mixed plantation woodland east of Carrickglass Demense. Suitable for pine marten and red squirrel.	County Importance	The potential exists for a Significant impact at the County Level, given that up to a quarter of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 51	Scrub/woodland & small raised bog.	County Importance	The potential exists for a Significant impact at County Level given that almost the entire site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as is possible.
Between Nodes 10A and 14.			
Ecological Site 45	Plantation at Lisduff. Areas of recently felled and planted woodland. Area crossed by ditches suitable for use by commuting otters.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 14 and 17A			
Ecological Site 75	Black River south of Edgeworthstown, between Node 14A and 16. River suitable for white-clawed crayfish, otter and salmonids.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 40	Degraded raised bog north of Glen Lough	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Between Nodes 17A and 19			
Ecological Site 31	Woodland, scrub and degraded raised bog north of Lough Iron	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Lough Iron – SPA, pNHA and Ramsar Site 000687	Open water, freshwater marsh, wet grassland, wet woodland, reed swamp and conifer plantation. Birds Directive Annex I species include Greenland white-fronted geese, whooper swan and kingfisher. Otter, marsh fritillary and Irish damselfly.	International Importance	There will be no impacts at International or National level. A route here would be aligned to the north within the corridor in order to avoid impacts on the SPA. However, the potential exists for impacts on geese feeding in fields to the north of the site. These impacts may be Significant at either a County or Local Level; this will be determined during more detailed surveys and assement to be undertaken during the next stages of the project. [NPWS has expressed a preference for the route to be moved as far north as possible to reduce ecological impacts, and this has been incorporated into the design as far as other constraints will allow.]
Ecological Site 18	River Inny between Lough Derravaragh and Lough Iron. Important fisheries	County Importance	Significant impacts will be avoided by the use of a wide span crossing.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
	interest. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.		
Between Nodes 19 and 21			
Ecological Site 74	Grassland/ disused quarry north of Lough Owel. Species-rich semi-improved neutral grassland and adjacent quarry with nesting kestrel, potentially suitable for peregrine and roosting bats. Species-rich rough grassland around quarry edges.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballynafid Lake and Fen pNHA 000673	Open water, reed swamp, freshwater marsh, calcareous fen and woodland. Also known to support particularly diverse invertebrate communities.	National Importance	Not significant. The Route Corridor Option would pass south of the site and the final alignment of the road within the route corridor would be aligned as far south as possible so as to minimise impacts upon this site. [NPWS has indicated a preference for the road to be aligned to the south of Ballynafid Lake and Fen as is proposed in this Route Corridor Option.]
Scragh Bog – pNHA, cSAC and Statutory Nature Reserve 000692	Calcareous fen, transition mire, open carr grading to ombrotrophic bog. Also marshy/ wet grassland known to support marsh fritillaries and Irish Damselfly, and other invertebrate communities of conservation interest.	International Importance	Not significant The on-line widening associated with this Route Corridor Option is not anticipated to lead to any hydrological impacts on the site, due to the topography/hydrology of the area and the distance of Scragh Bog from the road. No significant impacts on the site are therefore anticipated.
Ecological Site 8	Woodland and scrub west of Ballynafid Lake and Fen NHA	Local Importance (higher value)	Not significant. A route within the route corridor would pass to the south of the site.
Ecological Site 7	Woodland at Clanhugh Demense. Mixed plantation woodland. Margins of woodland could be used by foraging bats.	Local Importance (higher value)	Not significant. A route within the route corridor would be located north of the existing railway and would not impact on the site.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 5	Woodland east of Lough Owel. Block of broad-leaved mixed woodland. Potentially suitable for red squirrel. Likely to be used by foraging/ commuting and possibly roosting bats.	Local Importance (higher value)	Not significant. The road alignment within the route corridor would pass to the north of the site.
Between Nodes 21 and 22			
Lough Owel – pNHA, cSAC, SPA, and Ramsar Site 000688	Hard water lake, Tullaghan fen, Bunbrosna marsh. Birds Directive Annex I species include Greenland white-fronted geese and kingfisher. Lough also known to be used by otters and supports white-clawed crayfish, Scharff's char and River Lamprey.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 3	River Bronsa woodland / scrub	Local Importance (higher value)	Not significant. The route is anticipated to pass to the north of the site.

Summary of impacts for Route Corridor Option 4				
Significant at the International Level	Significant at the National	Significant at the County Level	Significant at the Local Level	Not Significant
0	**0**	**3**	**2**	**20**

Ecological Considerations

- Improvements to the N4 have already been undertaken as part of the Dromod-Roosky Scheme tie-in between Nodes 1 and 2 (affecting Clooneen Bog pNHA/cSAC and Aghnamona Bog NHA). Although this is within the mapped boundary of the designated site, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. No qualifying interests are anticipated to be present within the road footprint and therefore there would be no impacts on the qualifying features or integrity of this site.
- Alternative alignments of the route in the vicinity of Clooneen Bog pNHA/cSAC have been critically examined in order to minimise impacts as far as possible. The new road would be located within the existing N4 boundary fences and this would avoid affecting qualifying features for which the site is designated.
- Land-take would be minimised within the Rinn River NHA. The crossing footprint of the road at this location would also be minimised. Potential

impacts to be reduced by the use of a wide-span structure (around Node 2A). This would also help to ensure that existing flight lines are maintained. The Rinn River crossing constitutes an important flight line for birds, as identified during consultations with NPWS. Further surveys for commuting birds, focussing particularly on Greenland white-fronted goose, whooper swan, and hen harrier will be necessary to inform targeted mitigation in order to reduce any potential impacts.

- The footprint of the road at the crossings of the Camlin River (between Nodes 4B and 4C), Black River (between Nodes 14A and 16), River Inny (between Nodes 15 and 18) would be minimised. Potential impacts would be reduced by the use of wide-span structures, and this would also help to ensure that existing flight lines are maintained.
- Alternative route alignments within the Route Corridor in the vicinity of Lough Iron have been critically examined, and the route would be aligned as far north as possible to avoid impacts on the SPA. Consultations with NPWS have confirmed that this area is of particular importance to the population of Greenland white-fronted geese that are known to overwinter in the area. The potential exists for impacts on geese feeding in fields to the north of the site. These impacts are likely to be at county or local level, however this impact assessment will be further informed by surveys at later stages of the project.
- The footprint of works within the mapped designated area boundaries of Lough Owel NHA, cSAC, SPA would be reduced as much as possible. The proposed on-line widening to the east of Lough Owel is located within the boundary of the NHA/cSAC/SPA, however, this boundary includes the existing N4. The existing N4 boundary will not be extended within the designated area, therefore impacts on the qualifying features and integrity of this designated site would be avoided.
- Potential hydrological impacts on bogs and other wetland habitats will be minimised using appropriate construction techniques and drainage design. Aghnamona Bog NHA, Clooneen Bog NHA cSAC, Ballykenny Fishertown Bog SPA, Lough Forbes Complex pNHA cSAC, Ballynafid Lake and Fen pNHA, Lough Iron NHA SPA and Lough Owel NHA cSAC SPA and Scragh Bog pNHA and cSAC, Lough Garr Bog NHA, Garriskil Bog cSAC SPA, Derrymore Bog pNHA and Ecological Site 51 (County Importance)).

- Hydrological impacts on wet woodland (Ecological Site 70 (County Importance)) will be minimised through the use of appropriate construction techniques and drainage design
- The footprint of on-line widening in the vicinity of Ecological Sites 54, 57 and 70 (County Importance) and 7 and 5 (Local Importance (higher value)) would be minimised.

Route Corridor Option 5

A full description of the alignment of Route Corridor Option 5 can be found in Section 3.4. The table below summarises the sites of ecological interest affected by this route corridor option.

Table 4.10-7 Route Corridor Option 5

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 01 and 03A			
Clooneen Bog – pNHA and cSAC 000445	Raised bog with bog woodland and important wet grassland.	International Importance	Not Significant. At this location the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Rinn River – NHA 000691	Wet grassland, Raised / degraded bog, callows grassland. Birds Directive Annex I species known to use the site include whooper swan, and Greenland white-fronted geese.	National Importance	Impacts at a National Level are not anticipated; however, significant impacts may occur at the Local Level. An alignment within the Route Corridor at this location would be built as close to the northern edge of the existing N4 as possible, in order to minimise impacts on the site while at the same time avoiding impacts on the Natura 2000 sites to the south.
Aghnamona Bog NHA 000422	Active raised bog with birch woodland and Purple Moor-grass.	National Importance	Not Significant. Between Nodes 01 and 02 the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Lough Forbes Complex – pNHA and cSAC 001818	An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Raised bogs, Callow grasslands, Reed swamps and Freshwater marshes.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballykenny-Fishertown Bog – SPA 004101	Raised bog to Callow grasslands, also a small band of deciduous bog woodland. Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted geese. Pine marten, badger and bat.	International Importance	Not significant. Although impacts at a local level could occur due to disturbance of important bird species during the construction phase, given that the works would be situated adjacent to the existing N4, these impacts are not anticipated to be significant.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 70	Mixed deciduous and wet woodland and carr, grading into margins of adjacent Lough Forbes designated site. Suitable for bats, red squirrel and newts. Channels suitable for otters.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 69	Woodland southeast of Rinn River NHA	Local Importance (higher value)	Not Significant. The route would pass to the south of the Site.
Between Nodes 03A and 05			
Ecological Site 65	Woodland at Deerpark. May support roosting bats, pine marten and red squirrel.	County Importance	Impacts at a County Level are not anticipated; however, significant impacts may occur at the Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 05 and 14			
Ecological Site 57	Camlin River (west of Longford) and associated floodplain. White-clawed crayfish and lamprey (both listed as Annex II species on the EU Habitats Directive) Important for fisheries (wild brown trout). Camlin River constitutes a vital migration route to adult spawning grounds and for juvenile fish migrating between the Camlin River and Lough Ree. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	National Importance	Significant impacts will be avoided by the use of a wide span crossing.
Royal Canal – pNHA 002103	Disused canal and parallel ditch choked with emergent vegetation and adjacent hedgerow. This feature is likely to support amphibians, and invertebrates. Suitable for use by otters and commuting bats.	National Importance	Significant impacts will be avoided by the use of a wide span crossing.
Derrymore Bog – pNHA 000447	Raised bog. Notable for red grouse and two species of Sphagnum moss.	National Importance	Significant impacts at Local Level may occur at this site, due to the hydrologically sensitive nature of the site.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 1	Heathland, bog and marshy grassland at Ballyminion.	County Importance	The potential exists for a Significant impact at the Local Level, given that up to a quarter of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Ecological Site 45	Plantation at Lisduff. Areas of recently felled and planted woodland. Area crossed by ditches suitable for use by commuting otters.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 14 and 17A			
Ecological Site 75	Black River south of Edgeworthstown, between Node 14A and 16. River suitable for white-clawed crayfish, otter and salmonids.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 40	Degraded raised bog north of Glen Lough	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Between Nodes 17A and 19			
Ecological Site 31	Woodland, scrub and degraded raised bog north of Lough Iron	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Lough Iron – SPA, pNHA and Ramsar Site 000687	Open water, freshwater marsh, wet grassland, wet woodland, reed swamp and conifer plantation. Birds Directive Annex I species include Greenland white-fronted geese, whooper swan and kingfisher. Otter, marsh fritillary and Irish damselfly.	International Importance	There will be no impacts at International or National level. A route here would be aligned to the north within the corridor in order to avoid impacts on the SPA. However, the potential exists for impacts on geese feeding in fields to the north of the site. These impacts may be Significant at either a County or Local Level; this will be determined during more detailed surveys and assement to be undertaken during the next stages of the project. [NPWS has expressed a preference for the route to be moved as far north as possible to reduce ecological impacts, and this has been incorporated into the design as far as other constraints will allow.]

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 18	River Inny between Lough Derravaragh and Lough Iron. Important fisheries interest. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Between Nodes 19 and 21			
Ecological Site 74	Grassland/ disused quarry north of Lough Owel. Species-rich semi-improved neutral grassland and adjacent quarry with nesting kestrel, potentially suitable for peregrine and roosting bats. Species-rich rough grassland around quarry edges.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ballynafid Lake and Fen pNHA 000673	Open water, reed swamp, freshwater marsh, calcareous fen and woodland. Also known to support particularly diverse invertebrate communities.	National Importance	Not significant. The Route Corridor Option would pass south of the site and the final alignment of the road within the route corridor would be aligned as far south as possible so as to minimise impacts upon this site. [NPWS has indicated a preference for the road to be aligned to the south of Ballynafid Lake and Fen as is proposed in this Route Corridor Option.]
Ecological Site 9	Woodland north of Lough Owel	Local Importance (higher value)	Not Significant. The route would pass to the north of the site.
Ecological Site 8	Woodland and scrub west of Ballynafid Lake and Fen NHA	Local Importance (higher value)	Not significant. A route within the route corridor would pass to the south of the site.
Scragh Bog – pNHA, cSAC and Statutory Nature Reserve 000692	Calcareous fen, transition mire, open carr grading to ombrotrophic bog. Also marshy/ wet grassland known to support marsh fritillaries and Irish Damselfly, and other invertebrate communities of conservation interest.	International Importance	Not significant The on-line widening associated with this Route Corridor Option is not anticipated to lead to any hydrological impacts on the site, due to the topography/hydrology of the area and the distance of Scragh Bog from the road. No significant impacts on the site are therefore anticipated.
Ecological Site 7	Woodland at Clanhugh Demense. Mixed plantation woodland. Margins of woodland could be used by foraging bats.	Local Importance (higher value)	Not significant. A route within the route corridor would be located north of the existing railway and would not impact on the site.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ecological Site 5	Woodland east of Lough Owel. Block of broad-leaved mixed woodland. Potentially suitable for red squirrel. Likely to be used by foraging/ commuting and possibly roosting bats.	Local Importance (higher value)	Not significant. The road alignment within the route corridor would pass to the north of the site.
Between Nodes 21 and 22			
Lough Owel – pNHA, cSAC, SPA, and Ramsar Site 000688	Hard water lake, Tullaghan fen, Bunbrosna marsh. Birds Directive Annex I species include Greenland white-fronted geese and kingfisher. Lough also known to be used by otters and supports white-clawed crayfish, Scharff's char and River Lamprey.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 3	River Bronsa woodland / scrub	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.

Summary of impacts for Route Corridor Option 5				
Significant at the International Level	Significant at the National	Significant at the County Level	Significant at the Local Level	Not Significant
0	**0**	**1**	**5**	**21**

Ecological Considerations

- Improvements to the N4 have already been undertaken as part of the Dromod-Roosky Scheme tie-in between Nodes 1 and 2 (affecting Clooneen Bog pNHA/cSAC and Aghnamona Bog NHA). Although this is within the mapped boundary of the designated site, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. No qualifying interests are anticipated to be present within the road footprint and therefore there would be no impacts on the qualifying features or integrity of this site.
- Alternative alignments of the route in the vicinity of Clooneen Bog pNHA/cSAC have been critically examined in order to minimise impacts as far as possible. The new road would be located within the existing N4 boundary fences and this would avoid affecting qualifying features for which the site is designated.
- Land-take would be minimised within the Rinn River NHA. The crossing footprint of the road at this location would also be minimised. Potential impacts to be reduced by the use of a wide-span structure (around Node 2A). This would also help to ensure that existing flight lines are maintained. The Rinn River crossing constitutes an important flight line for birds, as identified

during consultations with NPWS. Further surveys for commuting birds, focussing particularly on Greenland white-fronted goose, whooper swan, and hen harrier will be necessary to inform targeted mitigation in order to reduce any potential impacts.

- The footprint of the road at the crossings of the Camlin River (between Nodes 5A and 5B), Black River (between Nodes 14A and 16), River Inny (between Nodes 17A and 19) would be minimised. Potential impacts would be reduced by the use of wide-span structures, and this would also help to ensure that existing flight lines are maintained.
- Alternative route alignments within the Route Corridor in the vicinity of Lough Iron have been critically examined, and the route would be aligned as far north as possible to avoid impacts on the SPA. Consultations with NPWS have confirmed that this area is of particular importance to the population of Greenland white-fronted geese that are known to overwinter in the area. The potential exists for impacts on geese feeding in fields to the north of the site. These impacts are likely to be at county or local level, however this impact assessment will be further informed by surveys at later stages of the project. If this Route Corridor Option is taken forward, and it is not possible to realign the route yet further to the north, then it would be necessary to devise an appropriate mitigation package to reduce and/or offset any potential impacts on wintering birds.
- The footprint of works within the mapped designated area boundaries of Lough Owel NHA, cSAC, SPA would be reduced as much as possible. The proposed on-line widening to the east of Lough Owel is located within the boundary of the NHA/cSAC/SPA, however, this boundary includes the existing N4. The existing N4 boundary will not be extended within the designated area, therefore impacts on the qualifying features and integrity of this designated site would be avoided.
- Hydrological impacts on wet woodland (Ecological Site 70 (County Importance)) will be minimised through the use of appropriate construction techniques and drainage design.
- The footprint of on-line widening in the vicinity of Lough Forbes pNHA/cSAC, Ballykenny-Fishertown Bog SPA, Ecological Sites 69, 65 and 74 (County Importance) and Ecological Sites 40, 9, 7, 5 and 3 (Local Importance (higher value)) would be minimised.

Route Corridor Option 6

A full description of the alignment of Route Corridor Option 6 can be found in Section 3.4. The table below summarises the sites of ecological interest affected by this route corridor option.

Table 4.10-8 Route Corridor Option 6

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 01 and 03A			
Aghnamona Bog NHA 000422	Active raised bog with birch woodland and Purple Moor-grass.	National Importance	Not Significant. Between Nodes 01 and 02 the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Clooneen Bog – pNHA and cSAC 000445	Raised bog with bog woodland and important wet grassland.	International Importance	Not Significant. At this location the road would be built within the land-take of the existing road. While this is within the mapped boundary of the designated site, there are no qualifying interests within the road footprint. Therefore no significant impacts are anticipated.
Rinn River – NHA 000691	Wet grassland, Raised / degraded bog, callows grassland. Birds Directive Annex I species known to use the site include whooper swan, and Greenland white-fronted geese.	National Importance	Impacts at a National Level are not anticipated; however, significant impacts may occur at the Local Level. An alignment within the Route Corridor at this location would be built as close to the northern edge of the existing N4 as possible, in order to minimise impacts on the site while at the same time avoiding impacts on the Natura 2000 sites to the south.
Lough Forbes Complex – pNHA and cSAC 001818	An excellent diversity of habitats and important for Greenland white-fronted geese. Open water, Raised bogs, Callow grasslands, Reed swamps and Freshwater marshes.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Ballykenny-Fishertown Bog – SPA 004101	Raised bog to Callow grasslands, also a small band of deciduous bog woodland. Birds Directive Annex I species include merlin, whooper swan, hen harrier, Greenland white-fronted geese. Pine marten, badger and bat.	International Importance	Not significant. Although impacts at a local level could occur due to disturbance of important bird species during the construction phase, given that the works would be situated adjacent to the existing N4, these impacts are not anticipated to be significant.
Ecological Site 70	Mixed deciduous and wet woodland and carr, grading into margins of adjacent Lough Forbes designated site. Suitable for bats, red squirrel and newts. Channels suitable for otters.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 69	Woodland southeast of Rinn River NHA	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the south of the Site.
Nodes 03A and 06			
Ecological Site 66	Woodland/scrub near Creenagh. Large woodland block surrounded by a series of semi-improved and marshy grassland fields; crossed by hedgerows and small ditches.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 06 and 07			
Ecological Site 58 - Camlin River	Camlin River (east of Longford) and associated floodplain. White-clawed crayfish and lamprey (both listed as Annex II species on the EU Habitats Directive) Important for fisheries (wild brown trout). Camlin River constitutes a vital migration route to adult spawning grounds and for juvenile fish migrating between the Camlin River and Lough Ree. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	National Importance	Significant impacts will be avoided by the use of a wide span crossing.
There are no significant negative impacts between Nodes 07 and 08A			
There are no significant negative impacts between Nodes 08A and 09B			

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 09B and 14			
Ecological Site 45	Plantation at Lisduff. Areas of recently felled and planted woodland. Area crossed by ditches suitable for use by commuting otters.	Local Importance (higher value)	The potential exists for a Significant impact at a Local Level, given that approximately a third of the site is located within the route corridor. The final alignment of the road within the route corridor would be aligned so as to minimise impacts upon this site as far as possible.
Between Nodes 14 and 17A			
Ecological Site 75	Black River south of Edgeworthstown, between Node 14A and 16. River suitable for white-clawed crayfish, otter and salmonids.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Ecological Site 40	Degraded raised bog north of Glen Lough	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Between Nodes 17A and 19			
Ecological Site 31	Woodland, scrub and degraded raised bog north of Lough Iron	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.
Ecological Site 18	River Inny between Lough Derravaragh and Lough Iron. Important fisheries interest. Flight line for Birds Directive Annex I species, including hen harrier, merlin and Greenland white-fronted geese.	County Importance	Significant impacts will be avoided by the use of a wide span crossing.
Lough Iron – SPA, pNHA and Ramsar Site 000687	Open water, freshwater marsh, wet grassland, wet woodland, reed swamp and conifer plantation. Birds Directive Annex I species include Greenland white-fronted geese, whooper swan and kingfisher. Otter, marsh fritillary and Irish damselfly.	International Importance	There will be no impacts at International or National level. A route here would be aligned to the north within the corridor in order to avoid impacts on the SPA. However, the potential exists for impacts on geese feeding in fields to the north of the site. These impacts may be Significant at either a County or Local Level; this will be determined during more detailed surveys and assement to be undertaken during the next stages of the project. [NPWS has expressed a preference for the route to be moved as far north as possible to reduce ecological impacts, and this has been incorporated into the design as far as other constraints will allow.]

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact
Between Nodes 19 and 21			
Ecological Site 8	Woodland and scrub west of Ballynafid Lake and Fen NHA.	Local Importance (higher value)	Not significant. A route within the route corridor would skirt the southern edge of the site.
Ballynafid Lake and Fen pNHA 000673	Open water, reed swamp, freshwater marsh, calcareous fen and woodland. Also known to support particularly diverse invertebrate communities.	National Importance	Not significant. The Route Corridor Option would pass south of the site and the final alignment of the road within the route corridor would be aligned as far south as possible so as to minimise impacts upon this site. [NPWS has indicated a preference for the road to be aligned to the south of Ballynafid Lake and Fen as is proposed in this Route Corridor Option.]
Scragh Bog –pNHA, cSAC and Statutory Nature Reserve 000692	Calcareous fen, transition mire, open carr grading to ombrotrophic bog. Also marshy/ wet grassland known to support marsh fritillaries and Irish Damselfly, and other invertebrate communities of conservation interest.	International Importance	Not significant. The on-line widening associated with this Route Corridor Option is not anticipated to lead to any hydrological impacts on the site, due to the topography/hydrology of the area and the distance of Scragh Bog from the road. No significant impacts on the site are therefore anticipated.
Ecological Site 74	Grassland/ disused quarry north of Lough Owel. Species-rich semi-improved neutral grassland and adjacent quarry with nesting kestrel, potentially suitable for peregrine and roosting bats. Species-rich rough grassland around quarry edges.	County Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 5	Woodland east of Lough Owel. Block of broad-leaved mixed woodland. Potentially suitable for red squirrel. Likely to be used by foraging/ commuting and possibly roosting bats.	Local Importance (higher value)	Not significant. The road alignment within the route corridor would pass to the north of the site.
Between Nodes 21 and 22			
Lough Owel – pNHA, cSAC, SPA, and Ramsar Site 000688	Hard water lake, Tullaghan fen, Bunbrosna marsh. Birds Directive Annex I species include Greenland white-fronted geese and kingfisher. Lough also known to be used by otters and supports white-clawed crayfish, Scharff's char and River Lamprey.	International Importance	Not significant. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the site are therefore anticipated.
Ecological Site 3	River Bronsa woodland / scrub	Local Importance (higher value)	Not Significant. The route is anticipated to pass to the north of the Site.

Features of interest	Site description/habitats and notable protected species information	Site Evaluation	Level/scale of impact	
Summary of impacts for Route Corridor Option 6				
Significant at the International Level	Significant at the National	Significant at the County Level	Significant at the Local Level	Not Significant
0	**0**	**1**	**2**	**19**

Ecological Considerations

- Improvements to the N4 have already been undertaken as part of the Dromod-Roosky Scheme tie-in between Nodes 1 and 2 (affecting Clooneen Bog pNHA/cSAC and Aghnamona Bog NHA). Although this is within the mapped boundary of the designated site, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. No qualifying interests are anticipated to be present within the road footprint and therefore there would be no impacts on the qualifying features or integrity of this site.
- Alternative alignments of the route in the vicinity of Clooneen Bog pNHA/cSAC have been critically examined in order to minimise impacts as far as possible. The new road would be located within the existing N4 boundary fences and this would avoid affecting qualifying features for which the site is designated.
- Land-take would be minimised within the Rinn River NHA. The crossing footprint of the road at this location would also be minimised. Potential impacts to be reduced by the use of a wide-span structure (around Node 2A). This would also help to ensure that existing flight lines are maintained. The Rinn River crossing constitutes an important flight line for birds, as identified during consultations with NPWS. Further surveys for commuting birds, focussing particularly on Greenland white-fronted goose, whooper swan, and hen harrier will be necessary to inform targeted mitigation in order to reduce any potential impacts.
- Alternative route alignments within the Route Corridor in the vicinity of Lough Iron have been critically examined, and the route would be aligned as far north as possible to avoid impacts on the SPA. Consultations with NPWS have confirmed that this area is of particular importance to the population of Greenland white-fronted geese that are known to overwinter in the area. The potential exists for impacts on geese feeding in fields to the north of the site. These impacts are likely to be at county or local level, however this impact assessment will be further informed by surveys at later stages of the project.

- The footprint of works within the mapped designated area boundaries of Lough Owel NHA, cSAC, SPA would be reduced as much as possible. The proposed on-line widening to the east of Lough Owel is located within the boundary of the NHA/cSAC/SPA, however, this boundary includes the existing N4. The existing N4 boundary will not be extended within the designated area, therefore impacts on the qualifying features and integrity of this designated site would be avoided.
- Potential hydrological impacts on bogs and other wetland habitats will be minimised using appropriate construction techniques and drainage design. Aghnamona Bog NHA, Clooneen Bog NHA cSAC, Ballykenny Fishertown Bog SPA, Lough Forbes Complex pNHA cSAC, Ballynafid Lake and Fen pNHA, Lough Iron NHA SPA and Lough Owel NHA cSAC SPA and Scragh Bog pNHA cSAC and Ecological Site 51 (County Importance)).
- Hydrological impacts on wet woodland (Ecological Site 70 (County Importance)) will be minimised through the use of appropriate construction techniques and drainage design
- The footprint of the road at the crossings of the Camlin River (between Nodes 6 and 7), Black River (between Nodes 14A and 16), River Inny (between Nodes 17A and 19) would be minimised. Potential impacts would be reduced by the use of wide-span structures, and this would also help to ensure that existing flight lines are maintained.
- The footprint of on-line widening in the vicinity of Ecological Sites 18 and 74 (County Importance) and Ecological Sites 69, 40, 7, 5 and 3 (Local Importance (higher value)) would be minimised.

Comparison of Route Corridor Options

Table 4.10-9 summarises the impacts of each of the different Route Corridor Options on designated sites, and sites of ecological value within the Study Area. In addition, a scaling statement using the NRA Project Appraisal Guidelines is given.

Table 4.10-9 Summary of impacts for each Route Corridor Options

Route Corridor	Significant at the International Level	Significant at the National Level	Significant at the County Level	Significant at the Local Level	Not Significant*	Scaling Statement
Option 1	0	0	2	3	19	Moderately negative
Option 2	0	0	1	4	18	Moderately negative
Option 3	0	1	5	5	13	Highly negative
Option 4	0	0	3	2	20	Moderately negative
Option 5	0	0	1	5	21	Moderately negative
Option 6	0	0	1	3	18	Moderately negative

At the northern end of the scheme (between Nodes 01 and 3A), all of the Route Corridor Options follow a similar alignment, within the existing N4 corridor, which contains a number of internationally and nationally important sites for nature conservation. However, improvements have already been undertaken as part of the N4 Dromod-Roosky Scheme tie-in (between Nodes 01 and 02), and therefore, although the proposed new road alignment would fall within the boundaries of Aghnamona Bog NHA and Clooneen Bog pNHA cSAC, in fact, this area is located within recently disturbed ground within the new N4 boundary fence. There will therefore be no impacts on the qualifying features or integrity of these sites. The impact on these sites has therefore been assessed as not significant.

Between Nodes 2A and 3A, there are Natura 2000 sites to the south of the existing N4 (Lough Forbes Complex pNHA cSAC and Ballykenny-Fishertown Bog SPA), and a NHA site to the north (Rinn River NHA). This pinch-point means that it is not possible to avoid impacts on all of these sites. During the early stages of the route selection process, it became clear that by avoiding any significant impacts on the Natura 2000 sites, it would not be possible to also avoid impacts on Rinn River NHA. Each of the Route Corridor Options in this location would therefore have a impact on this site. However, the footprint of the scheme will be minimised as far as possible (assuming

an on-line widening) and the impact on this nationally important site has therefore been assessed as being significant at the Local Level.

Between Nodes 03A and 05, Route Corridor Options 1 and 5 follow the same alignment. Similarly, Route Corridor Options 2, 3 and 6 follow the same general alignment between Nodes 03A and 6. Route Corridor Option 4 crosses the northern part of the Study Area. Between these Nodes, there is one impact that is significant at the Local Level (site 65) which is affected by Route Corridor Options 1, 2, 3, 5 and 6.

From Node 05, Route Corridor Option 5 passes through the south of the Study Area; the Route Corridor Options 1 and 3 follow the same alignment to Node 10; Route Corridor Option 2 traverses south from Node 06 and briefly rejoins Route Corridor Options 6 between Nodes 09B and 09C. Route Corridor Options 5 and 6 combine at Node 09D and start to merge with the other Route Corridor Options as they approach Node 14. Each of the proposed Route Options would cross the Camlin River (site 58): Route Corridor Options 1, 3 and 6 will cross between Nodes 06 and 07; Route Corridor Option 2 crosses the river between Nodes 06 and 07A; Route Corridor Option 4 crosses just after Node 04B; and Route Corridor Option 5 crosses the river between Node 05A and 05B. However, significant impacts would be avoided by the use of a wide span crossing. In addition, one Route Corridor Option (Route Corridor Option 5) crosses the Royal Canal NHA just after Node 05C. Again, significant impacts would be avoided by the use of a wide span crossing.

At Node 14, all of the Route Corridor Options converge again, with the exception of the Route Corridor Option 3, and follow a similar alignment until Node 20 (with very minor variations). All of the proposed Route Options would cross the River Inny (18) in the region of Node 17. However, significant impacts would be avoided by the use of a wide span crossing. Route Corridor Option 3 passes to the north of Edgeworthstown from Node 13, and continues on an alignment north of the other Route Corridor Options. Route Corridor Option 3 crosses the River Riffey twice between Nodes 15 and 18. Significant impacts would be avoided by the use of a wide span crossing.

There will be no impacts at International or National level on Lough Iron pNHA and cSAC (between Nodes 17 and 19). A route here would be aligned to the north within the corridor in order to avoid direct impacts on the SPA. However, the potential exists for impacts on geese feeding in fields to the north of the site. These impacts may be

Significant at either a County or Local Level; this will be determined during more detailed surveys and assessment to be undertaken during the next stages of the project. NPWS has expressed a preference for the route to be moved as far north as possible to reduce ecological impacts, and this has been incorporated into the design as far as other constraints will allow.

Between Nodes 20 and 21, an alignment within Route Corridor Option 1 would pass within the designated boundary of Ballynafid Lake and Fen pNHA. However, the on-line widening of the N4 in this location would be accommodated within the existing N4 boundary fence. As a consequence, any new impacts on the integrity of this NHA will be avoided. The impact on these sites has been assessed as not significant. Route Corridor Options 2, 4, 5 and 6 would all pass close to the south of Ballynafid Lake and Fen, however, no significant impacts are predicted. NPWS has indicated a preference for a road alignment south of the site, given that this would allow a wider buffer to be retained between the road and the designated site.

Route Corridor Option 3 has the potential for Significant Impacts at the National Level on Scragh Bog, a hydrologically sensitive site. NPWS has expressed concerns about hydrological impacts on this site, which could occur as a result of this Route Corridor Option. This would need to be investigated and resolved through further survey and mitigation, should this option be taken forward.

Route Corridor Options 1, 2, 4, 5 and 6 would be located to the south-west of Scragh Bog and no hydrological impacts are anticipated with this on-line widening of the N4, due to the topography/hydrology of the area and the distance of Scragh Bog from the existing road. The impact on the site resulting from these route options has therefore been assessed as not significant.

Between Node 21 and the end of the scheme, all of the Route Corridor Options (again with the exception of the Route Corridor Option 3) follow the same alignment. It is currently anticipated that the road alignment through the Route Corridor at this point would be constructed by an on-line widening to the north of the existing N4. No significant impacts on the sites present are therefore anticipated.

Route Corridor Option 3 joins the other route alignments at Node 21A, whereupon it follows the same on-line alignment to the end of the Scheme at Node 22.

Using the quantitative and qualitative information identified during this impact assessment, a 'Scaling Statement' has been assigned to each Route Corridor Option. As shown in Table 4.10-9, there are no impacts that are significant at the International Level as a result of any of the Route Corridor Options. There is one impact that has the potential to be significant at the National Level (Route Corridor Option 3 passing in close proximity to the northern edge of Scragh Bog). There are a maximum of five impacts that are significant at the County Level and a maximum of five impacts that are significant at the Local Level. Given these results, the Scaling Statement has been assessed as being 'Moderately Negative' for all of the Route Corridor Options, with the exception of Route Corridor Option 3, which is assessed as 'Highly Negative'.

Overall, with the exception of Route Corridor Option 3, there is no significant difference between the different Route Corridor Options in terms of impacts on the natural environment. Nevertheless, there are small differences in the potential impacts on the natural environment associated with each of the different Route Corridor Options. Although the differences are not substantial, it is possible to compare the number of anticipated impacts associated with each route option and use these to rank the routes in terms of their likely ecological impacts. Table 4.10-10, below, provides a ranking for each of the Route Corridor Options, based on the ecological information that has been gathered to date.

Given that there are no impacts that are significant at the International Level, the ranking is based on the number of impacts that are significant at the National, County and Local Levels. One Route Corridor Option (Option 3) has a single impact that is significant at the National Level and this is therefore the least favoured option. Where more than one Route Corridor Option has the same number of anticipated significant impacts at the County Level, the Route Corridor Option with the highest number of anticipated significant impacts at the Local Level has been assessed as being the least favoured.

Table 4.10-10 Ranking of Route Corridor Options

Route Corridor Option	Scaling Statement	Order of Preference
1	Moderately Negative	3
2	Moderately Negative	2
3	Highly Negative	6
4	Moderately Negative	5
5	Moderately Negative	4
6	Moderately Negative	1

4.10.4 Summary

The natural environment study has identified ecological resources within the Study Area which have been taken into account during the Route Corridor Selection. This will also be taken forward into the preliminary and detailed design stages of the Scheme. This has included identifying the main ecological constraints which should be avoided, or could affect the design of the scheme. Every effort will be made to avoid impacts on features of nature conservation importance. Where this is not possible, appropriate mitigation to reduce, ameliorate or, if necessary, compensate for these impacts will be devised. Similarly, the potential significance of impacts has been considered through the course of this assessment, and measures will also be taken to minimise the effects of impacts, such as fragmentation of habitats or effects on the hydrology of wetland systems.

Fragmentation effects will be avoided or mitigated by undertaking a combination of the following: choosing the least ecologically sensitive route options available (in combination with other environmental factors requiring consideration);

- the use of wide span bridges when crossing watercourses;
- habitat creation/enhancement measures as part of the new Scheme corridor;
- when crossing important flight lines for birds, locating the road adjacent to existing structures wherever possible;
- the provision of mammal tunnels and underpasses to allow the safe passage of animals, and to reduce the effects of fragmentation.

Similarly, mitigation for potential impacts of the proposed Scheme on the hydrology of wetland habitats could include the use of appropriate Sustainable Drainage Systems (SuDS) to manage and control road drainage;

- the installation of systems that allow hydrological processes not associated with road drainage to continue functioning post-construction; and
- in the last resort off-site habitat enhancements to compensate for unavoidable impacts on the hydrology of valuable sites (this is dealt with further in Section 4.7, Geology and Hydrogeology; and Section 4.9 Hydrology and Drainage).

The most important ecological constraints present within the Study Area are the 19 designated sites, which are of International and/or National Importance for nature conservation (cSACs, SPAs, and NHAs/pNHAs). Careful consideration of the implications of Articles 6(3) and 6(4) of the Habitats Directive and of the transposing measures, Articles 30 of the Habitats Regulations, 1997, will also continue to be required as the Scheme progresses Many non-designated ecologically valuable sites, and rare and protected species of flora and fauna have also been identified within the Study Area; the detailed status of these in relation to the proposed route options will require further investigation, and mitigation design as the Scheme progresses. Where sites have been designated on the basis of supporting internationally or nationally important populations of mobile species, particularly birds, impacts of any route options on these species outside designated sites will need to be considered in the context of their status as qualifying interests for the sites in question.

Following the selection of a preferred route alignment, further consultations and targeted surveys will be required. This will involve more detailed assessments of valuable habitats and designated sites in close proximity to the final route alignment, in order to inform the design of the scheme. In addition, further surveys will also be required in relation to foraging and commuting bats, red squirrels, otters, badgers, pine martens, deer, terrestrial and aquatic invertebrates, fisheries, and birds in order to devise appropriate mitigation, enhancement and compensation measures for incorporation into the scheme design. In addition, Appropriate Assessment is likely to be required under the EU Habitats Directive and the Birds Directive; the detailed requirements for this will be further reviewed. This is likely to require more detailed surveys for habitats and waterfowl and other important bird species, which may need to be extended into areas adjacent to the Study Area.

4.11 Phase 4

Phases 2 and 3, the Constraints and Route Corridor Selection studies, are two fundamental components of the Environmental Impact Assessment (EIA) process primarily concerned with the early identification and avoidance of significant adverse environmental impacts by means of appraisals and the consideration of alternative route options.

Phase 4 includes the preparation of the Environmental Impact Statement (EIS) for the preferred route, where required.

EIA is defined as:
''the process of examining the environmental effects of the development – from consideration of the environmental aspects at design stage, through to the preparation of an Environmental Impact Statement, evaluation of the EIS by a competent authority and the subsequent decision as to whether the development should be permitted to proceed, also encompassing public response to that decision''

The Environmental Impact Statement (EIS) is defined as "*a statement of the effects, if any, which the proposed development, if carried out, would have on the environment*" (Environmental Protection Agency, Guidelines on the Information to be Contained in an Environmental Impact Statement, 2002).

The EIA Directive (85/337/EEC as amended by 97/11/EC and 2003/35/EC) requires that certain developments be assessed for likely environmental effects before planning permission can be granted. In relation to roads, requirements for EIA are set out in Part IV of the Roads Act, 1993 and Part V of the Roads Regulations, 1994 (S.I.119 of 1994). Projects requiring environmental impact assessment are listed in Schedule 5 of the Planning and Development Regulations 2001 - 2005.

The current requirements for EIA are set out in Part IV of the Roads Act, 1993, and Part V of the Roads Regulations, 1994 (S.I.119 of 1994). In particular, sections 50 and 51 of the Act as amended deal with EIA. These sections have been subject to significant amendment through the European Communities (EIA) (Amendment) Regulations, 1999, and the Planning and Development Act, 2000. The 1999 amendment emphasises the need to consider significant environmental impacts in

specific environmentally sensitive locations. EIA is required for prescribed projects and other projects that, by reason of their nature, extent or location, are likely to have significant effects on the environment.

Road planning and design is an iterative process where planning and design evolve in response to environmental and other considerations. This ensures that environmental considerations become an integral part of the overall Route Corridor selection and road scheme planning and design process.

'Screening' is the term used to describe the process of ascertaining whether a road scheme requires an EIA and is determined by reference to mandatory and discretionary provisions set out in the Roads Act, 1993, as amended by the Roads Regulations 1994; the EIA (Amendment) Regulations, 1999; the Planning and Development Act, 2000; the Planning and Development (Strategic Infrastructure) Act, 2006 and the Roads Act, 2007.

The overriding consideration in determining whether a road scheme should be subject to EIA is the likelihood of significant environmental effects. Significant effects may arise by virtue of the type of road scheme, the scale or extent of the road scheme and the location of the road scheme in relation to sensitive environments.

The EIA Directive lists those projects for which EIS is mandatory (Annex I) and those projects for which EIA may be required (Annex II). With regard to the latter, Member States can choose to apply thresholds or use case by case examination or a combination of both to assess whether these projects require EIA. For road schemes in Ireland, a combination of both is used.

The Table below provides an overview of the legislative requirements that determine whether a road scheme will require an EIA

Table 4.11-1 Overview of the legislative requirements that determine whether a road scheme will require an EIA

Mandatory	Regulatory Reference
1. Construction of a motorway	S. 50 (1)(a) Roads Act, 1993 as substituted by S.9(1)(d)(i) of the Roads Act, 2007.
2. Construction of a busway	S. 50 (1)(a) Roads Act, 1993 as substituted by S.9(1)(d)(i) of the Roads Act, 2007.
3. Construction of a service area	S. 50 (1)(a) Roads Act, 1993 as substituted by S.9(1)(d)(i) of the Roads Act, 2007.
4. Any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road namely: (i) The construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area, or 500 metres or more in length in an urban area; (ii) The construction of a new bridge or tunnel which would be 100 metres or more in length.	Art. 8 of the Roads Regulations, 1994 (Road development prescribed for the purposes of S. 50 (1) (a) of the 1993 Act)
5. Where An Bord Pleanála (ABP) considers that a proposed road development would be likely to have significant effects on the environment it shall direct the road authority to prepare an EIS.	S. 50 (1)(b) Roads Act, 1993
6. Where a road authority considers that a proposed road development would be likely to have significant effects on the environment it shall inform ABP in writing and where ABP concurs it shall direct the road authority to prepare an EIS.	S. 50 (1)(c) Roads Act, 1993
7. Where a proposed road development would be located on certain environmental sites the road authority shall decide whether the proposed road development would be likely to have significant effects on the environment. The sites concerned are: (i) Special Area of Conservation (ii) A site notified in accordance with	S. 50 (1)(d) Roads Act, 1993 as inserted by Art. 14(a) of the EIA (Amnedment) Regulations, 1999.

Regulation 4 of the European Communities (Natural Habitats(Regulations, 1997 (S.I. No. 94 of 1997) (iii) Special Protection Area (SPA) (iv) A site where consultation has been initiated in accordance with Art. 5 of Council Directive 92/43/EC of 21 May, 1992, on the conservation of natural habitats and of wild flora and fauna. (v) A Nature Reserve within the meaning of sections 15 or 16 of the Wildlife Act, 1976. (vi) Refuge for Fauna under section 17 of the Wildlife Act, 1976.	

The Mullingar to Longford (Roosky) Scheme is approximately 52 kilometres in length. The latest traffic modelling and forecasting which has been carried out concludes that a dual carriageway road type is appropriate for this scheme.

It is therefore a mandatory requirement that an EIA for this scheme is undertaken as the scheme falls within the construction of a proposed public road or the improvement of an existing public road namely:

Item 4(i) of Table 4.11-1 above: The construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area. This is in accordance with Article 8 of the Roads Regulations 1994.

5 Engineering Appraisal

5.1 Introduction

The purpose of the Engineering Appraisal is to describe the standards and criteria which apply to the design of Route Corridor Options and to contribute to the Project Appraisal Balance Sheets (PABS) for the 6 Route Corridor Options as required by the Project Appraisal Guidelines (PAG).

The 5 main criteria in the PABS are Environment, Safety, Economy, Accessibility and Integration. The Environment, Accessibility and Integration Criteria are generally addressed in the Environmental Appraisal (Chapter 4). The Economy Criterion and the Accident Reduction element of the Safety Criterion are addressed in the Traffic and Economics Appraisal (Chapter 6). The Engineering Appraisal contributes to the Economy Criterion through provision of cost estimates (Option Comparison Estimates) for the Route Corridor Options, to the Safety Criterion through the appraisal of the element of Security of all road users and to the Integration Criterion through the appraisal of Non-Motorised User needs for the Transport Integration element.

In addition, this chapter gives initial consideration to construction phasing and impacts during construction, as required by the NRA Project Management Guidelines (PMG). The consideration of construction phasing and impacts during construction is an ongoing process and they will be examined again during the Preliminary Design of the Preferred Route and in the Environmental Impact Statement. Although the disruption caused by construction works is temporary it is necessary to start to consider how the works can be carried out as soon as the route option corridors have been defined so that measures for minimising and mitigating disruption can be identified and incorporated into the Preliminary Design.

During Phase 3, the Route Corridor Selection phase, 300m wide Route Corridor Options have been developed. At this stage, only the initial design work on anticipated alignments which is necessary to establish the basic feasibility of the mainline Route Corridors, has been carried out. The current standards for alignment and cross-section, as listed in the index to the NRA Design Manual for Roads and Bridges

(DMRB), January 2009, have been followed. Further design work to establish the necessary footprint of the scheme will be carried out in the next phase (Phase 4), the Preliminary Design of the Preferred Route. The final selection of carriageway standard and junction provision will be made in the next phase, in accordance with the relevant standards in the DMRB.

5.2 Design Standards and Criteria

5.2.1 Standards for Road Type/Cross-Section

This section focuses on the applicable standards for road type/cross-section. The overall selection of road types for the scheme is made in Section 6.5.2 because the selection of road type needs to be made on the basis of a range of different aspects, including;

- the required mainline capacity to meet the range of forecast traffic flow volumes (AADT), as summarised in Section 2.2.1 and detailed in Section 6.3, in accordance with TD 9/07 and TD 10/07,
- the constraints to on-line widening, as described in Section 3.3.1, and the consequential viability of a Type 3 cross-section,
- the balancing of scheme benefits and scheme costs to obtain optimum value for money,
- overall performance in terms of the scheme objectives,
- overall performance in terms of the 5 headline criteria in the PABS,
- consistency of cross-section along the scheme, to ensure as few changes in cross-section as possible.

TD9/07 and TD10/07 of the DMRB give capacities for road types in terms of Annual Average Daily Traffic (AADT) flows (in vehicles/day). However, the principal design standard within the DMRB which governs the dimensions of the road cross-section is TD 27/07. The standard road cross-sections are illustrated in the Road Construction Details (RCDs), RCD/000 series.

In the preceding Section 2.2.1, the issue of capacity was discussed. As described in the preceding Section 3.3.1, a Type 3 Dual Carriageway road (also known as 2 + 1) would usually be the initial choice for on-line widening, where forecast traffic flows are

less than 14,000 vehicles per day. However, recorded traffic volumes between Longford and Mullingar between February and August of 2008 exceed 14,000 vehicles per day. Furthermore, Type 3 is intended for use where a road can be widened on-line, however, Section 3.3.1 concluded that it was not possible to widen on-line along the existing N4 in many places due to the number and severity of the constraints, and the standards do not permit numerous changes in road type along the scheme for reasons of safety. Consequently for these reasons, a Type 3 dual carriageway has not been applied in this scheme.

The remaining road types which could cater for the forecast traffic flows are:

- a Type 2 Dual Carriageway (also known as 2 + 2) which provides 2 lanes in either direction but no hardshoulders and can cater for traffic flows up to 20,000 vehicles per day AADT,
- a Type 1 Dual Carriageway which provides 2 lanes in either direction with hardshoulders and can cater for traffic flows up to 38,100 vehicles per day AADT.

The Type 1 and Type 2 road cross-sectional dimensions are shown in the figures below (extracted from RCD/000/5 and RCD/000/4);

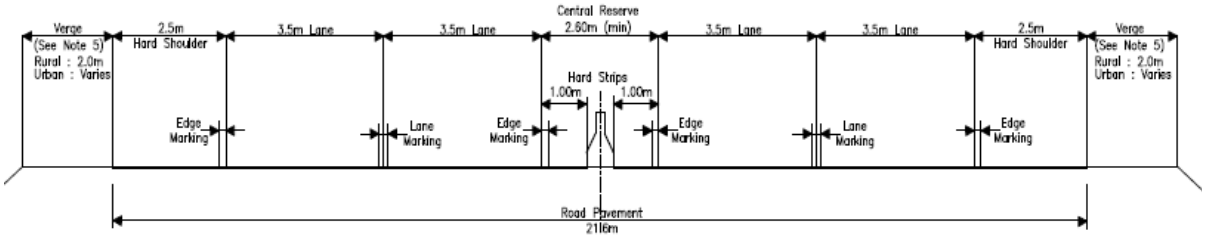

Figure 5.2-1 : Type 1 Road Cross-Section

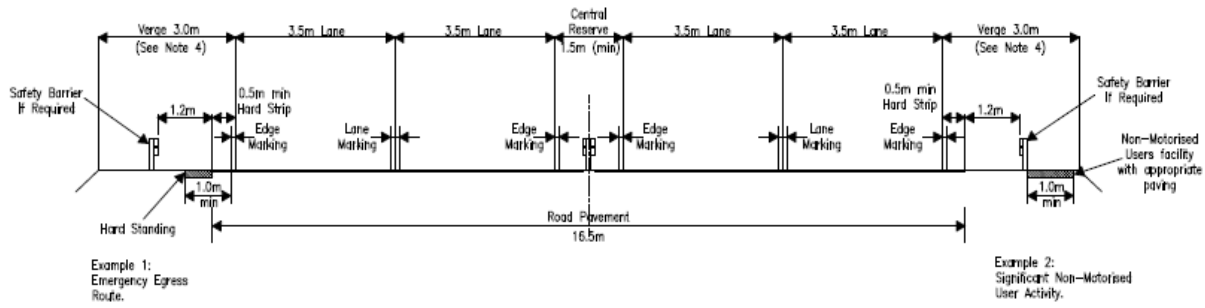

Figure 5.2-2 : Type 2 Road Cross-Section

The primary difference between the Type 2 dual carriageway and the Type 1 dual carriageway is that the Type 2 does not provide a full width hardshoulder. It does however provide a hardstrip and strengthened verge. It is a dual carriageway road type which is similar to those commonly adopted for many years in the UK and in other European countries.

It should be noted that in areas where on-line widening is possible, it is usually necessary to provide a parallel single carriageway access road to serve local accesses and properties. A reduced single carriageway road (type S2) running in parallel would add approximately 13m to the overall cross-section.

Side road cross-sections are usually based on the existing side road cross-section, with standard dimensions, e.g. 1.5m verge widths, applied where practical. The minimum carriageway width for side roads is normally 5.5m.

At present, all of the Route Corridor Options require only one identical Departure from Standard, which would relate to TD 27/07 and the need to reduce the Type 1 dual carriageway cross-section to fit beneath the existing Knockdrin Overbridge to the west of the R394 Castlepollard Road Junction. This structure is a concrete arch bridge carrying the L5706 local road. A survey has been carried out to establish the available headroom and cross-sectional dimensions, which has identified that a reduced dual carriageway cross-section is necessary and should be feasible. This would comprise discontinued hard shoulders and a narrowed central reserve 1.5m wide, with verges 1.8m wide on each side to allow sufficient space for safety barriers in front of the bank seat foundations of the bridge. The running lanes could remain at standard widths (3.5m each lane). The minimum maintained headroom requirement of 5.03m, as required by NRA Standard TD27/07, can be provided. However, the minimum headroom for new works of 5.30m can only be achieved by lowering the existing N4 carriageway.

5.2.2 Standards for Geometry

The principal design standards in the DMRB which govern road geometry are TD9/07 and TD10/07. The design of road geometry is based on selected design speeds. The design speed which was adopted for the preparation of the mainline Route Corridors

was 120kph. The design speeds adopted in the future preliminary design of the Preferred Route may typically be 100kph for sections of Type 2 Dual Carriageway and 120kph for sections of Type 1 Dual Carriageway. Design speeds adopted for side road realignments would typically vary from 50 to 80 kph, in line with local speed limits already in force on those roads. Longer link roads, if required, would typically require design speeds of 80 to 100kph. Those remaining sections of the existing N4 which would form part of a through-road (with a local or regional road classification) to provide local access would be subject to design speeds typically ranging from 50kph in built up areas to 80kph in rural areas. It should be noted that the design speed and speed limit applied may not necessarily be the same, in some cases road alignments are designed to a slightly higher design speed than the speed limit which is subsequently applied. Further design of side roads, link roads and access tracks will be necessary as part of the future preliminary design of the preferred route.

Departures from Standards for the horizontal and vertical alignments of the mainline have been avoided at present, but may be required on side-roads where constraints dictate. Widening of the central reserve and verges through horizontal curves, where necessary to allow for the required forward visibility (known as Stopping Sight Distance) will be carried out as part of the Preliminary Design of the Preferred Route. At present the corridors are sufficiently wide (300m) to cater for such widening, which typically requires a few extra metres beyond the minimum cross-section described in section 5.2.1 above.

A Stage F (Phase 1) Road Safety Audit has been carried out in accordance with standard HD19/09, for the six Route Corridor Options. Many of the points raised in the audit were of relatively low risk. All of the points raised could be addressed and risks reduced to acceptable levels by further design.

5.2.3 Standards for Junctions and Context to Junction Strategy

Once the mainline road type has been selected, it is then possible to select the appropriate junction strategy. Demand for and siting of junctions is generally led by analysis in the traffic model and is an iterative process, therefore only the context to the junction strategy in terms of applicable engineering standards and general requirements is given in this section. The initial junction strategies selected for the

Route Corridor Options are outlined within the Traffic and Economics Chapter, Section 6.5.2.

Just as there are many different factors to consider in the selection of road type, there are also several different factors to consider in setting the appropriate junction strategy for the scheme.

The design standards require that:

- junction types should provide for the mainline and side road flows and the turning flows between mainline and side roads (TD 9/07 and TD10/07)
- there should be economic justification for the selection of junction types, particularly grade-separated junctions (TD 9/07, Para 8.5),
- as few junctions as possible should be provided, no direct access to the mainline should be allowed except at junctions and there should be no gaps in the central reserve (TD 9/07, Para. 8.5, TD 10/07, Para. 2.26),
- junctions on a Type 1 mainline should not be less than 2km apart (TD 22/06, Para 4.35),
- junctions should be to standard layouts (TD 9/07, Para. 7.32, TD10/07 Para. 2.28),
- the junction layouts along the scheme should be as consistent as possible, i.e. there should not be many different layouts along a scheme (TD 9/07, Para. 7.32, TD10/07 Para 2.28).

TD9/07 states that on Type 1 dual carriageways, all junctions should be grade-separated or left-in/left-out (this latter should be provided within a reasonable distance of a grade-separated junction to allow for U-turns).

TD 10/07 states that on Type 2 dual carriageways, only the following junction types are permitted;

- At-grade roundabout (for total turning flows above 3,000 vehicles per day AADT),
- Compact grade separation (for total turning flows in the range 1,000 to 3,000 vehicles per day AADT),

- Left-in/left-out (for total turning flows below 1,000 vehicles per day AADT, where a nearby roundabout or grade-separated junction is available for U-turns).

At-grade crossings of the central reserve are not permitted in either case (Type 1 or Type 2 mainline).

Once the junction strategy has been determined, the standards in the DMRB which would relate to the preliminary and detailed design of junction layouts for the Preferred Route are (with January 2009 addenda):

- TD22/06 (with January 2009 addenda) 'Layout of Grade Separated Junctions'
- TD16/07 (with January 2009 addenda) 'Geometric Design of Roundabouts'
- TD40/94 (with January 2009 addenda) 'Layout of Compact Grade Separated Junctions'
- TD41-42/09 'Geometric Design of Major/Minor Priority Junctions and Vehicular Access to All-Purpose Trunk Roads'

In addition to the design standards, in the selection of potential junction locations and types the following issues must also be considered:

- **Sufficient demand, as demonstrated in the traffic model, to require a junction at a particular location** (i.e. sufficiently high forecast turning flows). This is determined by consideration of trip origins and destinations, by testing junction locations in the traffic model and siting junctions as conveniently as possible for major destinations or routes so as to minimise journey times. This question is directly related to the economic justification of junctions, because if there is low demand in the traffic model, the cost of the junction might outweigh the benefits it could achieve,
- **If the demand is served by a new junction, any other consequences;** e.g. providing a junction could give unintended results in terms of excessive traffic flows along particular sections of road or through particular junctions, which might cause delays, safety problems or environmental impacts.
- **Operational performance of new junctions at particular locations.** Detailed evaluation of operational performance is usually carried out during future stages of design, but it is necessary to give some consideration at this stage to any likely operational performance issues which might arise at particular locations. For example, with regard to at-grade roundabouts, the

design standards do not specify particular capacity limits for at-grade roundabouts in terms of Average Annual Daily Traffic. The capacity of a roundabout depends on several factors, not simply the total daily traffic flows through the junction, but also the variability of traffic flows during the day, the proportion of right turning traffic, the size of the roundabout and the number of lanes available.

- **Potential environmental impacts of junctions at particular locations** e.g. in terms of impacts on nearby constraints. Typical questions include; Would the junction cause excessive impact upon features of environmental importance or sensitivity? Would the junction be raised up above the surrounding landscape if sited at a particular location? Can the junction be relocated to reduce the impacts or can the impacts be mitigated?

Section 6.6.1 contains the appraisal of Linkage between the Route Corridor Options for the N4 and other roads in the study area and in particular considers the demand in terms of traffic patterns, and level of priority for improved linkage between the N4 and other roads.

5.2.4 Non-Motorised Users: Security & Transport Integration

The development of any new route must take into account Non-Motorized Users of the road network (NMUs), such as cyclists, pedestrians and equestrians and should aim to improve their safety on the roads as far as is reasonable practicable. The most relevant design standards to NMUs are;

- TD 10/07 'Road Link Design for Type 2 and Type 3 Dual Carriageways' (Paras 2.35 – 2.37)
- TD 27/07 'Cross-Sections and Headroom'
- TD 36/93 (with December 2000 addendum) 'Subways for Pedestrians and Pedal Cyclists'

From the UK DMRB there is an Advice Note which can be applied in Ireland;

- TA 91/05 'Provision for Non-Motorised Users'

Where a side road overbridge or underbridge can be provided separate subways would not usually be required. Route Corridors that run along the line of the existing alignment (e.g. along the existing Longford Bypass or at the northern and southern ends of the scheme) should provide parallel access roads to serve local traffic, cyclists, pedestrians and equestrians. Roads of good quality with improved sight

distances and footpaths where necessary should be provided ensuring the safety of non motorized road users. At road bridges, footways should be provided to enable pedestrians to pass freely. Measures for NMUs would apply on any route which is selected to become the Preferred Route. Design of NMU measures would occur during the Preliminary Design of the Preferred Route.

In terms of the appraisal of the Route Corridor Options the potential impacts on NMUs are taken into account in the Project Appraisal Balance Sheets as part of the appraisals for the elements titled 'Security' and 'Transport Integration', as shown in the detailed Project Appraisal Balance Sheets (PABS) in Appendix 1, Volume II.

Security and Accident Reduction are the two elements which comprise the Safety criterion within the PABS. The scope for Accident Reduction (reducing road traffic accident frequency and/or severity) is estimated as a monetised saving within the COBA program and is described in Chapter 6. With regard to Security, the NRA Project Appraisal Guidelines (PAG) states; "Security refers to the personal security of road users. The most likely occasion on which this impact would have to be assessed would be where pedestrian facilities such as underground passes are put in place". All NMUs have been taken into account in the appraisal of security.

Transport Integration is an element of the Integration criteria. The PAG states "Transport Integration impacts may arise where the project…provides for public transport and non-mechanised modes, as well as private car and goods vehicle use". Other aspects of the Transport Integration appraisal are addressed in Chapter 6, Section 6.2, and this is also where the overall appraisal commentary and order of preference table can be found.

In undertaking the appraisals in relation to NMUs, particular consideration has been given to those sections of the Route Corridor Options which comprise on-line widening. The reason for this is that along sections of the existing N4, NMUs will at present be crossing the existing road at-grade but following widening to dual carriageway a continuous safety barrier would have to be installed in the central reserve (and intermittently in the verges where necessary). It would no longer be possible for NMUs to cross at-grade so if there was sufficient demand underpasses or overbridges would have to be provided. The likely frequency of NMU activity along those sections where on-line widening is feasible has been taken into account, based on proximity to the largest settlements. At Longford Town, Option 2 runs along the line

of the existing Longford Bypass separating a residential area from an area of employment which attracts relatively high volumes of pedestrians and cyclists. As a result there will be a potential slightly negative impact on NMUs who may be travelling to and from work, in terms of additional journey times. Along rural sections of on-line widening and off-line new routes where residential development and employment is of much lower density NMU activity will be relatively low. Therefore the likely overall impacts on NMUs for Options 1, 3, 4, 5 and 6 are considered to be neutral.

Table 5.2-1 Order of Preference: Security

Route Corridor Option	Impact	Order of Preference
1	Neutral	Joint 1st
2	Slightly Negative	6th
3	Neutral	Joint 1st
4	Neutral	Joint 1st
5	Neutral	Joint 1st
6	Neutral	Joint 1st

5.3 Earthworks

Earthworks are influenced by the same aspects which influence the design of the vertical alignment, which include;

- Natural terrain and topography: it is necessary to take into account the topography of the area, so as to minimise depths of cuttings and heights of embankments, where possible,
- Surface waterbodies: the need to cross above rivers and streams and keep the road above flood levels, the need to keep above the water table, lakes and bogs which could be adversely affected by dewatering if the road were to be in cutting,
- Road drainage: the need to drain the road by gravity and avoid low spots on the road which would have to be pumped and could present a risk of the road flooding in severe storm events,
- Railways: the need to span over railways to minimise disruption to rail services during construction,
- Utilities: the need to minimise the number of costly utility diversions, by routing above buried services where possible and under overhead High Voltage power lines with sufficient headroom,

- Geology and Soils: the variable ground conditions encountered along the scheme and the engineering suitability of the natural material excavated from cuttings for use in embankments,
- Side roads: the need to provide bridges to take side roads over or under the mainline,
- Landscape, Visual and Noise impacts: the need to minimise these impacts where possible by lowering the alignment or by providing mitigation measures such as earthwork bunds, particularly where in proximity to homes.

Initial earthworks volumes have been estimated for each of the Route Corridor Options, and have contributed to the Option Comparison Estimates described in the following section 5.9. The earthworks volumes estimates indicate a current deficit of suitable fill material for all six Route Corridor Options in the region of 1.3 million cubic metres, in other words a deficit of natural subsoils and rock which would be suitable for use as an engineering fill for constructing embankments or as a structural fill material. However it should be noted that it may be possible to reduce this deficit by refinement of the vertical alignment of the preferred route, during future preliminary design.

The reasons for this deficit of suitable fill are:

- embankments on the approaches to bridges over main rivers and railways which increase the overall volume of fill required,
- the natural terrain/topography of the land between Longford and Bunbrosna (a distance of approximately 30km) is relatively level and there are various streams and rivers to be crossed. Few cuttings are possible to obtain the fill required on this section so that the road can cross over these watercourses,
- the sub-surface (superficial) geology of the study area includes peat bog and alluvial materials which are unsuitable as engineering fill.

It is likely that there will be substantial volumes of material excavated, including peat and alluvial soils which will not be suitable for reuse. This soft material would have to be redeposited within landscaping areas, or in borrow pits from which suitable fill material can be won and in which surplus unsuitable material can be redeposited. It is also likely that there will be a deficit of crushed rock within the scheme, which could be used as road sub-base and capping (the lowest layers of the road pavement) or as a structural fill material,. The few rock outcrops within the study area are generally avoided by the route Options in order to minimise landscape and visual impacts.

The initial estimate for the Route Corridor Options based on the initial Ground Investigation data, is that approximately 65% of the excavated material would be suitable for re-use.. The actual percentage suitable for re-use may vary very slightly from option to option, as for example Option 3 would have approximately 1km of rock cutting near Bunbrosna, whereas the other routes do not. However, this is balanced to an extent in the other options by the fact that they have the potential to win some rock from the disused quarry at Portnashangan, whereas Option 3 would not. In reality, these are very minor variations in volumes arising from cuttings of only 1km in length approximately, which are relatively insignificant in the context of the total earthwork volumes, because as mentioned above, all routes have to cross the relatively level terrain between Longford and Bunbrosna, a distance of approximately 30km.

Of the larger quarries within the study area as identified in the constraints study, Rhyne Quarry near Killoe to the north-east of Longford is active whereas Portnashangan Quarry near Mullingar (adjacent to the existing N4) is disused. There are other much smaller quarries (mostly disused) within the study area but at present none of these is large enough to supply the volumes of fill material which are likely to be required. Given the shortage of quarries in the middle of the study area, it is likely that there will be significant haulage of material from each end of the scheme to the centre of the scheme for all route options. Ground improvement techniques may also be necessary to improve the engineering properties of the natural soils to enable their reuse in the construction of the road.. Refinements to the vertical alignments as part of future preliminary design of the Preferred Route may reduce the total quantities of cut and fill.

5.4 Construction Phasing and Impacts during Construction

In order to minimise impacts during construction, it is usually preferable to start and finish each phase where a new Route Corridor crosses or passes close by the existing N4 route (preferably where a new junction is to be located) so as to minimise the need to divert traffic from the National Primary Route along roads of lower classification. For example, Route Corridor Options 1, 2, 4, 5 and 6 all cross the N55 south of Edgeworthstown and although this is approximately half way between Mullingar and Roosky, this may not be the most suitable place to finish a potential first phase from Mullingar. The reason is that on opening of this first phase, N4 traffic

would be routed along the N55 over a level crossing resulting in potential delays. If this has to be the end of Phase 1, it would appear necessary to construct the proposed N55 link from the new road back to the existing N4 within this phase.

Likewise the N55 North of Edgeworthstown might not be a suitable place to finish the first phase of Option 3, as it might route substantial volumes traffic through the centre of the town. Option 3 is more difficult to split into phases of equal length than the other five corridors because it does not cross the existing N4 except at either end of the scheme.

For Route Corridor Options 1, 2, 4, 5 and 6:

If split into three phases, then the most practicable phasing would appear to be as follows:

Section 1: Mullingar to Windtown
Section 2: Windtown to east of Longford
Section 3: East of Longford to Roosky

If split into two phases, the the most practicable phasing would appear to be:

Section 1: Mullingar to Windtown
Section 2: Windtown to Roosky

However the Route Corridor Options could also be split into two phases of unequal length:

Section 1: Mullingar to east of Longford
Section 2: East of Longford to Roosky

For Option 3 it would be difficult to split this corridor into two or three equal-sized sections for the reasons mentioned previously. It would be more practicable to split it into two phases of unequal length:

Section 1: Mullingar to east of Longford
Section 2: East of Longford to Roosky

As part of Preliminary Design of the Preferred Route, it would be possible to determine the optimum number and lengths of phases, taking into account significant factors such as traffic diversions, earthworks volumes and river and rail crossings.

River and rail crossings can be of particular importance in terms of phasing and programming construction works. It would be desirable to construct these major structures as early as possible to provide a haul route for lorries carrying material from cuttings to form embankments along the scheme. Lorry movements along the existing N4 would be reduced when these structures are completed. Given the length of the

scheme, a number of construction compounds may be required along the scheme. Access routes to the construction works via the existing N4 road would have to be minimised and points of access and egress clearly defined on local or regional roads. In defining access routes, which would be agreed with the appropriate road authority, it would be necessary to select local and regional roads of greatest carriageway width and with the most suitable existing junctions to cope with construction traffic volumes.

In the design of the Route Corridor Options the following issues which relate to minimising disruption during construction have been taken into account:

- The largest available gaps in existing development along side roads have been selected for the mainline alignments of the Route Corridor Options,
- Where side roads need to remain open to traffic consideration should be given to building the side road bridge off-line from the existing side road,
- Road over Rail bridges have been selected to minimise disruption to rail services during construction.

In the future design of the Preferred Route Corridor the following issues which relate to minimising disruption during construction would have to be taken into account:

- The specification and location of noise and visual impact mitigation measures,
- Consideration of advance works which could minimise disruption during construction,
- Lands Made Available (LMA) to include areas for borrow pits and construction compounds, where practicable.

To minimise disruption to local residents and businesses during construction, the following good practice should be considered:

- Routing of construction traffic only along local and regional roads able to cope with construction traffic volumes,
- Siting of construction compounds and site access/egress points away from residential areas,
- In summer months regular watering to keep dust levels down,
- Advance installation of permanent noise barriers (where practicable), so that noise levels are mitigated during construction,
- Maintain access to businesses and provide temporary signage to indicate that businesses are open as usual,

- Traffic Management for roadworks on existing roads scheduled and designed to take into account peak travel times and anticipated seasonal increases in traffic volumes, and to include clear signage and access routes for pedestrians to facilities such as crossing points and bus-stops.

5.5 Pavement

As the primary aim in this stage of the scheme is to identify Route Corridor Options, no detailed design has yet been undertaken for the road pavement design. However, based on the forecast Average Annual Daily Traffic (AADT) flows for the scheme, it is possible to derive an indicative pavement construction depth, excluding any additional capping layer requirements in areas of soft ground, the requirement for which would have to be determined from in-situ California Bearing Ratio (CBR) plate tests. The design of the road pavement layers above the capping layer (if required) depends on the forecast volumes of commercial vehicles over 3.5 tonnes in weight, which includes lorries and Public Service Vehicles such as coaches and buses. The cumulative traffic loading of the heavy vehicles is expressed in terms of traffic flow in million standard axles (msa). HD 24/96 (with December 2000 addendum) is the relevant design standard for calculating traffic flows in msa and HD 26/01 (with January 2005 addendum) is the relevant design standard for determining the appropriate road pavement layer types and thicknesses.

5.6 Drainage

The hydrological and hydrogeological impacts of the Route Corridor Options have been appraised in the Environmental Appraisal chapter of this report (Chapter 4), in sections 4.7 and 4.9. At this stage, as only 300m wide Route Corridor Options are being considered, no detailed drainage designs can yet be carried out. However, allowance has been made for the cost of drainage works in the Option Cost Estimates and the potential hydrological and hydrogeological impacts of the Route Corridor Options have been appraised, particular in terms of the sensitivity of receiving waters and groundwater (e.g. aquifers), both in terms of aquatic and riparian ecology and waterbodies from which drinking water is obtained. This section considers the Sustainable Drainage Systems which might typically apply to this scheme. Such systems are known as SuDS and are considered in the design standard HD 33.

The principal NRA design requirements for road drainage are as follows:

- HD 33/06 (with January 2009 addendum) ‘Surface and Sub-surface Drainage Systems for Highways’ and associated Advice Notes referenced therein,
- RCD 100 Series details show the general arrangement and positioning of drainage pipes in the verge and median, relative to other items,

- RCD 500 series comprises the standard details for drains, manholes, gulleys, catchpits, headwalls, channels, inlets and outlets.

It should be noted that the actual requirements for drainage measures to be applied to the Preferred Route would be developed in line with the above and through consultation with the relevant Statutory Authorities.

One of the first principles of drainage design is to identify suitable receiving groundwaters or watercourses for outfalls at the end of the drainage runs. It is necessary to consider the various attributes of each surface waterbody in terms of ecology, flooding and drinking water or water abstraction if relevant. It is necessary to consider the sensitivity of the receiving watercourse and whether it is possible to convey runoff to a less sensitive receiving watercourse further along the scheme. Watercourse sensitivity comprises two primary elements; flood sensitivity, i.e. the remaining capacity of the receiving watercourse to accept the additional flow, and water quality sensitivity, which may relate to ecology or to drinking water or both.

Firstly, taking flood control into consideration, the design standard requires that the road drainage which receives the runoff from the carriageways is to be designed to cope with a storm of 1 in 5 year return period. At present there is no specific return period specified for the design of flood control measures (e.g. ponds or tanks) but they are now typically designed to a 1 in 100 year return period plus a further 20% increase in rainfall intensity to allow for climate change, and to ensure that the peak flows from the road are restricted to the equivalent 'greenfield' peak flows.

HD33 provides further detail, but in summary flow control can be achieved in several ways:

- A control device at the outfall such as an orifice plate or hydrobrake to restrict the flow, together with larger sized drainage pipes upstream, designed to store the runoff and discharge it slowly over several hours,
- Buried tanks or attenuation ponds at suitable locations along the scheme, to store water and release it slowly over a long period of time through the base of the pond by infiltration or to soakaway (where soil permeability allows and groundwater is not highly vulnerable) or to a receiving watercourse,
- Sustainable drainage techniques such as filter drains, swales and filter strips, all of which slow down the flow of water and promote infiltration/percolation

In terms of maintaining water quality and controlling contaminants carried in road runoff, the following steps can be taken;

- Sealed pipe drainage systems where it is necessary to protect highly vulnerable aquifers or sensitive waterbodies,
- Pollution control measures to trap contaminated particulates and hydrocarbons in the runoff, as close to source as possible, which may take the form of grassed swales in the road verges and/or vegetated ponds or constructed wetlands or buried bypass interceptor tanks at suitable locations along the scheme,
- Spillage control by containment, which may include fitting penstocks/pollution control valves to outfalls and the inclusion of buried full retention interceptor tanks. Attenuation ponds can be fitted with penstocks which can be closed in the event of a road tanker spillage.

In relation to springs or streams where the road is in cutting, typical measures include provision of cut-off drainage at the top and toe of cuttings to intercept runoff from adjacent land and from the cutting faces. This runoff is usually conveyed in a separate drainage system to the road drainage and is conveyed to its original destination by means of a cross-carriageway pipe or culvert below the new road, located where the new road emerges from the cutting. The aims of these measures are to ensure that runoff received from adjacent land or springs is not mixed with road drainage and that the runoff is conveyed with the shortest possible diversion to its original destination (in order to maintain existing drainage patterns and thereby minimise environmental impacts). Detailed mapping of existing springs, streams and other watercourses forms part of the Preliminary Design of the Preferred Route.

All the measures described above are now common practice on major road schemes in Ireland, where sensitive waterbodies or groundwaters are close to the national road, and as such are taken into account in the appraisals of hydrology and hydrogeology which in common with all of the appraisals, consider potential impacts post-mitigation.

5.7 Utilities

It is not possible at this stage to determine precisely the extents and the exact requirements for utility diversions for each option, as they are heavily dependent on the final horizontal and vertical alignments. However, for each utility network the

number of utility crossings along each corridor has been tabulated in the following sections to give an indication of the extent to which the corridors affect utilities.

5.7.1 Electricity Supply Network

The electricity supply networks generally comprise Medium and Low Voltage (MV/LV - 10kV/20KV and 230V/400V) lines and some High Voltage (HV) lines (HV - 38kV / 110kV). A 110kV line is only present at one location within the study area, just to the south of the R394/N4 junction at Mullingar. This 110kV line passes through the most southerly extremity of the study area and is not affected by any of the Route Corridor Options.

The majority of the electricity supply network in the Study Area comprises overhead MV lines, with some 38kV HV lines between Roosky, Newtown Forbes, Longford Town and Edgeworthstown, and also near Mullingar.

Generally, HV lines tend to have the greatest potential to constrain route options and/or add significant cost and delay to the construction works. Overhead HV lines are relatively few within the Study Area and typically run through open rural areas, where it should be possible to align the routes to avoid existing HV pylons or posts and give adequate headroom. The 38kV overhead line network in the Study Area can be broadly defined in three parts;

- the 38kV overhead lines in Longford Town and the surrounding area;
- the 38kV overhead lines running northwards from Longford Town to Newtown Forbes and Roosky; and
- the 38kV overhead lines running between Longford Town and Edgeworthstown, which run for the majority of their length on the south side of the existing N4.

Underground 38kV lines are very few in the Study Area and are limited to short lengths at three specific locations; two adjacent to the south side of the Longford Bypass and the third at a new development on the north-west side of Edgeworthstown. Only Option 2 would potentially affect buried HV lines, near the Longford Bypass. There are two large electricity substations at Longford Town; one to

the north which is adjacent to the N4 and one to the east at Glebe. Neither of these substations would have to be relocated for any of the Route Corridor Options.

ESB has responsibility for future planning of electricity networks of up to 110kV. Eirgrid has responsibility for future planning of overhead lines over 110kV. It is understood from ESB and Eirgrid that there are no current plans for new transmission lines of 110kV or more in the Study Area and that there are only very few outline proposals for 38kV works currently in preparation, which have yet to be confirmed.

It is possible for all of the Route Corridor Options to avoid the existing substations and overhead HV posts and pylons from which the most significant relocation or diversion costs would otherwise occur. It is important in the Preliminary Design of the Preferred Route to ensure that adequate headroom be given to overhead lines, in the design of the vertical alignment and that the position of HV posts and pylons be taken into account in the design of the horizontal alignment.

Table 5.7-1 Electricity Network crossings by Route Corridor Option

Route Corridor Option	Approximate Number of LV (230V/400V) and MV (10kV/20kV) crossings	Approximate Number of HV (38kV) crossings
Option 1	62	4
Option 2	54	5
Option 3	40	3
Option 4	53	3
Option 5	58	5
Option 6	61	4

5.7.2 Telecommunications Infrastructure

The telecoms infrastructure in the Study Area, comprises underground ducting containing copper core or fibre optic cables. These cables typically follow the road network. The cost of diverting copper core cabling is relatively inexpensive, the cost of realigning them is usually proportional to the density of cables. In the table overleaf, only the number of trunk cables crossed has been estimated, it is possible that there may be numerous uncharted single line connections to the trunk network which may also be affected. Fibre optic cabling is much more costly to divert, but due to the minimal amount of this type of cable within the Study Area (primarily the Longford Town Municipal Area Network) it does not significantly affect the Route

Corridor Options. Where the existing N4 is crossed over by a corridor then it should be possible to span the N4 and leave the buried utilities in-situ.

To the south east of Longford town the existing N5 has broadband fibre optic cables which are located in the verge and would be crossed by Option 5. However, if the verge of the existing alignment is in the same position as the verge of the new alignment then the cables will not have to be moved. It is preferred that they should not be moved or if necessary realigned as little as possible i.e. slewed gently into place. Further liaison with the broadband cable provider may be required during the Preliminary Design of the Preferred Route.

Table 5.7-2 Telecoms crossings by Route Corridor Option

Route Corridor Option	Approximate Number of Trunk Copper Core Cable crossings	Approximate Number of Fibre Optic Cable crossings
Option 1	50	
Option 2	53	1 (laid in verge along Longford Bypass, may be possible to slew or leave in-situ)
Option 3	40	
Option 4	56	
Option 5	57	1 (laid in verge along N5, can span over)
Option 6	50	

5.7.3 Gas Supply Network

Enquiries with Bord Gais Éireann during the Constraints Study phases of the project confirmed that there were no gas transmission pipelines within the Study Area. Residential and commercial properties within the Study Area are not linked to a gas supply, with the closest properties linked to distribution lines being located within the town of Mullingar. Consequently the Route Corridor Options do not affect gas pipelines.

5.7.4 Water and Sanitary Services

Foul and storm water sewers are relatively few in number and size across the study area, therefore diversions should not be numerous or particularly costly. Consultation with the County Westmeath Water Conservation Officer has indicated that the majority of rural homes have private septic tanks or are connected to local sewerage treatment facilities within the smaller settlements such as Bunbrosna, Ballinalack and Rathowen. The cost of diverting small diameter drains and sewers is comparatively inexpensive in relation to other utilities. In relation to larger diameter drains and sewers (typically above 300mm diameter) provided that there are few constraints to the alignments of the new main road and its side roads then the road alignments can usually be designed such that the drains or sewers can continue to operate by gravity without need for diversions, and so any associated costs should be minimal. The Rathowen (proposed) and Ballinalack (existing) sewerage schemes are both in close proximity to Route Corridor Options 1, 2, 4, 5 and 6, but in each case should not have to be diverted, as the vertical alignment of these Route Corridor Options could allow the pipes to pass beneath. It might be necessary to protect the pipes associated with the Rathowen scheme from additional loading by placing them in a duct or sleeve as they pass beneath the new road. These pipes could continue to follow the alignment of the existing side road and the proposed bridge for the side road could be placed to one side, so that the bridge foundations would not interfere with the pipework. The pipes associated with the Ballinalack Scheme would be spanned by the proposed Inny River Bridge in each of the Route Corridor Options mentioned, so should not require special protection measures.

Water mains are much more numerous and so have greater potential to add to the construction costs. Public drinking water for Co. Longford is provided by five regional water schemes. Longford Central is one of these schemes and it supplies water to the population of Co. Longford within the Study Area. Approximately 1,000km of minor pipeline distributes water around Co. Longford and in the Study Area. The approximate number of crossings of the water main network is given in the table overleaf. In County Westmeath, Lough Owel supplies drinking water to approximately two-thirds of the county, including all parts of the county within the Study Area.

A 500mm diameter water main has been recently laid along the south side of the existing N4 Longford Bypass from the Ballinalee Roundabout (N4/N5) to the Dublin

road roundabout N4/R393. For the first 150 metres from the N4/N5 roundabout heading south, the watermain runs in the back of the verge due to the presence of existing services in the verge. The waterman is in the verge for the remaining length. It is possible that some protection measures and minor diversions might be required, but given that it has been laid as far back in the existing verge as possible and is primarily located on the south side of the Longford Bypass, it does not represent a major constraint to Route Corridor Options in this vicinity. Other lengths of the pipeline would need to be realigned/diverted by approximately 300m in order to create a right-angled crossing under Options 1, 3 and 6 rather than skewed. Similarily the pipeline would have to be diverted by approximately 100 m to pass under Option 2 at a right angle.

Table 5.7-3 Water Main crossings by Route Corridor Option

Route Corridor Option	Approximate Number Water Main crossings
Option 1	29
Option 2	29
Option 3	29
Option 4	30
Option 5	32
Option 6	32

5.8 Structures

5.8.1 Summary

This section focuses on the major structures anticipated along the various Route Corridor s. At this stage the precise number and locations of the numerous side roads, overbridges, underbridges, underpasses, accommodation bridges and culverts has not been finalised and is subject to alteration throughout the preliminary design phase. Tables identifying the estimated minimum number of anticipated structures along the Route Corridor Options can be found in Appendix 23, Volume II. Table 5.8-1 is a summary table which is presented below and gives the total minimum numbers of structures anticipated along each Route Corridor Option.

At this stage the use of overbridges as opposed to underbridges / underpasses (and vice versa) cannot be specified at the intersection points of the minor and major roads. The use of box culverts has been assumed to accommodate the minor water courses. In some cases pipe culverts may be sufficient following hydraulic assessment of these channels during the detailed design phase. The form of construction indicated in the tables is indicative only and is subject to alteration during future design phases.

5.8.2 Rail Bridges

A number of factors will need to be taken into account in the design of the rail bridges. The bridge are to be designed and built to satisfy the Iarnród Éireann track clearance requirements i.e. minimum design clearance of 5.3m vertical and minimum 4.5m horizontal clearance (from running edge of the nearest rail of the track) in accordance with Iarnród Éireann Infrastructure Technical Standard for the Permanent Way, PW3.

In addition to accommodating the existing railway, provision should be made for future adjacent rail lines. Horizontal clearances must also take into account visibility splay issues, requirements for lineside clearance, and requirements for track superelevation and track curvature. These issues will be determined through future consultations with Iarnród Éireann during the detailed design stage.

5.8.3 River Bridges

A river bridge must provide the minimum vertical clearance and span required to cope with the flood characteristics of the river and any environmental requirements. This may be achieved by means of a single span or with additional flood relief culverts on either side of the river bridge, depending on the flood plain associated with the watercourse. The hydraulic design of the waterway beneath the bridge must satisfy the requirements of the relevant authorities, i.e. the Office of Public Works and the Shannon Regional Fisheries Board. Further requirements may apply to those bridges passing over rivers serving as navigable waterways. Local authorities and the Shannon Regional Fisheries Board may also require adequate headroom and bank accessibility to conduct inspections/survey work.

5.8.4 Existing Road Bridges

The Knockdrin Bridge was built in 1991 and carries the L5706 over the N4 just to the west of the R394 Castlepollard Road. It is currently the only existing road bridge which would be directly affected by the scheme. The form of the structure is a cast-insitu reinforced concrete arch supporting a reinforced concrete deck slab. The arch is supported on bank seats which are separate from the abutments supporting either end of the deck slab. As mentioned in section 5.2.1 a Departure from Standards application would be necessary to allow a reduced cross-section for the dual carriageway beneath the bridge. The proposed reduced cross-section takes into account the minimum horizontal clearance of 4.5m from edge of carriageway, therefore a Bridge Collision Risk Assessment as per BD 60/94 will not be necessary.

The 2002 Eirspan Inspection Report for this bridge does not identify any particular damage or condition problems with this structure. Nevertheless an up-to-date condition survey would be recommended to confirm that the lifespan of the structure is as designed. The structure is located within a rock cutting and is founded on rock. The structural form is such that there would not be particular concern in relation to vibrations caused by normal construction plant operations, but vibrations caused by rock blasting would be a concern. If rock must be excavated in proximity to the structure to lower the carriageway, then excavation works at or near the bank seats ought be avoided and consideration should be given to low vibration techniques, such as localised splitting of rock by means of injected resin which also gives a high degree of control over the extent excavated, thereby minimising overbreak. The zone of

influence of the loads transmitted through the foundations into the rock strata and the bedding of the rock would have to be taken into account in the design of any excavations close to the structure and in the design of any retaining walls adjacent to the bank seats, if required.

5.8.5 Conclusions

It is not possible to identify all of the minor structures and their locations at this stage, such as agricultural underpasses, because these depend upon specific landowner access requirements and would be determined during Phase 4 (Preliminary Design of the Preferred Route). In some cases it may be possible to increase the size of a box culvert to allow for a vehicular underpass or a cattle creep within the same structure.

Table 5.8-1 Estimated Number and Types of Structures along Route Corridor Options

Route Corridor Option	No. of Box Culverts	No. of River Bridges	No. of Rail Bridges	No. of Overbridges / Underpasses
Option 1	16	4	3	43
Option 2	27	6	3	40
Option 3	17	5	3	44
Option 4	12	4	3	38
Option 5	14	5	3	45
Option6	18	4	3	45

5.9 Cost Estimates

Option Comparison Estimates (OCEs) have been prepared for each of the six Route Corridor Options, based on the engineering aspects mentioned in this chapter, in line with the requirements of the NRA Cost Management Manual Version 1 (October 2007). The method of measurement followed is as outlined in the Cost Management Manual. The OCEs comprise base costs under seven principal headings; Main Contract Construction, Main Contract Supervision, Archaeology, Advance Works, Residual Network, Land and Property, Planning & Design. Costs were calculated for each of the Route Corridor Options using the current NRA Roadworks Unit Rate Database Version 3 – Base Date May 2008. Inflation and Programme Risk allowances were added onto the base estimates. The OCEs were then reviewed by the NRA Cost Management Unit and approved for use in the economic appraisal.

Further details regarding the inputting of the OCEs into COBA program in order to calculate the scheme economics, are given in Chapter 6.

5.10 Engineering Appraisal: Conclusions

The conclusions of the Engineering Appraisal chapter can be summarised as follows:

- **Design Standards:** All six of the Route Corridor Options are feasible from an engineering perspective and could comply with the relevant design standards
- **Non-Motorised Users:** by careful design NMUs can be provided for along all six Options to ensure a neutral impact. The appraisal of impact on NMUs has fed into the appraisal for the Transport Integration element, discussed further in the next chapter
- **Security:** the Security element of the Project Appraisal Balance Sheets (PABS) has been appraised; Option 2 would have a slightly negative impact whereas the other five Options would be neutral for this element
- **Earthworks:** Areas of soft ground have been identified in the Geology section of the Environmental Appraisal and have been taken into account in the appraisal of earthworks, which in turns feeds into the Option Comparison Estimates (OCEs). There is likely to be a deficit of suitable fill material on all six Options, which could be mitigated by use of nearby quarries and borrow pits
- **Construction Phasing and Impacts:** each of the Route Corridor Options could be broken down into separate phases if desired although Option 3 would not lend itself so easily to phasing as the other Options as it does not cross the existing N4 except at either end
- **Pavement:** a conventional pavement design which would apply to all six Options has been estimated and included in the Option Cost Estimates
- **Drainage:** flood and pollution control measures have been described and could be applied where hydrological assessments require e.g. near sensitive waterbodies
- **Utilities:** a range of utility networks exist across the study area but none of these appears to present major constraints to Route Corridor Options. The major utility pipes or cables have been avoided where possible. Numerous minor diversions or protection works would be required along all six Options. Options involving on-line widening would require a slightly higher number of such diversions or protection works

- **Structures:** The six Options would all have a similar number of major structures. There is a relatively low variance in the numbers of other ordinary bridges or minor structures across the six Options, those Route Corridor Options which are furthest from the existing N4 tend to have a slightly lower numbers of these types of structures. The costs of the various types of structures has been taken into account in the Option Comparison Estimates. All Options require three crossings of the Dublin to Sligo railway line.
- **Cost Estimates:** Option Comparison Estimates have been prepared and have fed into the Economic Appraisal in the next chapter

6 Traffic & Economic Appraisal

6.1 Introduction

The Traffic and Economic Appraisal contributes to the Project Appraisal Balance Sheets (PABS) by covering the criteria of Economy but also contributes the Integration criteria by means of the appraisal of the Transport Integration element, which involves considering how the scheme fits into the road network and with other modes of transport.

The approach to the appraisal under the Economy heading, for each of the Route Corridor Options was as follows:

- Gather a range of Traffic Survey data from within the study area,
- Construct and Validate a Traffic Model in the SATURN software to represent the actual traffic patterns in the study area as closely as possible,
- Forecast the traffic growth which could take place between the potential scheme opening year of 2015, through to the design year 2035.
- Calculate the scheme economics including the ratio of Benefits to Costs using the COBA Program.

6.2 Traffic Surveys and Model Building

The following is a list of the traffic surveys which were undertaken in order to develop the 2008 base SATURN traffic model;

- Automatic Number Plate Recognition surveys (ANPRs);
- Long Term & Short Term Automatic Traffic Counts (ATCs)*;
- Manually Classified Junction Counts (MCJC) to identify weekday turning movements at key intersections;
- Vehicle journey times surveys along the N4 and on other well-used routes within the study area;
- Queue Length Surveys; and
- Road Side Interview surveys (RSIs).

* existing NRA traffic counters were also used for comparison purposes

As far as possible, survey dates were chosen to avoid unusual events which might otherwise give atypical survey results, such as major roadworks or public and school holidays. In particular the Easter holiday period was completely avoided, substantial allowances being made either side of the bank holidays and observed holiday dates (in 2008 Good Friday fell on the 21st March and Easter Monday on the 24th March). Also the May bank holiday was avoided, which fell on the 5th May in 2008.

ATC data were recorded in 15 minute intervals for a period of 2 weeks in both directions, commencing on 27th/ 28th February 2008 at various sites around the study area. Likewise, ANPRs were sited close to many of the ATCs on the 4th March 2008 to record vehicle registrations in order to build up a picture of trip patterns within the study area. MCJC (turning count) surveys were undertaken between 27th February and 6th March 2008 within the study area. Journey time surveys were undertaken between May 12th and 15th 2008. Queue length surveys were undertaken in conjunction with the journey time surveys during the AM, PM and Off peak periods between May 12th and 15th 2008. The RSI surveys were undertaken over a four day period from the 10th March 2008 to the 13th March from 7am-7pm each day. Neutral dates were selected for these traffic surveys, in terms of potential for variability in traffic volumes.

Table 6.2-1 summarises trip purposes recorded from road side interviews which took place on the N4 and N55 at Edgeworthstown from the 10th – 13th March 2008:

Table 6.2-1Summary of Trip Purposes from Origin Destination Surveys, March 2008

Purpose	Origin	Destination
Home	43%	25%
Holiday Home	0%	0%
Usual Workplace	16%	21%
Employers Business	24%	28%
Education	1%	1%
Shopping	2%	5%
Personal Business	4%	7%
Visit Friends	3%	3%
Recreation/ Leisure	1%	2%
Tourist	0%	1%
School Run	2%	1%
Other	4%	6%

As can be seen from this table, many of the trips made along the N4 are between the home and the workplace. Relatively few appear to be for other reasons, although the surveys were undertaken during a weekday, therefore some trip purposes would tend to be less prevalent, e.g. visiting friends, recreation/leisure, shopping etc which would tend to occur more frequently at weekends. Also the school run is typically limited to short periods in the morning and mid-afternoon. The following tables 6.2-2 to 6.2-5 summarise the top five destinations of traffic at Edgeworthstown from the road side interviews which were undertaken (the most frequently mentioned are at the top of each table).

Table 6.2-2Destinations of Traffic on N55 North of Edgeworthstown (Southbound)

AM Peak	Off Peak	PM Peak
Longford	Edgeworthstown	Edgeworthstown
N55 South	Longford	N55 South
Edgeworthstown	N55 South	Longford
N4 East of Mullingar	N4 East of Mullingar	N63 South of Longford
N63 South of Longford	Mullingar	N4 East of Mullingar

Table 6.2-3Destinations of Traffic on N55 South of Edgeworthstown (Northbound)

AM Peak	Off Peak	PM Peak
N55 North	N55 North	N55 North
Edgeworthstown	Edgeworthstown	Edgeworthstown
Longford	Longford	R194 North
Mullingar	N4 East of Mullingar	Longford
R194 North	R194 North	N4 East of Mullingar

Table 6.2-4Destinations of Traffic on N4 East of Edgeworthstown (Westbound)

AM Peak	Off Peak	PM Peak
N4 West of Longford	Longford	Longford
Longford	N4 West of Longford	N4 West of Longford
N5 West of Longford	Edgeworthstown	Edgeworthstown
N63 South of Longford	N5 West of Longford	N55 North
N55 South	N55 North	N5 West of Longford

Table 6.2-5Destinations of Traffic on N4 West of Edgeworthstown (Eastbound)

AM Peak	Off Peak	PM Peak
N4 East of Mullingar	N4 East of Mullingar	N4 East of Mullingar
Mullingar	Mullingar	Mullingar
N55 South	N55 North	N55 North
N55 North	Edgeworthstown	Edgeworthstown
Edgeworthstown	N55 South	N55 South

To provide some further detail in relation to the interviews on the N4 Longford, Mullingar and Dublin were by far the three most common origins and destinations of trips. Sligo, Edgeworthstown, Rathowen and Carrick-on-Shannon were the next most frequent origins and destinations. Many other places on or near the N4 were also mentioned. Analysis of the traffic surveyed on the N55 can be found in the appraisal of Linkage, section 6.6.1.

The SATURN (Version 10.8.15) suite of programs has been used in the model development, as it is considered to be the most accurate tool available to measure the effects of changes in traffic levels and the highway infrastructure, on both a link and junction basis.

The focus for the model is the route of the N4 and the towns and townlands connecting to the route. Thus, the network within the study area has been represented entirely as a 'simulation' network. This incorporates detailed layouts of links and junctions.

The extents of the SATURN network stretches from Tomisky in the north to Mullingar in the south of the study area and incorporates the towns of Newtown Forbes, Longford, Edgeworthstown and the villages of Rathowen and Ballinalack. The extent of the N4 Mullingar to Longford (Roosky) model is considered adequate for the purposes of this study.

Extensive checks have been made on the network configurations defined in the SATURN models, to ensure there is proper connectivity, consistent link distances and speeds and realistic capacities and permitted manoeuvres.

It is considered that the introduction of the N4 Mullingar to Longford (Roosky) scheme into the road network has no effect on the total volume of trip movements in the study area for any given future year Hence, the traffic and economic appraisals have been undertaken using a 'fixed trip matrix' approach. The 'trip matrix' of origin-destination, zone-to-zone, movements in a future year is assumed to comprise three components, namely:

- existing base year trip movements;
- background growth in the number of vehicles making these existing movements, based on NRA low growth and NRA high growth; and
- inclusion of central Longford Area Plan land use assumptions for an optimistic scenario.

The magnitude of these future movements in the trip matrix is not dependent upon the proposed N4 Mullingar to Longford (Roosky) scheme going ahead. Traffic growth will proceed independently of the road scheme.

The proposed scheme will involve the construction of a dual carriageway link which will increase N4 mainline capacity. Beyond the study area for this scheme, there are no nearby equivalent national or regional routes running in parallel that would compete with the N4. Consequently in the Do-Something scenario, the likelihood of reassignment of traffic to the N4 from beyond the study area is negligible.

6.3 Model Validation

In accordance with the DMRB the calibration/validation of the base SATURN model has required the calculation of a 'GEH error statistic'. The GEH is a standard measure of the correspondence between observed and modelled data. It indicates the accuracy of certain calibration measurements and makes allowance for the fact that an apparently considerable difference between two large flows can be insignificant in terms of percentage difference. Conversely, it takes account of the fact that an apparently large percentage difference between two small flows can be insignificant in absolute terms. The GEH statistic has been used in the calibration of trip matrices, network flows and network journey times in the N4 Mullingar to Longford (Roosky) model. GEH is calculated according to the following formula:

$$GEH = \sqrt{\left[\frac{(observed - modelled)^2}{(observed + modelled) \times 0.5} \right]}$$

Use has been made of speed/flow/capacity parameters in the simulation network. This gives a more accurate representation of route capacity and travel cost on roads where

an upstream link is more restricted than its downstream junction. Speed flow parameters have been used, categorised by road type, which correspond to parameters contained in COBA.

Three representative average weekday time periods were selected for modelling in SATURN at base year 2008, namely:

- AM peak hour 08:15 – 09:15;
- Average Off peak hour 10:00 – 16:00; and
- PM peak hour 17:00 – 18:00.

The AM and PM peak hours have been selected to reflect the heaviest directional traffic flows through the study area. Whereas, the main purpose of the average Off Peak Hour model is to provide data (for economic assessment) that can be extended to represent the whole period outside the two peak hours. All three models are representative of an average weekday for the associated time period.

A key indicator of the dependability of the N4 Mullingar to Longford (Roosky) traffic model is how close the modelled network flows compare against observed counts and how close the conformity is between travel times and speeds in the SATURN model and those observed on the road network.

It is expected that a reliable traffic model should pass several validation tests. These tests are defined in DMRB Volume 12 (Section 2, Part 1, Chapter 4, Table 4.2) and have been applied to the N4 Mullingar to Longford (Roosky) AM peak, Off peak and PM peak models.

In summary;

- The SATURN models for each peak period converged well, meeting all DMRB criteria;
- The correlation between the observed and modelled link counts met DMRB guidelines for each modelled period; and

- The models reproduced observed year 2008 junction turning counts to a satisfactory degree of accuracy for all three models.

The AM peak, Off peak and PM peak models all showed accurate comparison to observed conditions. The models are reliable in the critical areas, in terms of the matrix of origins/destinations movements, assigned traffic flows, route choice and network journey times.

Based on the results of the validation, it was considered that the N4 Mullingar to Longford (Roosky) model represents a robust basis for use in future year traffic forecasting and is suitable for operational, economic and environmental appraisals of the route options. 2008 (Base Year) flows from the traffic model are summarised in the preceding Table 2.2-3 in Section 2.2. 2015 and 2035 forecast flows are presented in Appendix 22 in Volume II.

6.4 Forecasting

After a satisfactory representation of the transport system at base year 2008 was achieved, a forecast of the future year movement at years 2015 and 2035 was developed both with and without Route Corridor Options. The predicted pattern and volume of movement has been used to assess the effectiveness of Route Corridor Options for the N4 Mullingar to Longford (Roosky) scheme.

6.4.1 Traffic Growth

Traffic growth from base year 2008 has been accounted for in all of the model forecasts. Traffic growth is considered to be inevitable in response to economic and demographic change. However, the rate of traffic growth and the amount of movement between particular zones is uncertain. Therefore, a range of growth forecasts has been developed corresponding to the 'most likely', 'pessimistic' and 'optimistic' cases, respectively.

For simplicity, the range of growth forecasts has been identified as follows:

- Medium case (equivalent to most-likely situation);
- Low growth (equivalent to pessimistic situation); and

- High growth (equivalent to optimistic situation).

Medium Case, Low Growth and High Growth forecasts have been produced for each of the three modelled time periods, (AM Peak, PM Peak, and Off Peak) for 2015 (the assumed opening year) and 2035 (20 years after opening). The determinants of each growth scenario are as follows:

- NRA national traffic forecasts and
- Longford Local Area Plan.

Components of the respective growth scenarios have been assumed to include the following:

- Low Growth
  - application NRA Low traffic growth only.
- Medium Case Growth
  - application of NRA High traffic growth only.
- High Growth
  - application of background growth using NRA High traffic growth; and- inclusion of Longford Northern Environs Local Area Plan (LNELAP) land use assumptions.

In accordance with NRA guidelines the NRA Future Traffic Forecasts 2002-2040 (August 2003) have been rebased and are reproduced below in Table 6.4-1.

Table 6.4-1 Future Traffic Growth Factors Rebased to 2008

Road Type/Growth Scenario	2008		2015		2035	
	PC	HV	PC	HV	PC	HV
National Primary (NRA High Traffic Growth)	1.00	1.00	1.50	1.50	1.45	1.57
All Roads (NRA Low Growth)	1.00	1.00	1.37	1.37	1.33	1.42

Source: NRA Future Traffic Forecasts 2002-2040 (August 2003)

The LNELAP is a strategic policy outline, which sets the context of further development of Longford between 2008 and 2014 in the area between the existing N4 and the town centre.

Longford is designated “as a principal town in the polycentric model of the region”. The town experienced an 11.6% growth in population between 2002 and 2006 which was higher than both the regional and county growth. This may have been substantially due to the fact that the area was included in the Upper Shannon Rural Renewal Scheme which offered tax incentives for residential and commercial development that obtained planning permission between 1998 and 2004.

In the LNELAP the population of Longford is estimated to grow to over 12,000 by 2009 which is an increase of approximately 11% per annum over 7 years. In the current economic climate this may be an optimistic scenario, but there is no reason to believe that the projections will not occur, albeit at a later date.

The LNELAP extends to 2014. Even if the rate of growth is slower than anticipated there is no reason to assume that substantial growth in Longford town and the surrounding county by 2035 (the design year for the currently proposed improvement of the N4) will not occur. This growth therefore needs to be included as part of the appraisal process.

The plan itself sets out two growth scenarios, firstly the ‘worst’ case in which it is assumed that all available land is developed by 2013 and secondly an ‘expected’ case which takes a more realistic view on the level of additional development by 2013 as set out in Table 6.4-2. The table also includes comparable data extracted from the NRA’s National Model for 2025.

Table 6.4-2 LNELAP Scenarios

Land Use	LNELAP Worst Case Scenario (2013)	LNELAP Expected Case Scenario (2013)	National Model (2025 Longford Zone)
Residential	4800 units	2240 units	1998 units
Industrial	206,000 sqm GFA[1]	117,000 sqm GFA[1]	No Data for Comparison
Mixed Use	128,000 sqm GFA[1]	55,000 sqm GFA[1]	No Data for Comparison
Commercial	100,000 sqm GFA[1]	62,400 sqm GFA[1]	No Data for Comparison

([1]. – Gross Floor Area)

Bearing in mind that Ireland is currently suffering from an economic downturn, it has been assumed that the LNELAP 'expected' case is the optimal scenario to be included. Also, to ensure reasonable consistency with the National Model it has been assumed that the development is not all in place by 2013 but occurs over time up to 2025 using a linear profile.

The model statistics for each of the forecast years demonstrates a good level of convergence. The estimates of future year traffic are considered robust and have been used to assess the proposed route options.

6.4.2 Flow Volumes

Model output flow volumes have been factored from AM peak, Off peak, and PM peak model periods to 24 hour annual average daily traffic flow (AADT) equivalent, in vehicles per day.

The output AADTs from the model are given in Appendix 22, Volume II and shown on drawings RFig 6.1 – 6.7, Volume III. A comparison is also included between the Do Minimum scenario **(NOTE**: The Do Minimum Option reported on in Section 3.3.1

relates to the on-line widening of the existing N4. The Do Minimum scenario in this chapter is equivalent to the Do Nothing Option in Chapter 3) and the six route options. Future year forecasts for 2015 and 2035 have been produced for each network option under Low, Medium and High Growth Conditions, and are shown at Appendix 22, Volume II.

6.5 Cost and Benefit Analysis

The economic performance between 2015 and 2044 of the 'Do-Something' (DS) situation (i.e. with a particular Route Corridor Option in place) has been compared against the 'Do-Minimum' (DM) situation, i.e. if the N4 Mullingar to Longford (Roosky) project does not go ahead but other committed road improvements in the study area are constructed. In this way, the economic performance of all six Route Corridor Options have been assessed. For major road schemes in Ireland, a 'design year' approximately twenty years from the provisional date of road opening is set (in this case 2035), whereas a thirty year assessment period from the opening year is applied. No further growth is applied after 2035. The selection of road type and junction provision is based on the forecast traffic flows in the design year.

The economic appraisal for this scheme has been based upon a Do-Minimum situation where all known committed improvements are undertaken prior to the opening of the new route, as is common practice. This includes the construction of the N5 Bypass at Longford Town, which would connect the N5 national primary route with the N4 by means of a single carriageway road on the western side of Longford Town.

6.5.1 COBA Specification

COBA calculates user benefits in terms of savings in travel time, vehicle operating costs and accident savings. The benefits are compared to the scheme costs of construction, land, preparation and supervision costs. The economic assessment has been undertaken with the Irish version of COBA version 11 Release 8.

The default parameters within COBA11 are set with Irish Standards and recommendations, as detailed in National Roads Authority (NRA) 'Guidelines for Cost Benefit Analysis, July 2005'. All NRA default values for a National Primary Route have been used.

The anticipated scheme-opening year is 2015 and the evaluation period is 2015 to 2044. This is in line with the NRA's guidelines, which stipulates a 30-year evaluation period following the scheme-opening year, but with traffic growth applied only up to 2035.

COBA11 (rather than output from the SATURN traffic model) has been used to evaluate the junction delays associated with each scheme assessment period. This procedure is reasonably accurate, but junction delay has been 'cut-off' at a maximum of 5 minutes in the economic evaluation. This limit is set, because COBA11 is relatively imprecise at predicting long junction delays when compared to the detailed SATURN simulation model.

6.5.2 Road Standard and Junction Provision

Introduction

It should be noted that the final decision on road standards, junction types and locations applicable to the Preferred Route, will be made following future evaluation during the preliminary design of the Preferred Route. The following should therefore be regarded as indicative.

The selection of potential junction locations and types must weigh up the following issues:

- **Design Standards governing permitted junction types for particular road types** as per TD9/07 and TD10/07,
- **Sufficient demand, as demonstrated in the traffic model, to require a junction at a particular location** (i.e. sufficiently high forecast turning flows). This is determined by means of testing junction locations in the traffic model and siting junctions as conveniently as possible for major destinations or routes so as to minimise journey times. This question is directly related to the economic justification of junctions, because if there is low demand in the traffic model, the cost of the junction might outweigh the benefits it could achieve,

- **If the demand is served by a new junction, any other consequences,** e.g. providing a junction could give unintended results in terms of excessive traffic flows along particular sections of road or through particular junctions, which might cause delays, safety problems or environmental impacts.

- **Operational performance of new junctions at particular locations.** Detailed evaluation of operational performance is usually carried out during future stages of design, but it is necessary to give some consideration at this stage to any likely operational performance issues which might arise at particular locations. For example, with regard to at-grade roundabouts, the design standards do not specify particular capacity limits for at-grade roundabouts in terms of Average Annual Daily Traffic. The capacity of a roundabout depends not simply the total daily traffic flows through the junction but on several other factors , including the variability of traffic flows during the day, the proportion of right turning traffic, the size of the roundabout and the number of lanes available.

- **Potential environmental impacts of junctions at particular locations** e.g. in terms of impacts on nearby constraints. Typical questions include; Would the junction cause excessive impact upon features of environmental importance or sensitivity? Would the junction be raised up above the surrounding landscape if sited at a particular location? Can the junction be relocated to reduce the impacts or can the impacts be mitigated?

Potential Road Standard and Junction Provision for Route Corridor Options 1, 2, 3, 4 and 6

In taking the design standards and the above aspects into account it was found that for Route Corridor Options 1, 2, 3, 4 and 6 a current permissible road standard and junction provision in accordance with design standards, could be as follows;

- Type 2 Dual Carriageway from Roosky to Longford (R194), including one at-grade roundabout near Carrickmoyragh, north of Newtown Forbes,

- A junction at the R194 would be located near the transition from Type 2 to Type 1 Dual Carriageway (the junction layout is to be confirmed during the future preliminary design stage)

- Type 1 Dual Carriageway from Longford (R194) to Mullingar (R394 Castlepollard Road Junction), including three Full Grade Separated Junctions of a

dumb-bell layout type between the R194 and R394; one sited on the existing N4, to the east of Longford Town, one sited on the N55 at Edgeworthstown and one close to the existing N4 at Portnashangan.

NRA Design Standard TD 10/07 requires that where a junction is to be provided between a Type 2 Dual Carriageway and a side road carrying more than 3000 vehicles per day AADT, the junction type must be a roundabout. Compact grade-separated junctions are permitted on a Type 2 Dual Carriageway where the side road flows are between 1000 and 3000 vehicles per day. TD10/07 does not currently allow full grade-separated junction layouts on a Type 2 dual carriageway.

The R198

A roundabout junction on the R198 was not provided because of the potential problems with queues and delays which could result given that the volume of traffic on the R198 Drumlish Road is high relative to the flows on nearby sections of the N4, in all scenarios. Reference to the flows for Link IDs 8 and 9 in the tables in Appendix 22 in Volume II illustrates this point. Furthermore the tables indicate a high volume of traffic heading out of Longford Town in the evening from the N5 Ballinalee Road, using the N4 Longford Bypass and turning right at the N4-R198 Red Cow Roundabout. The concern would be that if a junction were to be provided at the R198, then this heavy right-turning flow would transfer onto the relevant N4 Route Corridor Option north of Longford Town, causing an adverse effect on capacity. Traffic approaching this roundabout on the eastbound N4 would have to yield to this right-turning traffic and so queues on the N4 would result. Likewise, the corresponding flow into Longford Town in the morning would cause a similar problem at the R194 Ballinalee Road Roundabout, causing queues on the westbound N4 approach.

Potential Road Standard and Junction Provision for Route Corridor Option 5

In relation to Route Corridor Option 5, which bypasses Longford Town on the south side, a current permissible road standard and junction provision could be as follows:

- Type 2 Dual Carriageway from Roosky to Longford (R393), including two at-grade roundabouts, one at Carrickmoyragh, north of Newtown Forbes, and another at the N5 west of Longford Town,

- The junction type at the R393 would be located near the transition from Type 2 to Type 1 Dual Carriageway therefore the junction type is to be confirmed during the future preliminary design stage (and with regard to any future revisions to the relevant design standards)
- Type 1 Dual Carriageway from Longford (R393) to Mullingar (R394 Castlepollard Road Junction), including two Full Grade Separated Junctions of a dumb-bell layout type; sited at the N55 south of Edgeworthstown and close to the existing N4 at Portnashangan.

In summary, the proposed junction strategy provides a satisfactory means of connecting with the existing roads and communities and complies with the basic feasibility criteria mentioned previously. Junction locations and layout types will be reviewed during the Preliminary Design phase.

6.5.3 Option Comparison Estimates (OCEs)

The OCEs were prepared to the latest Base Date (May 2008) as described in Section 5.8. As per NRA guidelines, the construction costs have been factored to the equivalent general price level using a Relative Price Factor for 2002 of (x 1.00).

In addition, the costs at 2008 values have been re-based to 2002 prices using the Irish Consumer Price Index for the respective years. The re-basing factor is (x 0.82).

Allocation of capital costs to different scheme years was estimated. For the Do-Something schemes (i.e. the Route Corridor Options), a construction period of 3 years has been assumed. Capital expenditure saving on maintenance is considered to be non-traffic related and is calculated automatically within COBA11.

Cost data have been converted for input to COBA using Appendix 12 of the NRA Project Appraisal Guidelines. This guidance note defines the practice to be followed in the preparation of cost data for input into Cost Benefit Analyses (CBAs) of road schemes.

6.5.4 Economic Results

Tables 6.5-1 to 6.5-3 provide the total Cost Benefit Analysis Summaries for the different growth scenarios by option. An option's total road user benefit is a 'net' value, because it represents the total positive benefits, less the negative disbenefits.

Table 6.5-1Cost Benefit Analysis Summary (NRA Low Growth)

Cost Benefit Analysis Summary	Market Prices (2002) in multiples of €1m					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Present Value of Benefits (PVB)	365.54	370.06	314.37	315.67	346.78	370.27
Present Value of Costs (PVC)	239.99	247.45	244.75	252.30	260.28	244.39
Net Present Value (NPV)	125.54	122.61	69.61	63.38	86.50	125.88
Benefit Cost Ratio (BCR)	1.52	1.50	1.28	1.25	1.33	1.52
Internal Rate of Return (IRR)	7.1%	7.0%	5.9%	5.7%	6.1%	7.2%

Table 6.5-2Cost Benefit Analysis Summary (NRA High Growth)

Cost Benefit Analysis Summary	Market Prices (2002) in multiples of €1m					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Present Value of Benefits (PVB)	419.26	424.49	364.53	365.29	405.04	425.31
Present Value of Costs (PVC)	239.88	247.32	244.60	252.20	260.14	244.29
Net Present Value (NPV)	179.38	177.17	119.93	113.10	144.90	181.01
Benefit Cost Ratio (BCR)	1.75	1.72	1.49	1.45	1.56	1.74
Internal Rate of Return (IRR)	8.1%	7.9%	6.9%	6.7%	7.2%	8.2%

Table 6.5-3Cost Benefit Analysis Summary (Longford Northern Environs Local Area Plan Based Growth)

Cost Benefit Analysis Summary	Market Prices (2002) in multiples of €1m					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Present Value of Benefits (PVB)	494.48	507.17	436.75	422.35	484.42	503.60
Present Value of Costs (PVC)	239.74	247.13	244.44	252.08	259.98	244.17
Net Present Value (NPV)	254.74	260.04	192.31	170.27	224.45	259.43
Benefit Cost Ratio (BCR)	2.06	2.05	1.79	1.68	1.86	2.06
Internal Rate of Return (IRR)	9.2%	9.1%	8.1%	7.6%	8.3%	9.4%

6.6 Transport Integration

The NRA Project Appraisal Guidelines (PAG) states that beneficial transport integration impacts may arise where the project:

- Provides a missing link in road networks
- Improves the linkage along key road corridors
- Improves the inter-connectivity between road and other modes
- Provides for public transport and non-mechanised modes as well as private car and goods vehicle use, and
- Provides access to other transport infrastructure such as ports and airports

These points are addressed in the following two sub-sections and the combined overall impacts presented.

6.6.1 Linkage

This sub-section addresses the first two bullet points for Transport Integration. The performance of the scheme in terms of improved linkage is closely related to the selection of road standard and junction provision for each of the six Route Corridor Options, which is explained in the preceding section 6.5.2.

All six of the Route Corridor Options would link two existing sections of Type 1 two-lane dual carriageway; the N4 Dromod-Roosky Bypass and the N4 Mullingar Bypass, which are at present connected by a single carriageway section from Mullingar to Roosky. It would therefore provide a missing dual carriageway link in the National Road Network.

Furthermore the scheme would provide improved linkage (either directly or indirectly) with other roads and places in the study area, e.g.

- N5 National Primary
- N63 National Secondary
- N55 National Secondary
- Places on or near the Existing N4 National Primary

- R194, R198, R393, R394, R395, R397
- Various Local Roads within the Study Area

All of the Route Corridor Options improve linkage between the roads mentioned, directly or indirectly. The level of priority for direct linkage with other roads must be regarded in the context of traffic flows and the origins and destinations of the majority of trips being made, which together indicate the level of demand for improved linkages.

Linkage with the N5 and N63

The N5 runs from the N4-N5 Ballinalee Road Roundabout just north-east of the centre of Longford to Westport, County Mayo.

Table 2.2-3 in the preceding section 2.2 showed that the 2008 two-way daily traffic flow on the N5 west of Longford was 7,766 vehicles per day, which was considerably lower than the traffic flows on the N4 and was also lower than the flows on some roads of lower classification such as the N63 and the R198. By reference to Table 6.2-4 it can be seen that N5 and N63 are generally the least significant destinations of westbound trips along the N4.

For trips along the N4 recorded at Edgeworthstown origins and destinations along the N5 west of Longford only feature in up to 13% of the interviews.

The N63 runs from the centre of Longford Town, through Roscommon Town, to join the N17 in County Galway. Of the most frequently mentioned origins and destinations for trips along the N4, as recorded at Edgeworthstown, Roscommon and other destinations along the N63 were mentioned in up to 7% of the interviews.

In summary, the origin and destination data collected from the interviews on the N4 near Edgeworthstown showed that trips to and from Longford, Dublin and Mullingar and other places along or near the N4 are dominant. The flows of traffic between the N4 east of Longford and the N5 and N63 are smaller. Although there is not a very high demand for direct linkage between the N4 and the N5 west of Longford Town such a link would provide relief to the congested town centre. Also there is not a very high demand for direct linkage between N4 and the N63 when compared with the demand for improved linkage between places along the N4.

It should be noted that the proposed single carriageway N5 Western Bypass of Longford Town, which will link the N5 with the N4, is being progressed as a separate

scheme. It is understood that it will be completed prior to the construction of the N4 Mullingar to Longford (Roosky) scheme and has been taken into account in the traffic forecasting for all six Route Corridor Options (Option 5 includes on-line widening of this bypass).

Linkage with the N55

The N55 begins at Cavan to the north and runs through Edgeworthstown to Athlone to the south. Tables 6.2-2 and 6.2-3 presented in the preceding section 6.2 summarise the main destinations of traffic using the N55 near Edgeworthstown, as recorded by interview. To give some further detail, of the traffic heading south on the N55 towards the centre of Edgeworthstown the most frequent origins recorded were Granard and Edgeworthstown itself and the most frequent destination recorded was Longford. These results would be expected, given that Longford is the nearest large town to Edgeworthstown and Granard and shows that the N55/N4 provides a convenient route between Longford and Granard in preference to the R194. Of the traffic heading north on the N55 towards the centre of Edgeworthstown the most frequent origin recorded was Athlone and the most frequent destination was Edgeworthstown which would be expected given that the N55 provides the most direct route between the two towns. From the interviews recorded on the N55 northbound it would appear that a high proportion of trips related to home to work journeys between Edgeworthstown and Athlone.

Linkage with other places on or near the existing N4

The junction provision for other places is described in the preceding section 6.5.2. In summary all six Route Corridors have the same level of junction provision in this regard and so the linkage appraisal anticipates broadly equal performance.

Linkage with Regional Roads

As regards Regional Roads, the R198 and R194 would appear to carry high volumes of traffic between Longford Town and nearby commuter destinations to the north and east of the town. These flows of traffic cross the N4 and at peak times there can be delays at the roundabouts on the existing N4 Longford Bypass, particularly at the R198 Drumlish Road/Battery Road (Red Cow) Roundabout and the N5/R194 Ballinalee Road Roundabout. The existing N4 Longford Bypass appears to be used by commuter traffic as a means of accessing other parts of the town and avoiding the town centre, which means this traffic interacts with N4 through-traffic, particularly between the R198 and

R194 junctions. In this context, it has become apparent that if the N4 is to serve long-distance traffic as efficiently and safely as possible, the appropriateness of linkages with these Regional Roads must be carefully considered. This issue is discussed in further detail in the preceding section 6.5.2.

In relation to the R393 (which runs from Mullingar to Longford, serving places such as Ballynacarrigy and Ardagh and meets the Dublin Road just to the east of Longford Town) all six route options have a junction sited near the existing Dublin Road Roundabout which would serve the R393 and the eastern side of Longford Town.

In relation to the R394 Castlepollard Road, there is currently a grade-separated junction at the N4 Mullingar Bypass, providing good linkage between these routes. This junction could be improved in terms of safety and capacity by providing a roundabout on the south side to replace the priority junction which currently exists there. This would be investigated during the preliminary design phase and would apply to all six Route Corridor Options.

The R395 runs from Delvin, through Castlepollard to meet the N55 to the north of Edgeworthstown. The R397 runs from the N63 to the south of Longford and heads towards Ballymahon to the south. Both roads serve relatively low flows and therefore direct linkage would not appear to be a high priority. All six Route Corridor Options perform similarly in relation to these roads.

Linkage with Local Roads

Side road realignments and parallel access roads (where the scheme runs on the line of the existing N4) would be provided as part of the scheme. This would help to improve linkage for local trips by relieving the existing N4 of high traffic volumes and by providing better quality roads and junctions which are safer and easier for local traffic to use. It will be easier for local traffic to join and leave the existing N4, because traffic volumes using it will be greatly reduced and waiting times at junctions during peak hours will be greatly reduced also. Some local trips may become slightly longer in terms of distance travelled (although for motorised users not generally in terms of duration) due to the need to follow a short diversion. However, new side road realignments and new T-junctions would be designed to current standards so would be safer to use, delivering an overall improvement to the local road network and consequently there would be a net benefit to local road users. With any new road scheme it is necessary to ensure improved linkage for Non-Motorised Users as well as

motorists. A Non-Motorised User Audit would confirm the locations of the most frequently used routes and crossing points and consequently would influence the siting of underpasses or footbridges over the new N4. Some Non-Motorised User routes may become slightly longer in order to connect up with the nearest new underpass or bridge but it would no longer be necessary to wait for short gaps in traffic in order to cross the main road and safety would be improved as well.

Summary of Linkage Appraisal

In summary, in terms of road traffic, there appears to be greatest demand for improved direct linkage between places along or near the N4. The surveys indicate that there is demand for improved linkage between the N4 and Longford Town, which is served by two junctions close to Longford Town in each Route Corridor Option. Also there is some demand for some improved linkage between the N4 and N55, at least in terms of serving trips between north of Edgeworthstown and Longford and again a junction with the N55 is provided in each option. In terms of linkage with other places and areas which generate demand, a junction is provided at Carrickmoyragh and another at Portnashangan, in all options. The traffic surveys and model show that direct linkage with other roads and places would appear to be of much lower priority in traffic flow terms.

The most effective options in terms of improved links and linkage will tend to be those which would offer road users the biggest calculated benefits as described in section 6.5, which are a function of two aspects; firstly the vehicular traffic volumes likely to transfer to each option and secondly the journey time savings which would then arise. Consequently the economic results presented in section 6.5 give a good indication of how effective each of the Route Corridor Options would be in providing a dual carriageway N4 link between Mullingar and Roosky and improved linkage with other roads. The economic results show that all options would deliver benefits to road users, to various levels. Additionally the provision of a continuous two-lane dual carriageway route from Dromod to Dublin may improve the perceived attractiveness of the area west of Mullingar for businesses and homes. This is a difficult effect to estimate as personal perceptions vary, but all Route Corridor Options could be expected to perform similarly in this respect, with a positive effect.

All options would therefore have a Slightly or Moderately Positive impact, in improving road links and linkage, as summarised in Table 6.6-1.

Table 6.6-1 Linkage Impacts

Route Corridor Option	Linkage Impact
1	Moderately Positive
2	Moderately Positive
3	Slightly Positive
4	Slightly Positive
5	Slightly Positive
6	Moderately Positive

6.6.2 Inter-Connectivity and Other Modes of Transport

This sub-section, together with the preceding section 5.2.4 which addressed the needs of Non-Motorised Users, addresses the remaining three sub-criteria for Transport Integration, namely:

- Interconnectivity between roads and other modes of transport,
- Provision for public transport and non-mechanised modes and,
- Provision of access to other transport infrastructure such as ports and airports.

The majority of the bus services operating along this section of the N4 are Bus Éireann services. Routes 22 (Dublin to Ballina via Mullingar and Longford), 23 (Dublin to Sligo, via Mullingar and Longford) , 76 (Roscrea to Sligo, via Longford), and 77 (Athlone to Enniskillen, via Longford) are the main Expressway Long Distance services and Routes 117(Mullingar to Longford) and 469 (Longford to Sligo) are the Local/Rural Commuter services which use parts of this section of the N4. Bus services would benefit from reduced traffic volumes on the existing N4, which would be converted to a Regional or Local through road following construction of the new route. This may benefit bus journey times at peak times. However, bus routes may have to be altered slightly to reflect the minor changes to the local road network which would be necessary in each option. An estimated overall impact on bus services of Slightly Positive can therefore be identified for each Route Corridor Option.

Rail services have also been taken into account in this element of the appraisal. The Dublin to Sligo railway line passes through the study area for this scheme. The nearest stations to the scheme are at Mullingar, Edgeworthstown, Longford and Dromod. The railway line is single track with passing loops between Maynooth and Sligo. At present,

there are no known definite plans to upgrade this section to double-track. In the study area for this scheme, the road and railway are approximately parallel to each other as the existing N4 national primary route also passes by Mullingar, Edgeworthstown, Longford and Dromod. At the time of writing, every weekday there are 11 scheduled passenger train services westbound (of which 3 terminate at Longford) and 10 eastbound services (of which 2 commence at Longford). 2 of the weekday eastbound train services arrive in Dublin before 9am and 4 of the weekday westbound services depart from Dublin after 5pm. There are 7 westbound and 7 eastbound services on Saturdays. There are 6 eastbound and 6 westbound services on Sundays. New high quality rolling stock has recently been provided on the Dublin – Sligo route, comprising Iarnród Éireann 22000 Class "ICR" Diesel Multiple Units.

Rail passengers choose to take the train for various reasons, usually one or more of the following;

- To get to a urban centre quicker than would be possible by car or bus
- Not able, cannot afford or do not wish to drive
- To transfer to another mode of public transport at their rail destination, e.g. to catch another train or tram, bus, ferry or flight
- To avoid the difficulty of parking a car at their destination, particularly if destination is a town or city
- To minimise stress and relax in reasonable comfort
- To use their travel time in more useful ways e.g. work

Given that the quality and frequency of train services is now relatively good along the Dublin – Sligo line and in the context of the principal reasons why rail passengers typically take the train, an upgrade of the section of the N4 between Mullingar and Roosky appears unlikely to offer rail passengers sufficient motives to make the switch to a mode of road transport, i.e. a car or bus. Those rail passengers who do not currently live within a feasible walking or cycling distance of the railway stations mentioned, currently have to travel by road to their nearest station and as bus services are relatively few, they will tend to take their car. However for these people, the journey time benefits of this N4 scheme are still unlikely to be substantial enough to encourage them to remain in their cars as far as their destination (which could for example be Dublin for some of them), because the journey time savings do not appear sufficient to

outweigh the problems which they could still face (and would prefer to avoid) on arrival at their destination, for example traffic congestion or difficulty in parking their car. The overall impact on rail services will therefore be neutral.

There are no nearby ports or airports, although the N4 route provides access to ports and airports in other parts of Ireland such as Dublin and Sligo and overall impact will be neutral.

Taking all of the above aspects into account and section 5.2.4 in relation to provision for Non-Motorised Users, the overall impact in terms of Inter-Connectivity and other modes of transport is Neutral for all Route Corridor Options.

Table 6.6-2Inter-Connectivity and Other Modes of Transport

Route Corridor Option	Inter-Connectivity and Other Modes of Transport Impact
1	Neutral
2	Neutral
3	Neutral
4	Neutral
5	Neutral
6	Neutral

When the results of Tables 6.6-1 and 6.6-2 are combined, this gives overall Slightly Positive impacts for all Route Corridor Options and consequently there is no particular order of preference arising from this appraisal element.

Table 6.6-3Transport Integration: Overall Impact

Route Corridor Option	Overall Impact
1	Slightly Positive
2	Slightly Positive
3	Slightly Positive
4	Slightly Positive
5	Slightly Positive
6	Slightly Positive

7 Results of the Route Corridor Option Appraisals

7.1 Introduction

The Environmental, Engineering and Economic appraisal results given in the Project Appraisal Balance Sheets (PABS) indicate that a range of impacts would be likely to occur along each of the Route Corridor Options. The Detailed PABS which include the scaling statements and their supporting qualitative and quantitative statements are available in Appendix 1, Volume II. A summary of the scaling statements is given in Table 7.1-1 overleaf, as extracted from the Detailed PABS, together with the Order of Preference arising from the appraisals shown beneath. The scale for the order of preference is as follows; a score of 1 is given to the best option, a score of 2 is given to the next best option and so on. In some cases the Route Corridor Options may be almost equal in terms of impact or performance in a particular element, and so it is possible to give the same order of preference score to more than one option. Following the assessment of the individual sub-elements of main criteria of Environment, Safety, Economy, Accessibility and Integration an overall scaling statement of the criterion is given.

These PABS Criteria scaling statements are shown together in Table 7.1-2. A nominal weighting has been applied to the scaling statements to give an indication of the order of preference of the Route Corridor Options. A discussion of the findings of the assessments follows the tables and recommendation is made on the preferred option.

Table 7.1-1Summary of PABS Scaling Statements and Orders of Preference

PABS Criterion	PABS Element	Route Corridor Options 1	2	3	4	5	6
Environment	Air Quality (Climate Change)	MN	MN	MN	MN	MN	MN
		3	4	6	1	5	2
	Air Quality (General)	SN	MP	MP	MP	MP	MP
		6	1	2	5	4	2
	Noise & Vibration	SN	SN	SN	SN	SN	SN
		4	6	1	2	5	3
	Landscape	MN	MN	MN	MN	MN	SN
		4	2	2	4	4	1
	Visual	MN	SN	SN	SN	MN	MN
		4	1	1	1	6	4
	Natural Environment & Biodiversity	MN	MN	HN	MN	MN	MN
		3	2	6	5	4	1
	Heritage	HN	MN	MN	HN	HN	MN
		5	3	2	4	6	1
	Land Use: Planning and Socio Economics	N	MN	SP	SN	MN	N
		2	6	1	4	5	2
	Land Use: Agriculture (Soils, Intensity of Farming, ,land take and severance)	MN	HN	HN	HN	HN	MN
		2	4	6	5	3	1
	Hydrology and Drainage	MN	MN	HN	MN	HN	MN
		4	1	5	1	6	1
	Hydrogeology	MN	MN	MN	SN	MN	MN
		6	2	5	1	4	3
	Geology	MN	MN	MN	MN	MN	MN
		1	1	6	1	1	1
	Poor/Soft Ground	MN	MN	MN	MN	MN	MN
		1	1	6	1	1	1
Total of Environmental preference scores		45	34	49	35	54	23
ENVIRONMENTAL RANKING		4	2	5	3	6	1
ENVIRONMENTAL SCALING STATEMENT		MN	MN	HN	MN	HN	MN

Safety	Accident Reduction	HP	HP	MP	MP	MP	HP
		1	1	4	6	4	1
	Security	N	SN	N	N	N	N
		1	6	1	1	1	1
Total of Safety preference scores		2	7	5	7	5	2
SAFETY RANKING		1	5	3	5	3	1
SAFETY SCALING STATEMENT		HP	MP	MP	MP	MP	HP

Economy	Effectiveness/Efficiency	HP	MP	HP	MP	MP	HP
		1	5	1	6	4	1
Total of Economy preference scores		1	5	1	6	4	1
ECONOMY RANKING		1	5	1	6	4	1
ECONOMY SCALING STATEMENT		HP	MP	HP	MP	MP	HP

Accessibility	Vulnerable Groups	N	N	N	N	N	N
		1	1	1	1	1	1
	Deprived Areas	SP	SP	SP	SP	MP	MP
		3	3	3	3	1	1
Total of Accessibility preference scores		4	4	4	4	2	2
ACCESSIBILITY RANKING		3	3	3	3	1	1
ACCESSIBILITY SCALING STATEMENT		SP	SP	SP	SP	MP	MP

Integration	Transport Integration	SP	SP	SP	SP	SP	SP
		1	1	1	1	1	1
	Land Use Integration	MN	SN	SN	SN	HN	SN
		5	1	1	1	6	1
	Geographical Integration	MP	MP	MP	MP	MP	MP
		1	1	1	1	1	1
	Other Policies Integration	MP	MP	MP	MP	MP	MP
		1	1	1	1	1	1
Total of Integration preference scores		8	4	4	4	9	4
INTEGRATION RANKING		5	1	1	1	6	1
INTEGRATION SCALING STATEMENT		SP	MP	MP	MP	N	MP

Table 7.1-2 PABS Criteria Scaling Statements

PABS Criterion	Route Corridor Options					
	1	2	3	4	5	6
Environment	MN	MN	HN	MN	HN	MN
Safety	HP	MP	MP	MP	MP	HP
Economy	HP	MP	HP	MP	MP	HP
Accessibility	SP	SP	SP	SP	MP	MP
Integration	SP	MP	MP	MP	N	MP
	Totals of Scaling Statements					
HP: Highly Positive	2		1			2
MP: Moderately Positive		3	2	3	3	2
SP: Slightly Positive	2	1	1	1		
Neu: Neutral					1	
SN: Slightly Negative						
MN: Moderately Negative	1	1		1		1
HN: Highly Negative			1		1	
Weighted Totals	6	5	5	5	3	8
Ranking	2	3	3	3	6	1

Weightings : HP 3; MP 2; SP 1; N 0; SN -1; MN -2 and HN -3.

7.2 Environmental Appraisal Results

(Relevant PABS Criteria: Environment, Accessibility and Integration (part))

Although there are Highly Negative impacts on certain Route Corridor Options, the appraisals indicate that none of these impacts would necessarily require an Option to be eliminated. However, certain Route Corridor Options score poorly across several environmental areas.

The potential impacts of each of the routes vary greatly between the different specialist appraisals and there is no defined procedure to identify a preferred route. However Route Corridor Option 6 is best (or joint best) in terms of Landscape, Natural Environment, Cultural Heritage, Land Use: Agriculture, Hydrology and Drainage and Geology and Soft Ground, and ranks no lower than fourth in other appraisals. Route Corridor Option 6 is the only Option with no Highly Negative impacts. From Table 7.1-2 it can be concluded that the Route Corridor Option 6 performs best overall in terms of environmental impact, albeit with lower scores for some aspects.

7.3 Engineering Appraisal Results

(Relevant PABS Criteria: Safety, Economy, Integration (part))

The engineering appraisal of the scheme provides inputs to the safety, economy and integration elements of the overall appraisal. The alignments of the Route Corridor Options have been designed to comply with all relevant standards and seek .to minimise adverse environmental impacts. The engineering components of the options have been costed within the Option Comparison Estimates which provide inputs for the Economic Appraisal (COBA). Particular engineering issues such as areas of soft ground have been identified and a potential deficit of suitable fill material identified, together with mitigation measures. Appraisals for the elements of Security and Transport Integration have been provided.

7.4 Economic Appraisal Conclusions

(Relevant PABS Criteria: Safety, Economy)

All six of the Route Corridor Options present positive Benefit Cost Ratios. Route Corridor Options 1, 2 and 6 present almost equal Benefit to Cost Ratios and are the highest Benefit to Cost Ratios of the six options. Route Corridor Options 3, 4 and 5 present significantly lower Benefit to Cost Ratios. The Economic Appraisal results are reflected in the PABS and Table 7.1-1. Route Corridor Option 1 has the lowest total cost of the six options and third highest total benefits. Only Route Corridor Options 1 and 6 are Highly Positive in terms of both Safety and Effectiveness/Efficiency elements. Route Corridor Option 6 has the second lowest cost of the six options but has the highest total benefits.

7.5 Public Consultation Feedback (see Appendix 3, Volume III)

Analysis of the public consultation responses following the exhibitions held in September 2008 found that Route Corridor preferences were relatively evenly split but did indicate an order of preference; 32% preferred the Orange Route (now Option 2), 27% preferred the Red Route (now Option 1), 24% preferred the Green Route (now Option 3), 17% preferred another alternative. In terms of other alternatives, the main preference was to widen the existing N4 on-line. Options 4, 5, and 6 were identified following these exhibitions as described in Chapter 3.

The analysis of the responses to the public consultation questionnaire which set out aspects of potential concern identified that 'Impacts on the community near the corridors' was viewed as the aspect of greatest importance. 'Effect on Archaeological and Historical Sites' and 'Impact on Landscape' were ranked as being the next two most important aspects respectively. There were concerns with regard to how land and property would be affected and the environmental impacts. All of the main issues raised have been addressed in the appraisals and helped to inform the recommendation for the Emerging Preferred Route Corridor (EPRC) summarised overleaf.

7.6 Summary of Results

Project Appraisal Balance Sheets for the six Route Options are in Appendix 1, Volume II.

Environmental Appraisal: The environmental appraisals and scaling statements for the relevant elements given in the Project Appraisal Balance Sheets indicate that Route Corridor Option No. 6 is the best overall in terms of the environmental appraisal.

Engineering Appraisal: The engineering appraisal indicates that all six Route Corridor Options are feasible in terms of construction, would have similar engineering aspects and perform similarly in terms of the relevant Security and Transport Integration elements.

Economy Appraisal: The economic appraisal indicates that Route Corridor Option 1 has the lowest total cost of the six options and third highest total benefits. However, Route Corridor Option 6 has the second lowest cost of the six options and the highest total benefits.

Overall PABS Appraisal Results: The PABS scaling statements collated in Table 7.1.-1 indicate that Route Corridor Option 6 is on balance, the best overall.

Public Consultation Feedback: The feedback from the exhibitions held in September 2008 indicated that public preferences for the first three Route Corridors options were relatively evenly split, but gave the following order of preference; 32% preferred the Orange Route (now Option 2), 27% preferred the Red Route (now Option 1), 24% preferred the Green Route (now Option 3), 17% preferred another alternative. In terms of other alternative corridors, the main preference was for widening the existing N4 on-line. Options 4, 5, and 6 were not defined until after the exhibitions. A range of issues of concern were raised in the feedback which were taken into account in the appraisals of all six Route Corridor Options. Notably Route Corridor Option 6 incorporates sections of on-line widening where the appraisals indicate it would be practical to do so and would not entail excessive impacts.

Final Recommendation: In respect of the conclusions above, and taking all the relevant aspects and appraisals into account, Hyder Tobin Consultants recommended that Route Corridor Option No. 6 should be presented for comment as the Emerging Preferred Route Corridor (EPRC) at a set of exhibitions. It was noted that it would be

important to take into account and analyse the feedback received following the exhibitions, including suggested modifications to the EPRC, prior to confirming the Preferred Route Corridor (PRC).

8 The Identification of the Preferred Route Corridor

8.1 The Emerging Preferred Route Corridor: Summary of Feedback Received (see Appendices 25 & 26, Volume II)

The identification of a Preferred Route Corridor (PRC) is based on the environmental, engineering and economic appraisals undertaken and the feedback on the Emerging Preferred Route Corridor from stakeholders including members of the public and statutory and non-statutory bodies. Chapters 2 – 7 of this report set out the processes that developed the route options that were presented to the public at the second Public Consultation and subsequently identified the Emerging Preferred Route Corridor (EPRC). The EPRC (Route Corridor Option 6) was presented to the public at a third set of exhibitions, which took place from Monday 11th May to Wednesday 13th May 2009 at venues in Longford, Edgeworthstown and Mullingar. The primary information produced for these exhibitions can be found in Volume II, Appendix 25 and the detailed analysis of the feedback can be found in Appendix 26.

In summary the main findings from the analysis of the feedback were as follows:

- There were over 400 responses to the public consultation (including pro-forma responses);
- Responses were received from a wide range of locations along the EPRC or from places within the study area for the scheme, including Portnashangan, Mullingar, Longford, Newtown Forbes, Edgeworthstown, Rathowen, Bunbrosna, Ballynafid, Ballinalack, Multyfarnham and Bornacoola;
- Responses were also received from areas located outside the study area, within Counties Westmeath, Longford and beyond;
- A high proportion of the responses were from properties which might be directly affected by the EPRC;

- Various issues of concern were raised. The five most frequently raised issues were; Noise/Vibration, Air Pollution & Dust, Environmental Damage, Visual Impact and Loss of Amenity;
- 86 respondents put forward suggestions to modify the EPRC (although many of these suggestions related to the same proposals). The five most popular suggested modifications were as follows:
    i. To widen the existing N4 (i.e. on-line widening);
    ii. To reposition the junction on R194 north of Longford;
    iii. To move the route south of Kilsallagh Bog near Windtown;
    iv. To move the route south of Longford Town;
    v. To move the route further north at Shantum near Edgeworthstown.

8.2 Investigation of Suggested Modifications to the EPRC

Many of the suggested modifications were within the 300m wide EPRC and can therefore be investigated during future phases of preliminary design of the preferred route. Many of the other suggestions had already been investigated as part of earlier work to identify the Route Corridor Options. For example the feasibility of on-line widening of the existing N4 was investigated early in the process (see section 3.3.1) and routes south of Longford had been investigated as part of the Route Corridor selection process (Route Option 5).

Twelve of the suggested modifications ran outside the EPRC and had not been investigated in detail as part of earlier work on the Route Corridor Options. These twelve suggestions were typically relatively short in the context of the 50.8 km total length of the EPRC, ranging from 0.7km to 6.1km. The twelve suggested modifications relate to seven distinct areas (see RFig 8.1 to 8.7, Volume III):

- Modification 1 at Carrickmoyragh – to move the EPRC to the south;
- Modification 2 at R194 Ballinalee Road, Longford – to reposition the junction to the east of the existing regional road;
- Modifications 3, 4 and 5 near Windtown (west of Rathowen) - one main suggestion to route the EPRC to the south of Kilsallagh Bog and Newpass Demesne with two minor variations at its eastern end;

- Modifications 6, 7 and 8 near Rathowen – two to the north of EPRC and one to the south;
- Modification 9 at Bunbrosna - to the north of EPRC;
- Modification 10 at Ballynafid – to the south of EPRC ;
- Modifications 11 and 12 at Portnashangan – both to the south of EPRC.

These twelve suggested modifications were investigated following the exhibitions to determine whether they would offer environmental benefits over the EPRC. The main environmental and engineering aspects were considered.

The principal findings of the investigations into the suggested modifications are described in the following sections. Of the twelve suggestions investigated only two were found to have environmental benefits which could outweigh the impacts or risks. These two suggestions offer environmental benefits in comparison to the EPRC by reducing impacts on residential property, the first being the Carrickmoyragh (County Longford) suggested modification and the other at Portnashangan (County Westmeath).

8.2.1 Modification 1 at Carrickmoyragh (See Volume III, RFig 8.1)

The suggested modification leaves the EPRC approximately 1.5km west of Ballagh Bridge to run southwards, crossing over the existing N4 on a bridge before running parallel to the N4 through the townland of Deerpark. It then swings northwards to re-cross the N4, where a junction would be provided, before crossing the Dublin to Sligo railway line and rejoining the EPRC.

This modification has been suggested to reduce the adverse effects on properties caused by the EPRC and proposed junction.

Landscape & Visual

The modification would be further from residential properties as detailed in the Table 8.2-1 below and would therefore reduce the adverse visual impacts. However there would be increased intrusion on the landscape associated with the adjacent Castleforbes Demesne, although a local lime tree avenue to the south would remain preserved, retaining its beneficial contribution to the local landscape character. The

western end of the modification passes through the Shannon Basin / Lough Ree Landscape Character Unit, and on into the Central Corridor Landscape Character Unit west of Lissagernal. Landscape sensitivity of the Shannon Basin / Lough Ree area is deemed to be medium to high, whilst the Central Corridor is generally considered to be of low landscape sensitivity. The fact that the western end of the suggestion would be on embankment would result in increased landscape impacts on these defined landscape character units. This suggestion would also sever the agrarian pattern to the south of the existing N4.

In summary, this suggestion would present an overall reduction in visual impact but an increased landscape impact, affecting defined landscapes. It would be difficult to mitigate the landscape impact at the western end of the suggestion given that it is raised up on embankment. It would be possible to mitigate the impact at the central portion of this suggestion.

Natural Environment

The impacts on the Natural Environment associated with this suggested modification are similar to those of the EPRC.

Cultural and Architectural Heritage

The suggested modification would be closer to the Castleforbes Demesne and its associated Deerpark. The Deerpark is recorded separately from other elements of the Castleforbes Demesne as having architectural and artistic merit in the Record of Protected Structures (RPS) in the current Longford CDP and in the National Inventory of Architectural Heritage (NIAH). Neither the RPS listing nor the NIAH listing, which contains GIS points only, define the boundary of the Deerpark. The boundary of the ancient Deerpark is not to be confused with the boundary of the Deerpark Townland. Further research and consultation during the investigation of this proposed modification has led to the conclusion that on the basis of all available information the modification will have a direct impact on the Deerpark as listed in the RPS and NIAH. However, any direct impact would be eliminated or minimised at Preliminary Design Stage. As the modification would be closer to the Castleforbes Demesne and Deerpark there would be increased indirect adverse effects in respect of cultural heritage.

Hydrology, Hydrogeology and Geology

There are no major impacts on Hydrology, Hydrogeology or Geology associated with this suggested modification.

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 1 from residential properties.

There is a reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-1 Modification 1 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
Carrickmoyragh EPRC Alignment	1	14	13	2
Carrickmoyragh Suggested Modification	0	7	14	4
Difference	-1	-7	1	2

Engineering

The modification is 1.6km long. The relevant section of the EPRC is slightly shorter at 1.55km.

One additional skewed structure would be necessary to bridge over the existing N4 at the western end of the suggestion. The bridge over the railway line would be at an improved skew angle when compared with the EPRC.

The repositioning of the proposed junction to the eastern crossing of the existing N4 would on balance provide a more satisfactory connection to the local road network.

Summary and Conclusions

The modification would move the new N4 further away from residential properties near Carrickmoyragh/Ballagh Bridge thereby significantly reducing adverse impacts of noise, air pollution and potential demolition. Three residential properties on the south side of the existing N4 would face increased noise air quality and visual impacts. There would be increased adverse landscape impacts. On the basis of the available evidence the corridor would have a direct impact on the NIAH listed deer park associated with Castleforbes Demesne. However, this impact would be eliminated or minimised at Preliminary Design Stage. The modification offers a satisfactory engineering solution.

On balance it is concluded that the suggested Modification 1 offers significant environmental benefits over the EPRC and should form part of the Preferred Route Corridor.

8.2.2 Modification 2 at R194 Ballinalee Road near Longford (See Volume III, RFig.8.2)

The suggested modification relates to the repositioning of the proposed junction with the R194 to the east of the existing R194. Although no details of junction layouts have been developed as part of this Route Corridor Selection Report indicative layouts were presented at the 3rd Public Consultation exhibitions. The indicative layout for the R194 junction was shown to the west of the existing regional road.

The modification was suggested as a means of reducing severance of the Clonoose community; reducing the adverse effects of noise and air pollution on adjacent properties; reducing the effects on the nearby horse breeding facilities; and reducing the effects on the Clonoose stream.

Landscape & Visual

This suggested modification reduces potential visual impact to properties. However, there would be greater impact upon local topography. Overall the modification would result in a greater landscape impact, but reduced visual impact.

Natural Environment

The suggestion would have a greater impact on the Clooncoose Stream than if the junction remained to the west. The presence of otters has been confirmed and the stream has been identified as being suitable for use by white-clawed crayfish. The Shannon Regional Fisheries Board (ShRFB) advised that the stream contains lamprey and crayfish and is a spawning stream for trout and salmon. The ShRFB have advised that they are against the location of a junction on the east side of the R194 as in their view the impact on the Clooncoose Stream would be excessive.

Cultural and Arcitectural Heritage

No additional impacts would arise as a result of this modification.

Hydrology/Hydrogeology/Geology

The alternative R194 junction position would overlie the confluence of the Clooncoose Stream and a tributary and would require several bridges, culverts and stream diversions. The Clooncoose Stream has been reported by the Water Framework Directive (WFD) project to Europe as being of 'good status' and not at risk of impact from metals in road runoff or channelisation/diversion. Locating a junction to the east of the R194 would potentially affect both of these and in turn compromise the at 'good status'.

Air Quality and Noise

As can be seen from the Table below the suggested modification would move the junction further away from residential property and the horse breeding facility thereby reducing impacts on these properties in terms of noise and air quality.

Table 8.2-2 Modification 2 Property Counts

Property Counts By Section	Up to 50m from junction centreline	50m to 100m from junction centreline	100m to 200m from junction centreline	200m to 300m from junction centreline
R194 Junction EPRC alignment	5	15	9	4
R194 Junction Suggested Modification	0	3	15	17
Difference	-5	-12	6	13

Summary and Conclusions

Although the suggested modification would reduce the adverse effects on a number of properties adjacent to the R194 there would be significant effects on the ecology and hydrology of the Clonoose Stream and tributary

As stated the detailed layouts of the junctions have not been developed as part of the Route Corridor selection process. As part of the Preliminary Design Stage of the scheme, further assessment of the traffic and junction design will be carried out. During this stage consultation with local residents and landowners will take place with the aim to develop a detailed junction layout that will address the concerns of the community where possible.

8.2.3 Modifications 3, 4 & 5 at Windtown, west of Rathowen (See Volume III, RFig 8.4 & RFig 8.5)

The suggested Modification 3 leaves the EPRC southeast of Edgeworthstown swinging southwards to run south of Kilsallagh Bog. The modification then swings eastwards to run along the Black River Valley, passing south of Newpass Demesne, before rejoining the EPRC southeast of Rathowen.

Modifications 4 and 5 are minor variations to the eastern end of Modification 3. Modification 4 runs slightly to the south of Modification 3 and Modification 5 rejoins the EPRC slightly further to the east.

The modifications have been suggested as a means of reducing the effects on agricultural land north of Kilsallagh Bog and reducing adverse noise and air quality effects on dwellings alongside the existing N4.

Landscape & Visual

The main Modification 3 would cause a high level of landscape impact and would significantly sever the agrarian grain and field patterns, but would have relatively low visual impact on account of the low density / number of dispersed properties, as indicated by the property count Table 8.2-3 below.

Modification 4 would result in some additional landscape impacts on the views through the Newpass Demesne parkland towards the countryside to the east, as the demesne is aligned on the same axis as this modification (East-West).

Modification 5 would be on embankment for much of its length, in order to be above the water table and flood level associated with the Black River. It would therefore have a high impact on the landscape of the Black River valley and could generate a slightly increased impact on the landscape viewed through the parkland at Newpass Demesne.

Natural Environment

Modification 3 would result in the Black River (site of County Importance) being crossed a further four times by the proposed scheme, resulting in a total of five crossings of this watercourse, within a distance of less than 4km. The river has been identified as being important for salmonids and otters, and could support white-clawed crayfish. An increase in the number of crossings could increase the fragmentation

effects associated with the proposals. In particular, given the alignment of the crossings, which in one location appears to run parallel with the river for at least 500m, the proposals would result in a significant amount of additional habitat loss along the watercourse corridor. Also, an increase in the number of crossings of the river has an associated increase in risk of the potential for pollution events during the construction phase, as well as resulting in a greater amount of shading on this feature of nature conservation importance. Overall, the proposed modification would increase the potential impact on the Black River from not significant to significant at the Local Level.

Modification 4 would bring the route alignment closer to the Black River (site of County Importance) and non-designated Area of Ecological Value No. 36 (Local Importance (higher value)).

Modification 5 would be in close proximity to the Black River. It would remove a large part of the Area of Ecological Value No. 37 (Local Importance (higher value)) alongside the Black River. As noted in the Constraints Study, this Area of Ecological Value could be more extensive than shown for Area of Ecological Value No. 37 because there is potential for the flood plain habitat which is suitable for wintering birds to extend further along the Black River. This suggested modification could lead to increased levels of disturbance to wildlife during construction and operation.

Hydrology/Hydrogeology/Geology

In relation to surface hydrology, Modifications 3, 4 and 5 have four additional crossings of the Black River and take the road over large areas of benefiting lands which are potentially liable to flood events. Additional culverts for flood relief purposes would also be necessary. There would be complex interactions with the catchment of the Black River. ShRFB has raised concerns in relation to impacts on the Black River.

With regards to Hydrogeology, the suggestion passes through a bog to the south of Windtown, which although not designated and degraded, presents potential hydro-ecological impacts. The hydrological and hydrogeological functions of the Kilsallagh Bog are unclear but the area is linked to Glen Lough to the south which is a designated site (NHA, SPA) and interference with the groundwater or surface waters feeding Glen Lough could cause potential impacts on the designated site. Adequate drainage of the

road formation could be difficult to achieve, potentially presenting long-term stability issues.

In relation to geology and soils, the peat layers of the bog have been subject to investigation near the alignment of the suggestion and determined that depths of soft ground varied between 1.4m and 3.4m.

Cultural and Architectural Heritage

Modification 3 would have a significant or profound impact on a holy well site (AH 89), but the EPRC's significant impact on a ringfort site (AH 87) to the immediate north would be removed. The proposed modification passes close to the site of a ringfort at Derrydooan Middle (see Constraints Study Figure CFig 4.5.1(3), Site WM005-003) and would have an indirect adverse effect on the site and may have a direct effect on any larger outer enclosure. However, overall there would be fewer indirect impacts due to this alignment. It does not appear to pass through any of the original demesne extents of Newpass (based on the first edition mapping) and as such there would not be a direct impact on the attendant grounds. Newpass House is recorded in the Record of Protected Structures (RPS) in the Westmeath County Development Plan, although as the modification runs approximately 400m from the house any impact on the architecture of the house would be indirect. There are no other RPS or NIAH listed structures within close proximity to the modification.

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 3 from residential properties (Figures for Modifications 4 and 5 are the same).

There is a reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-3 Modification 3, 4 and 5 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
Windtown EPRC alignment	1	5	37	32
Windtown Suggested Modification	0	0	8	10
Difference	-1	-5	-29	-22

Although the suggestion would reduce noise and visual impacts for residential property along the existing N4, the houses off the L5165 would be closer to the modification. These latter properties currently experience low background noise levels, therefore the change in noise levels which would be experienced would be substantially greater than for the properties alongside the existing N4 which already experience noise impacts from the existing road.

Land Use: Agriculture

The modifications generally pass through a greater proportion of poorer quality farmland and woodland and avoid the better quality land between the existing N4 and Kilsallagh Bog.

Engineering

The suggested modifications are approximately 200m shorter than the EPRC. However they run through extensive areas of potentially poor ground with consequent risk of significantly increased costs. Four additional bridges/culverts will be required where the modification crosses the Black River.

Summary and Conclusions

There would be a potential slight reduction in impact in terms of archaeology but higher impact on the landscape. Effects on dwellings and agriculture would be lessened. However the increased ecological, hydrological, hydrogeological impacts and risks which would result from these modifications are potentially high. The suggested modifications would bring impacts to two relatively unspoilt and tranquil branches of the Black River with consequent adverse effects on aquatic ecology and surrounding lands. There is the potential for significantly increased costs.

Taking account all of the issues, the increased impacts and risks of these suggested modifications outweigh the potential benefits and it is recommended that the EPRC remains in its current location. However, discussions will be held with adjacent landowners during the preliminary design stage to determine how the alignment can be designed within the corridor to minimise adverse effects on dwellings and agriculture.

8.2.4 Modifications 6 and 7 between Rathowen and Ballinalack (See Volume III, RFig 8.5)

Modification 6 leaves the EPRC east of Rathowen and swings eastwards to run closer to the existing N4 and rejoins the EPRC west of Ballinalack.

Modification 7 initially follows the same alignment as Modification 6 but rejoins the EPRC slightly further to the east.

The modifications have been suggested to reduce effects on agricultural holdings.

Landscape & Visual

Both modifications would cause a greater visual impact than the EPRC. In terms of landscape impacts, the eastern end of Modification 6 is concealed to an extent behind existing hedgerows whereas that of Modification 7 has the potential to cause landscape impacts where it crosses the side road close to the existing N4.The western and central sections of the modifications cut across the field pattern. Overall there is little difference in landscape impacts between these suggestions and the EPRC.

Natural Environment

Although the modifications are approximately 200m closer to Lough Garr NHA than the EPRC, they are still to the south of the existing N4 alignment. There are no additional impacts on the Natural Environment associated with this suggested modifications.

Hydrology/Hydrogeology/Geology

There are no increased impacts or risks with respect to hydrogeology, hydrology or geology for either of the modifications.

Cultural and Architectural Heritage

There is no change in impacts associated with these modifications when compared to the relevant section of the EPRC.

Air Quality and Noise

The table below sets out the distances of the EPRC and the modifications from residential properties.

There is an increase in the number of properties close to the new road with a consequent increase in adverse effects in relation to noise and air quality.

Table 8.2-4 Modification 6 and 7 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
EPRC alignment	0	0	1	2
Suggested Modification 6	0	1	1	6
Suggested Modification 7	0	1	4	4
Difference	0	1/1	0/3	4/2

Land Use: Agriculture

The modifications would have limited benefits in terms of severance of agricultural land with similar effects experienced for the modifications and the EPRC.

Summary and Conclusions

The suggestions are closer to residential property than the EPRC taking account all of the issues, these suggestions appear to bring increased impacts on residential property (particularly visual and noise) with very little discernable benefit. It is recommended that the EPRC should remain in its current location.

8.2.5 Modification Number 8 between Rathowen and Ballinalack (See Volume III, RFig 8.5)

Modification 8 leaves the EPRC southwest of Rathowen to run approximately 400m west of the EPRC before rejoining it west of Ballinalack.

The modification was suggested to reduce the effects on farmland.

Landscape & Visual

At its western end and central section the modification is closer to the Black River valley. There are no existing hedgerows between this suggestion and the river and therefore it could impact upon the landscape of the river valley to a greater extent than the EPRC. However, to compensate for that, in terms of views from the north it will be screened more effectively by existing hedgerows to which it runs in parallel at its western end. The modification avoids the pattern of smaller fields to the north. At its eastern end, at the bog near Ballinalack, it could be partially screened by passing through part of the existing Coillte plantation. Visual impacts would be reduced due to reduced proximity to residential property.

Natural Environment

This modification would bring the route alignment closer to the Black River. It would have a direct impact on non-designated Area of Ecological Value 31 (Local Importance (higher value)), with the northern extent of the site being directly affected.

Hydrology/Hydrogeology/Geology

There are no additional effects or increased risks with respect to hydrogeology compared with the EPRC.

In terms of hydrology, this suggestion is closer to the Black River at its western end and passes through areas which may be prone to flood events.

In geological terms, this suggestion would present geotechnical difficulties, due to the likelihood of soft and/or saturated soils close to the Black River at the western end and the presence of peat near the bog at Ballinalack.

Cultural and Architectural Heritage

There are no changes in impacts associated with the suggested modifications when compared to the relevant section of the EPRC.

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 8 from residential properties

There is a small reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-5 Modification 8 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
EPRC alignment	1	2	4	7
Suggested	0	1	3	5
Difference	-1	-1	-1	-2

Land Use: Agriculture

The modification generally passes through a greater proportion of poorer quality farmland and woodland.

Engineering

The modification is approximately 50m longer than the comparable section of EPRC. Additional flood relief culverts may be required where this suggestion passes through lands liable to flood. The modification crosses an area of potentially poor ground resulting in the likelihood of additional costs.

Summary and Conclusions

This suggestion is slightly more distant from residential property than the EPRC with consequent reduced visual and noise impacts and runs through some agricultural land of slightly lower quality. However it presents increased landscape and ecological impacts, substantially increased hydrological impacts and much greater geotechnical risks. It would be necessary to purchase part of the Coillte plantation adjacent to the bog at Ballinalack and fell part of the margin of mixed woodland alongside the bog. Taking into account all of the issues, the increased impacts and risks of this suggested modification outweigh the potential benefits. There is also potential for significantly increased costs with this modification and it is therefore recommended that the EPRC remains in its current location.

8.2.6 Modification 9 at Bunbrosna, (See Volume III, RFig 8.6)

The suggested modification leaves the EPRC northwest of Bunbrosna and swings eastwards to bridge over the existing N4. It then runs parallel to and to the east of the N4 crossing beneath the local road to Multyfarnham before again bridging over the existing N4 to rejoin the EPRC approximately 1km southeast of Bunbrosna.
The modification was suggested to reduce the impacts on properties in Bunbrosna.

Landscape & Visual

The suggestion presents advantages and disadvantages when compared with the EPRC. The suggestion avoids impact on the north/south aligned narrow field pattern that would be beneficial to preserve as part of the local landscape character. However, the suggestion passes through side-long ground east of Bunbrosna and through the end of a ridge which overlooks the river plain of the Inny River. The landscape impacts of the exposed cutting face and the embankments over the existing N4 which would result from this suggestion could be high. Although overall visual impacts would be reduced because this suggestion is further from residential property, the properties which are in close proximity to this suggestion would experience an increased visual

impact. In overall terms, the visual impact would marginally increase, as compared to the EPRC.

Natural Environment

This suggestion brings the route alignment closer (within approximately 100m) to non-designated Ecological Site 12 (site of County Importance), which is part of Leny Fens, an area that was identified as important by the NPWS during the consultation process. This is likely to be one of the most valuable non-designated ecological sites within the Study Area. The suggested modification is further away from the northwestern tip of Lough Owel cSAC, SPA & pNHA, and brings the route to the north of the existing N4. Based on the available evidence the suggested modification on balance could result in a minor reduction in the ecological impacts compared with the EPRC

Hydrology/Hydrogeology/Geology

There are no major impacts or increased risks with respect to hydrogeology, except that a cutting would have some potential to interfere with the flow of runoff from the hillsides towards Bunbrosna.

This suggestion may offer a slight hydrological benefit as it is further from the headwaters of the Brosna River.

With regards to geology the cutting through the ridge east of Bunbrosna would be in limestone rock which is likely to require blasting.

Cultural and Architectural Heritage

The suggested modification is likely to have a significant impact on a church and graveyard site (AH 104) and may require the partial removal of the graveyard. The church itself would be directly adjacent to the modification. This could have significant implications as burial sites are often a large undertaking in terms of archaeological resolution.

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 9 from residential properties.

There is a reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-6 Modification 9 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
EPRC alignment	4	5	3	7
Suggested Modification	0	2	4	10
Difference	-4	-3	1	3

Engineering

This suggestion is approximately 50m shorter than the relevant section of the EPRC. The blasting of the limestone rock cutting could have adverse effects on adjacent properties. There would be two additional highly skewed structures over the existing N4, which together with the increased difficulty of excavation would result in considerable additional costs.

Summary and Conclusions

Although further from residential property, this suggestion would generate an increase in visual intrusion and highly increased impacts on landscape, archaeology and built heritage. The scope for mitigation of these impacts would be very limited. There would appear to be ecological advantages and disadvantages arising from this suggestion. Likewise there are advantages and disadvantages arising from hydrogeology, hydrology and geology. It is likely that there would be significant noise impacts on Bunbrosna during construction. There would be a significant increase in costs.

On balance there are not sufficient benefits arising from this suggestion to outweigh the increased impacts and costs and it is recommended that the EPRC should not be amended to include this modification.

8.2.7 Modification 10 at Ballynafid, (Volume III, RFig 8.6)

The suggested modification leaves the EPRC west of Ballynafid, near the entrance to Clanhugh Demesne, and swings southwards to run parallel to the railway line for about 500m before turning eastwards to cross the railway line and rejoin the EPRC.

The modification has been suggested to reduce the effects on property and landholdings.

Landscape & Visual

This suggestion would increase impacts on the landscape associated with Clanhugh Demesne. It would reduce visual impact slightly, by being further from residential property as detailed in Table 8.2-7 below.

Natural Environment

This suggestion would lead to an increased land-take within non-designated Ecological Site 7 (Local Importance (higher value).

Hydrology/Hydrogeology/Geology

This modification passes through slightly less of potentially soft ground around Ballynafid Lake. There are no significant hydrology or geology impacts associated with this modification when compared to the relevant section of the EPRC.

Cultural and Architectural Heritage

There are no impacts on archaeological sites, but the modification is closer to Clanhugh Demesne with a consequent greater impact.

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 10 from residential properties.

There is a small reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-7 Modification 10 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
EPRC alignment	0	4	3	6
Suggested Modification	0	2	3	5
Difference	0	-2	0	-1

Engineering

The modification with require an increased skew to the bridge over the railway line resulting in increased costs.

Summary and Conclusions

Although the suggestion is slightly further from some residential property (and therefore could be expected to reduce the associated visual and noise impacts slightly) it would increase the impacts on landscape, ecology and built heritage. An area of forestry plantation would have to be removed if this modification was to be incorporated. It would not be possible to move this modification much closer to the Dublin to Sligo railway line as has been proposed, as this would make the skew angle even more acute thereby lengthening the bridge over the railway line. In terms of severance and impact on agricultural land, this suggestion would pass through the fields at Ballynafid further to the south, below a small stream, but would pass through a larger portion of the field at Clanhugh Demesne, therefore there would appear to be no overall benefit.

On balance there are insufficient benefits arising from this modification to outweigh the increased impacts. It is recommended that this suggestion should not be adopted. During development of the preliminary design liaison with local landowners affected will ensure that impacts on residential property will be reduced as far as possible.

8.2.8 Modification 11 at Portnashangan, (See Volume III, RFig 8.7)

Modification 11 diverges from the EPRC south of Ballynafid Lake and runs parallel to and to the north of the railway line for a distance of approximately 1.4km before swinging eastwards to rejoin the EPRC.

The modification was suggested to reduce adverse effects on properties and landholdings.

Landscape & Visual

The suggested modification offers reduced visual intrusion in respect of local residential property but could increase visual intrusion and reduce tranquillity for those using Lough Owel for leisure pursuits. There would be increased landscape impact due to the effects on views across Lough Owel. The railway line will not provide screening for the modification at its eastern end. As the suggestion is to the south of a Coillte plantation, these trees would not screen this suggestion from views across Lough Owel. There would be no opportunity to partially conceal a junction with the existing N4 within the disused quarry at Portnashangan and it would not be possible to locate

the junction without considerable landscape or visual impacts and probable property demolition.

Natural Environment

This suggestion brings the alignment of the EPRC closer to Lough Owel, although it is still to the north of the existing railway line and therefore not likely to lead to a significant increase in impacts upon the Natura 2000 site. The suggested amendment is also likely to lead to a minor increase in land-take on non-designated Ecological Site 5 (Local Importance (higher value)) but this is unlikely to lead to an increased impact upon this site.

Hydrology/Hydrogeology/Geology

There are no significant additional hydrogeology, hydrology or geological impacts associated with this modification. The modification would be closer to Lough Owel but appropriate mitigation measures would avoid any increased impacts.

Archaeology & Built Heritage

With this modification there would be profound impacts on AH 126 (see Modification 12). There would also be profound impacts on AH 140 (ringfort) and AH 141 (earthwork).

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 11 from residential properties

There is a reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-8 Modification 11 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
EPRC alignment	2	4	2	0
Suggested Modification	0	3	5	2
Difference	-2	-1	3	2

Engineering

This suggestion would not offer the opportunity to recover rock from the disused quarry at Portnashangan, as does the EPRC. The provision of the junction to connect with the existing N4 would be likely to result in the loss of the Lough Owel viewing area and the demolition of a number of properties adjacent to the existing N4.

Summary and Conclusions

The modification is further from residential property with consequent reductions in noise and visual intrusion. It would however increase landscape, noise and visual impacts on Lough Owel. This suggestion would not provide a suitable location for a junction with the existing N4 without significant adverse impacts on properties and the Lough viewing area. There would be a major increase in impacts on archaeology.

On balance there are insufficient benefits arising from this suggestion to outweigh the increased impacts. It is recommended that this suggestion should not be adopted as a modification to the EPRC.

8.2.9 Modification 12 at Portnashangan (See Volume III, RFig 8.7)

Modification 12 diverges from EPRC south of Ballynafid Lake and swings southwards to pass between the railway line and farm buildings before swinging eastwards to rejoin the EPRC at the disused quarry.

The modification was suggested to reduce adverse impacts on properties adjacent to the existing N4.

Landscape & Visual

As the suggested modification is closer to Lough Owel than the EPRC it has the potential to increase both landscape impact and visual impact for lake users. It runs between the lake and two properties which were to the west of the Emerging Preferred Route Corridor thereby adversely affecting their views to the lake. However it will reduce visual impacts on properties adjacent to the existing N4. As with the EPRC the modification will be in cutting which will reduce the impacts but the modification would be on sidelong ground with the possibility that part of the cutting face may be visible from across the lake

Natural Environment

There are no additional impacts associated with this suggested modification when compared to the EPRC.

Hydrology/Hydrogeology/Geology

There are no additional impacts on hydrology, hydrogeology or geology when compared with the EPRC

Cultural and Architectural Heritage

This suggested modification would have a direct profound impact on an RMP site (as listed in the Records of Monuments and Places). This has been given the reference AH 126 within this report. During field inspections carried out as part of the route selection assessment this site was visited and found to be under crop. No obvious archaeological remains were noted during this visit. However the earthwork is visible as a circular enclosure on some aerial photographs and appears to represent a large ringfort. The diameter of the ringfort is approximately 57m with an area of approximately 2540 sqm. The area of ringfort affected by the suggested modification is approximately 1140 sqm, 45% of the total area. The EPRC was routed to the north of the nearby farm buildings in order to avoid the site.

Due to the possible importance of this site a geophysical survey of the area followed by archaeological test trenching was undertaken. The archaeological investigations are reported in *'Tempus Archaeology (Ref:13-12) – Report on Test Trenching at Site of Earthworks WM. 12:087 Portnashangan Townland, Co. Westmeath, August 2009).* A copy of the report's summary and a plan showing the positions of the trenches are at Appendix 27, Vol. II. The position of the nine test trenches was determined with reference to the geophysical survey. The results of the archaeological testing that was carried out at the site of the enclosure, revealed the presence of significant archaeological remains. The remains appear to consist of a large bivallate (double ditched) ringfort, which possessed little surface expression. Archaeological testing also revealed the presence of a stone built structure on the edge of the ringfort, which was thought to be later in date. This may be associated with the small farmstead that was located on the northern edge of the enclosure, as marked on the first edition Ordnance Survey map.

It is possible that this ringfort has an association with the site of an abbey (now occupied by a ruined church and graveyard), located to the immediate west (RMP Ref.: WM012-086), on the opposite side of the railway track. It is possible that the ecclesiastical site possesses an early medieval foundation date. If this is the case, then the two sites may be contemporary with one another. However, the archaeological investigations proved that the probable ringfort did not possess a direct ritual use, which would have been indicated by the presence of burials.

Ringforts are by far the most numerous archaeological monument located within the receiving environment of the proposed route options. Over 45,000 examples have been recorded throughout Ireland, making it the most common site of early medieval date.

Following the archaeological investigations at the site consultation took place between Westmeath County Council, NRA Project Archaeologist and the National Monuments section of the DoEHLG. This consultation concluded that there is no fundamental objection to the alternative alignment. During the further design process investigations will be carried out to determine the feasibility of preserving the site in situ although 'preservation by record' would be an acceptable mitigation measure.

Air Quality and Noise

The Table below sets out the distances of the EPRC and Modification 12 from residential properties.

There is a significant reduction in the number of properties in close proximity to the new road with a consequent reduction in adverse effects in relation to noise and air quality.

Table 8.2-9 Modification 12 Property Counts

Property Counts By Section	Up to 50m from corridor centreline	50m to 100m from corridor centreline	100m to 200m from corridor centreline	200m to 300m from corridor centreline
Portnashangan EPRC alignment	0	5	2	1
Portnashangan Suggested Modification	0	1	5	2
Difference	0	-4	3	1

Land Use: Agriculture

Modification 12 would cause increased severance to one farm unit. Additional accommodation structures would be required to mitigate this.

Engineering

Modification 12 is of a similar length to the EPRC. A junction with the existing N4 could be provided in the general area of the disused quarry similar to the EPRC.

Summary and Conclusions

Modification 12 would significantly reduce the noise, air quality and visual impacts on the residential properties alongside the existing N4, but could increase landscape and visual impact from across Lough Owel and to two properties. The suggestion would increase farm severance which could be mitigated with additional crossing points. The suggestion would directly affect an archaeological site although investigations have shown that this would not promote a fundamental objection. On balance it is concluded that the environmental benefits afforded by the suggested modification outweigh the disadvantages and it is recommended that the EPRC is amended to include this modification.

8.3 Conclusions and Recommendations in relation to the Preferred Route Corridor

Following the third Public Consultation a number of suggested modifications to the Emerging Preferred Route Corridor have been investigated. Modification 1 at Carrickmoyragh and Modification 12 at Portnashangan both significantly reduce potential adverse environmental effects and it has been concluded that on balance these modifications offer environmental benefits over the EPRC and the EPRC should be amended to include these modifications.

The recommended Preferred Route Corridor (PRC) comprises the EPRC amended to include Modifications 1 and 12 and is shown on drawings RFig 8.10 to RFig 8.17 in Volume III.

From its north-western end at the Tomisky roundabout near Roosky the Preferred Route Corridor (PRC) runs online or close to the existing N4 through to Carrickmoyragh, travelling to the south of the existing N4 at Cloonart North. Adjacent to the southern extents of the Aghnamona Bog NHA and the north-eastern extents of the Clooneen Bog pNHA and cSAC the route is contained within the existing highway

boundaries. For a distance of approximately 1km the PRC runs within the south western extent of the Rinn River NHA although by keeping close to the existing N4 any adverse effects will be minimised.

At Carrickmoyragh the PRC deviates from the EPRC to cross the existing N4 and runs south of the N4 before swinging eastwards to re-cross the N4. This alignment minimises the effects on adjacent properties. A junction is proposed where the PRC recrosses the existing N4 to provide access to Newtown Forbes and the surrounding area. From Carrickmoyragh the PRC crosses the Dublin to Sligo railway line before passing the northern and eastern edges of Longford Town. The PRC is aligned to minimise effects on property by running through gaps in existing developments.

From the crossing of the R198 the PRC runs in a south-easterly direction, crossing the R194 to the north of the Longford Bypass, near Clooncoose. A junction is proposed with the R194 to provide access to Longford. Continuing eastwards the PRC is positioned to avoid hindering the potential for further northerly and easterly expansion of the town. The PRC crosses the existing N4 west of Lissardowlan, where a junction is proposed to provide access to the eastern side of Longford Town.

Continuing eastwards the PRC crosses the railway line east of Freehalman and runs approximately parallel to and close to the railway line thereby minimising the adverse effects on agriculture. Swinging away from the railway line the PRC crosses the N55 National Road to bypass Edgeworthstown to the south. A junction is proposed with the N55 to link the National Road with the new N4 and to provide access to Edgeworthstown. From Edgeworthstown, the PRC runs to the south of and approximately parallel to the existing N4 passing between Kilsallagh Bog and the existing road.

The PRC bypasses Rathowen on the south side with the route positioned to minimise adverse effects on property although a ringfort (AH 87) would be directly affected. The PRC continues eastwards crossing the Inny River south of Ballinalack between the town and Lough Iron (pNHA, SPA). The route can be positioned within the corridor to avoid any encroachment into the designated site. The route then runs close to and to

the south of the existing N4 through Bunbrosna and on to cross the railway line before swinging southwards to pass south of Ballynafid Lake and Fen.

The PRC deviates from the EPRC at this point to pass southwest of farm buildings thereby reducing potential adverse effects on properties adjacent to the existing N4 although directly affecting a ringfort (AH 126). The route rejoins the existing road at Portnashangan where a junction is proposed and continues along the line of the existing road to the existing R394 junction at the northwestern end of the Mullingar Bypass. Where this section of the PRC runs adjacent to Lough Owel (NHA, cSAC, SPA) the alignment can be positioned within the corridor so that the new road would not encroach beyond the western boundary of the existing N4.

A Project Appraisal Balance Sheet (PABS) for the recommended Preferred Route Corridor can be found at Appendix 1 in Volume II. In terms of the PABS it can be seen that there is very little difference between the Emerging Preferred Route Corridor (Option 6) and the Preferred Route Corridor. On the basis of all the engineering, environmental and economic studies carried out, and consultations with the public and statutory and non-statutory bodies, it is recommended that the Preferred Route Corridor provides the most appropriate means of up-grading the N4 National Primary Road between Mullingar and Longford (Roosky).

References

1. An Foras Talúntais, (1980) *The General* Soil *Map of Ireland*, Second Edition
2. Bailey M & Rochford J. (2006). *Otter Survey of Ireland 2004/2005*. Irish Wildlife Manuals No. 23. Department of the Environment, Heritage and Local Government.
3. Bence-Jones, M. (1990). *A Guide to Irish Country Houses*. London: Constable.
4. Bennett, I (Ed). (1987-2004). *Excavations: Summary Accounts of Archaeological Excavations in Ireland*. Bray: Wordwell.
5. BMW Regional Assembly (2007), *The Border, Midland and Western Operational Programme, 2007-2013*
6. Boland H & Crowe O. (2004). *Irish Wetland Bird Survey: Results of Waterbird Monitoring in the Republic of Ireland in 2002/03*.
7. Brindley, A.L., & Lanting, J.N., 1990, 'The dating of *fulachta fiadh*' in V. Buckley (Ed). *Burnt Offerings.* Dublin. Wordwell.
8. Byrne, F.J., (2001), Irish Kings and High Kings, Dublin.
9. Casey, M, (2002), Chapter 5.6 Archaeology, in *N4 Drumsna to Longford Realignment Scheme, Route Corridor Selection Report*, Longford & Leitrim Co. Council.
10. Central Statistics Office (2000) *The* Census *of Agriculture*
11. Chadwick, N., (1970), *The Celts*. London, Penguin Books.
12. Cihar, J. (1998). *A Field Guide in Colour to Freshwater Fish*. Blitz Editions, Leicester.
13. Cooney, G., (2000), "Reading a landscape manuscript: a review of progress in preshistoric settlement studies in Ireland", in Barry, T. (Ed), *A History of settlement in Ireland,* Dublin (1-49).
14. Corbet, G.B. & Harris, S. (1991). *The Handbook of British Mammals Third Edition*. Blackwell Scientific Publications.
15. Davin, A., (1982) "*Tower Houses of the Pale*", unpublished M. Litt. Thesis, UCD.
16. Davin, A., (1982), "*Tower Houses of the Pale*", unpublished M. Litt. Thesis, UCD.
17. De Breffny, B. & Folliott, R. (1975). *The Houses Of Ireland*. London: Thames and Hudson.
18. Demers, A., Lucey, M.L., McGarrigle, Reynolds, J.D. (2005). The distribution of the white-clawed crayfish, *Austropotamobius Pallipes*, in Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy* 105B (2) pp. 65-69.
19. Department of Arts, Heritage, Gaeltacht and the Islands. (1999a). *Framework and Principles for the Protection of the Archaeological Heritage*. Dublin: Government Publications Office.
20. Department of Arts, Heritage, Gaeltacht and the Islands. (1999b). *Policy and Guidelines on Archaeological Excavation*. Dublin: Government Publications Office.

21. Department of Environment, Heritage and Local Government – Archaeological Archive Unit, The National Monuments Section. Sites and Monuments Record, Counties Longford and Westmeath.
22. Department of the Environment, Heritage and Local Government, Environment and Heritage Service & An Agency within the Department of the Environment. 2005. *All Ireland Species Action Plans*. National Parks & Wildlife Service.
23. Department of the Environment, Heritage and Local Government (2000), *The National Spatial Strategy, 2000-2020*
24. Department of Transport(2006), *Transport 21, Policy 2006-2015*
25. Ehrlich, P.R., Dobkin, D.S., Wheye, D. (1994). *The Birdwatcher's Handbook, a Guide to the Natural History of the Birds of Britain and Europe*. Oxford University Press, Oxford.
26. Electricity Supply Board. (2005) *Lough Ree Power Station Brochure*.
27. Electricity Supply Board. (2008) http://www.esb.ie/main/news_events/press_release271.jsp
28. Environmental Protection Agency (2004). Water Quality in Ireland, 2001 – 2003.
29. Environmental Protection Agency (2004). Website.
30. Environmental Protection Agency (2006a). River Water Quality Report 2005.
31. Environmental Protection Agency (2006b). Register of Hydrometric Station in Ireland.
32. Environmental Protection Agency (2003) *Ambient Air Monitoring in Athlone 5th March 2003 – 29th October 2003*, Environmental Protection Agency, Wexford.
33. Environmental Protection Agency (2007). *Waste Licensing Database* (www.epa.ie).
34. Environmental Protection Agency (2008) EPA *Environmental Maps*, (www.epa.ie)
35. Environmental Protection Agency (2008). *Air Quality Data web-page,* http://www.epa.ie/whatwedo/monitoring/air/data/
36. Environmental Protection Agency. (2001). *Ambient Air Monitoring in Mullingar 10th April 2001 – 21st November 2001*, Environmental Protection Agency, Wexford.
37. Environmental Protection Agency (2003) *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) and Guidelines on the Information to be Contained in Environmental Impact Statements*, Environmental Protection Agency, Wexford.
38. EPA/Teagasc Spatial Dataset. (2004) *Subsoil Map of Ireland*.
39. European Communities (Quality of Bathing Water) (Revocation) Regulations (1992). S.I. No. 154/1992.
40. European Communities (Water Policy) Regulations (2003). Statutory Instrument No. 722.
41. European Parliament/Council. (2001). *Directive 2001/80/EC On the limitation of emissions of certain pollutants into the air from large combustion plants,.* European Commission, Brussels.

42. Farrell, J. P. (1891) *History of the County of Longford*, Dublin.
43. Fitzpatrick PJ. (2006). *Forest Management Plan Ballynafid*. Coillte Teoranta.
44. Fitzpatrick PJ. (2006). *Forest Management Plan Lough Ennell*. Coillte Teoranta
45. Geological Survey of Ireland (2002). *Directory of Active Quarries, Pits and Mines in Ireland*.
46. Geological Survey of Ireland (2007). *Groundwater Web Mapping Data* (www.gsi.ie).
47. Geological Survey of Ireland (2007). *Well Database Inventory*.
48. Geological Survey of Ireland (Irish Landslides Working Group). (2006). *Landslides in Ireland*.
49. Geological Survey of Ireland. (1999 & 2001). *1:100,000 scale Sheet 12 and 16, Bedrock Geology Series*.
50. Geological Survey of Ireland. (2007) *Karst Database of Ireland*.
51. Gillespie, R, (1991) "The O Farrells and Longford in the seventeenth century", in Gillespie, R., and Moran, G., (Ed). *Longford: Essays in County History,* Dublin, 13-29.
52. Hanrahan, E.T. (1977). *Irish Glacial Till: Origin and Characteristics*.
53. Harbison, P. (1992) *Guide to the National and Historic Monuments of Ireland*. Dublin: Gill and Macmillan.
54. Heritage Council (2007) A Guide to Habitats in Ireland.
55. Institute of Field Archaeologists. (2001a). *Standards and Guidance for Archaeological Desk-based Assessments.* Manchester: IFA.
56. Joyce, P.W. (1995) *Irish Names of Places, Vol. III.* Beta Print.Mitchell, F. and Ryan, M. 1997. *Reading the Irish Landscape*. Dublin: Townhouse.
57. Kurz. I & Costello. M. J. (1999). An outline of the biology, distribution and conservation of Lampreys in Ireland. *Irish Wildlife Manuals*. No.5
58. Lewis, S. (1970). *Topographical Dictionary of Ireland (1837).* Vol. I, II. New York: Kennikat Press.
59. Longford County Council *Longford County Development Plan 2009-2015*
60. Longford County Council *Longford County Development Plan 2003-2009*
61. Longford County Council *Edgeworthstown Local Area Plan 2008-2014*
62. Longford County Council *Newtown Forbes Local Area Plan 2006-2012*
63. Longford County Council *Carrickglass Local Area Plan 2004-2010*
64. Longford County Council (2008), *Longford Northern Environs Local Plan, 2008-2014*
65. Macgivney, J., (1908), *Place Names of Co. Longford*, Dublin.
66. MacNamee, J.J., (1954), *History of the Diocese of Ardagh*, Dublin.
67. Meath County Council/Geological Survey of Ireland. (1998 / 2004) *Meath Groundwater Protection Scheme*.
68. Midland Regional Authority(2004), *Regional Planning Guidelines*
69. Mitchell, F. and Ryan, M. (1997). *Reading the Irish Landscape*. Dublin: Townhouse.
70. Moore, C., (2007), "Right on track at Edercloon", In *Seanda*, NRA Archaeology Magazine. (2007) (2) NRA, Dublin.

71. National Inventory of Architectural Heritage –Co. Westmeath (www.buildingsofireland.ie)
72. National Parks & Wildlife Service. (2007). *Species Action Plan: Otter (Draft for Public Consultation)*. National Parks & Wildlife Service Department of the Environment, Heritage and Local Government: Dublin
73. National Parks and Wildlife Service (November 2007-January 2008) *Species for which SPAs have been designated*. http://www.npws.ie/en/
74. National Parks and Wildlife Service (November 2007-January 2008) SAC Habitats and Species: Priority Habitats. http://www.npws.ie/en/
75. National Parks and Wildlife Service (November 2007-January 2008). *Designated Sites Citations.* http://www.npws.ie/en/
76. National Roads Authority (1998), *The National Roads Needs Study.*
77. National Road Authority *Design Manual for Roads and Bridges*
78. National Roads Authority (2005) *Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes.* National Roads Authority, Dublin.
79. National Roads Authority (2005) Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes. National Roads Authority, Dublin.
80. National Roads Authority. (2005) *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*. National Roads Authority, Dublin.
81. National Roads Authority. (2004) *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*. National Roads Authority, Dublin.
82. National Roads Authority. (2006) *Guidelines for Assessment of Ecological Impacts of National Roads Schemes*. National Roads Authority, Dublin.
83. National Roads Authority. (2009) *Guidelines for Assessment of Ecological Impacts of National Roads Schemes Rev 2*.
84. National Roads Authority. (2009) *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*. National Roads Authority, Dublin.
85. National Roads Authority. (2005) *Best Practice Guidelines for the Conservation of Bats in the Planning of National Roads Schemes*. National Roads Authority, Dublin.
86. National Roads Authority. (2008) *Environmental Impact Assessment of National Road Schemes – A Practical Guide.* National Roads Authority, Dublin.
87. National Roads Authority. (2008) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.* National Roads Authority, Dublin.
88. National Roads Authority. (2006) *A Guide to Landscape Treatments for National Road Schemes in Ireland.* National Roads, Authority, Dublin.
89. Ríordáin, S P. (1995) *Antiquities of the Irish Countryside*. London: Methuen.
90. O' Mahony D. *et al.* National Pine Marten Survey of Ireland (2005). Coford Connects. *Environment* No. 7.
91. O'Donovan, J., 1837-38, *Ordnance Survey Memoirs, Longford*, unpublished manuscript, National Library.

92. O'Drisceoil, D., 1988, 'Burnt mounds: cooking or bathing? *Antiquity* 62.
93. Raftery, B., (1997) Trackway excavations in Mountdillion Bogs, Co. Longford 1985-1991, Irish Archaeological Wetland Unit Transactions 3, Dublin.
94. Reeves-Smyth, T. (1997a). 'Demesnes' In Aalan, F.H.A., *et al* (eds) *Atlas of the Irish Rural Landscape.* Cork: Cork University Press
95. Reeves-Smyth, T. (1997b). 'The natural history of demesnes' In Foster, J.W. and Chesney H.C.G. (eds) *Nature in Ireland: A Scientific and Cultural History.* Dublin: Lilliput Press
96. Reynolds J.D (1998). Conservation Management of the White-clawed Crayfish (*Austropotamobuis pallipes*) Part 1. *Irish Wildlife Manuals* No .1.
97. Rynne, C., (2006), *Industrial Ireland 1750-1930; an archaeology* Collins, Press, Cork.
98. Seaver, M., (2004) *Archaeological, Architectural and Cultural Heritage Assessment of the Preferred Route of the Edgeworthstown Inner Relief Road, Co. Longford.* Unpublished Report, Valerie J. Keeley Ltd.
99. Stout, M. (1997) *The Irish Ringfort*. Dublin: Four Courts
100. Stationery Office (2007), *National Development Plan 2007-2013*
101. Stationery Office (2000), *National Development Plan 2000-2006*
102. Trenter, N.A. (1999). *Engineering in Glacial Tills (CIRIA Report C504)*.
103. Urban Wastewater Treatment Regulations (2001). Statutory Instrument No. 254 of 2001.
104. Waddell, J. (1998) *The Prehistoric Archaeology of Ireland*. Galway: Galway University Press.
105. Westmeath County Council (2008) *Westmeath County Development Plan 2008-2014*
106. Westmeath County Council (2002-) *Westmeath County Development Plan 2002-2008*
107. Westmeath County Council, *Strategic Environmental Assessment*, *Environmental Report for Draft Westmeath County Development Plan 2008-2014.*
108. Whelan K. (1997). 'The Modern Irish Landscape from Plantation to Present' In Aalan, F.H.A., *et al* (eds) *Atlas of the Irish Rural Landscape.* Cork: Cork University Press.